

P-2019/15456

SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO

DIRECCIÓN DE NUEVAS CREACIONES

E. S. D.

Re: Expediente No. **NC2019/0004543**Solicitud de patente a nombre de **PARAMOUNT PRODUCTS 1 LLC**

Yo, CAROLINA DAZA MONTALVO identificada como aparece al pie de mi firma, domiciliada en la Carrera 11 No. 86-53, obrando como apoderada de la sociedad PARAMOUNT PRODUCTS 1 LLC, domiciliada en New York, Estados Unidos de América, solicitante de la patente de la referencia, en respuesta al oficio No. **14781** notificado electrónicamente el 30 de noviembre de 2020 , relacionado con los requerimientos de fondo de la solicitud, y para el cual solicité prórroga de 30 días el 4 de febrero de 2021, atentamente me permito presentar la siguiente información:

1. Reivindicaciones relativas a un uso

Indica el examinador que las reivindicaciones 40-74, a pesar de señalar en su preámbulo "un método", se refieren al uso de la composición reclamada.

A este respecto se solicita tener en cuenta que los métodos reclamados hacen referencia a "aplicar" lo cual es un "paso" del método reivindicado junto con pasos adicionales, lo que lo hace admisible como un método.

2. Modificación a las Reivindicaciones

Con fundamento en la facultad que confiere el artículo 34 de la Decisión 486 al solicitante para modificar la solicitud de patente en cualquier momento del trámite, presento junto con este memorial nuevo capítulo reivindicatorio, el cual consta de sesenta y nueve (69) reivindicaciones y reemplaza completamente el presentado anteriormente. Específicamente, se realizaron las siguientes modificaciones:

- 2.1.** Se han modificado las antiguas reivindicaciones 1-3, 7, 8, 13-16, 18, 21, 22, 24, 26, 41 y 61 a fin de:
- Especificar el es espesante es asociativo.

- Indicar que la sal divalente soluble en agua comprende un catión divalente seleccionado del grupo que consiste en bario, calcio, cobalto (II), cobre (II), hierro (II), magnesio, manganeso (II), estroncio, zinc (II) y mezclas de los mismos.

2.2. No se incluyen las antiguas reivindicaciones 6, 38, 39, 55 y 56.

2.3. En vista de las modificaciones previas, las reivindicaciones, así como sus dependencias, se han modificado.

En cuanto a estas modificaciones, me permito decir que las mismas no amplían de ninguna manera la materia objeto de la presente solicitud y se realizaron con el ánimo de superar las objeciones de claridad y nivel inventivo planteadas por el examinador en su concepto técnico.

3. Pago de tasas

Considerando que el presente memorial se presenta junto con modificaciones a las reivindicaciones se adjunta recibo por concepto de pago de tasa de modificación a las reivindicaciones, según lo establecido en la **Resolución 59669 de 2020**.

En relación con el número de reivindicaciones, atentamente nos permitimos decir que no se adjunta tasa por concepto de reivindicaciones adicionales, toda vez que el nuevo capítulo reivindicatorio tiene un menor número de reivindicaciones que el anteriormente presentado, y en esencia es el mismo objeto, pero definido con mayor claridad.

4. Claridad y concisión de las reivindicaciones

El solicitante manifiesta que mediante la presentación del nuevo capítulo reivindicatorio quedan subsanadas la totalidad de las objeciones, de modo tal que las nuevas reivindicaciones proporcionan claridad y concisión a la invención descrita, siguiendo las recomendaciones realizadas por el Examinador en su concepto técnico. Respecto a las objeciones específicas del examinador, se desea manifestar lo siguiente:

- 4.1.** Las reivindicaciones 1 y 15 indican el uso que puede darse al producto reivindicado, el cual no es una característica técnica que defina a la invención.

Se han eliminado las referencias a los usos.

- 4.2.** El capítulo reivindicatorio no es conciso puesto que presenta 3 reivindicaciones independientes de composición (1, 15 y 23).

A este respecto, el solicitante considera que cada una de las reivindicaciones de composición debe reclamarse de manera independiente, ya están dirigidas a diferentes productos, como se establece en la siguiente tabla.

Reiv.	Materia Reclamada
1-5 y 7-13	Una <u>composición adyuvante premezcla</u> , que comprende: un espesante asociativo; una sal divalente soluble en agua, donde la sal divalente soluble en agua comprende un catión divalente seleccionado del grupo que consiste en bario, calcio, cobalto (II), cobre (II), hierro (II), magnesio, manganeso (II), estroncio, zinc (II) y mezclas de los mismos; un agente de control de espuma; un agente formador de complejo; y un agente de formación de película
14-21	Una composición adyuvante que comprende: la composición adyuvante premezcla de la reivindicación 1 y agua.
22-36	Una <u>formulación química para tratamiento de plantas</u> , caracterizada porque comprende: la composición adyuvante de la reivindicación 14 y uno o más productos químicos para tratamiento de plantas.

Aunque la composición adyuvante de las reivindicaciones 14 a 22 y contiene todos los componentes de la composición de premezcla de las

reivindicaciones 1 a 5 y 7 a 14, también requiere la inclusión de un componente adicional (es decir, agua). Asimismo, la formulación química de tratamiento de plantas de las reivindicaciones 23 a 37 requiere cada uno de los componentes de la composición adyuvante de las reivindicaciones 15 a 22, pero también requiere la inclusión de un componente adicional (es decir, uno o más productos químicos de tratamiento de plantas). Por estas razones, cada una de la composición de premezcla de adyuvante, la composición de adyuvante y la formulación química de tratamiento de plantas deben reivindicarse como hemos propuesto.

Además, se resalta que solo se presenta una única reivindicación de producto independiente (es decir, la reivindicación 1); las reivindicaciones 15 y 23 (nuevas reivindicaciones 14 y 22) dependen de las reivindicaciones 1 y 14, respectivamente. Por lo tanto se evidencia que no hay más de una reivindicación de producto independiente.

- 4.3.** Las reivindicaciones 1, 2, 15 y 23, no son concisas, ya que los términos: "un espesante", "una sal divalente soluble en agua", "un agente de control de espuma", "un agente formador de complejo", "un agente de formación de película", "espesante aniónico asociativo"; incluyen una cantidad indeterminada de posibles compuestos que no están comprendidos dentro del objeto de la solicitud, y que dada la complejidad, no se permite determinar de forma precisa el alcance de lo que se quiere proteger.

A fin de superar la objeción se ha especificado que los espesantes son asociativos y se ha establecido que la sal divalente soluble en agua comprende un catión divalente seleccionado del grupo que consiste en bario, calcio, cobalto (II), cobre (II), hierro (II), magnesio, manganeso (II), estroncio, zinc (II) y mezclas de los mismos en la reivindicación 1.

Adicionalmente, la reivindicación independiente indica que la composición comprende un espesante ", " una sal divalente soluble en agua ", " un control de espuma agente ", " un agente formador de complejo ", " un agente formador de película ", " espesante aniónico asociativo "y los componentes específicos se incluyen en las reivindicaciones dependientes, por lo que el pliego reivindicatorio es claro y no extiende la materia a proteger y que ha sido desarrollada en la invención.

- 4.4.** Las reivindicaciones 6, 18 y 26 no son claras ya que reclaman una composición y señalan "(...) se forma a partir de (...) ", lo cual hace referencia a un método de obtención.

Se ha eliminado la reivindicación 6 y se han modificado las reivindicaciones 8 y 26, así:

La formulación química para tratamiento de plantas de conformidad con la reivindicación ... , caracterizada porque la sal divalente soluble en agua es sulfato de zinc.

En vista de las modificaciones introducidas en el nuevo pliego reivindicatorio, es posible afirmar que éste es claro y conciso, cumpliendo con lo establecido en el artículo 30 de la Decisión 486.

5. Descripción

Indica el examinador que las unidades de medida "lb, oz, psi, galón" no corresponden a las unidades establecidas por el Sistema Internacional de Medidas, por lo tanto, se solicita hacer las modificaciones respectivas. Adicionalmente, solicita definir la composición química de las marcas registradas "capistrano" (Pág. 37) y las marcas "Manzate® Pro-Stick, Kocide® 3000 DF, Rally® 40WSP Quintec® 2SC 6, Mycoshield®, Spread®, Captan® 80WDG, Captevate® 68WDG, Flint® 50WG, Evito® 480SC, Abound® 2,08F", "Imazapir", "Triclopir", "Spraytex", "IMBIREX", "Volley 88 OL", "BANAZEB 60 SC".

A fin de superar las objeciones se ha modificado la descripción reemplazando las unidades de medida a las del Sistema Internacional y se han reemplazado las marcas comerciales por el nombre químico de acuerdo a la siguiente tabla cuyo soporte se encuentra como "anexo 1":

Tabla 1. Nombres químicos

Marca comercial	Nombre químico	No CAS.
Manzate ® Pro- Stick	Mancozeb	8018-01-7
	Etileno tiourea	96-45-7
Kocide ® 3000 DF	Hidróxido de cobre	20427-59-2

	Arcilla Ácido 2-propenoico, Homopolímero	
Rally [®] 40WSP	Myclobutanil Caolín Polisilicato de calcio Sílice cristalino (cuarzo) Dióxido de Titaneo	88671-89-0 1332-58-7 1344-95-2 14808-60-7 13463-67-7
Quintec [®] 2SC 6	Quinoxifeno propilenglicol	124495-18-7 57-55-6
Mycoshield [®]	Oxitetraciclina de calcio Sílice cristalina (cuarzo) Pirofilita Mica Caolín	7179-50-2 14808-60-7 12269-78-2 12001-26-2 1332-58-7
Spread [®]	Alquilarilpolietoxi etanol Ácidos grasos libres Isopropanol	
Captan [®] 80WDG	Captan	133-06-2
Captevate [®] 68WDG	Captano: [(triclorometil) tio] -4- ciclohexeno-1,2- dicarboximida Fenhexamid : N- (2,3- dicloro-4- hidroxifenil) -1- metilciclohexanocarboxamida	133-06-02 126833-17-8
Flint [®] 50WG	Trifloxistrobina Tierra de diatomeas	141517-21-7 61790-53-2
Evito [®] 480SC	Fluoxastrobina : (E) - {2- [6- (2-clorofenoxi) -5- fluoropirimidin-4-iloxi] fenil} (5,6-dihidro-1,4,2-dioxazin- 3-il) metanona O- metiloxima	361377-29-9
Abound [®] 2.08F	1,2-propanodiol Bentonita	57-55-6 1302-78-9 131860-33-8

	Metil (E) -2- {2- [6 [(2- cianofenoxi) pirimidin - 4-iloxi] fenil} -3- metoxiacrilato	
Imazapir	Imazapir	81334-34-1
Triclopir	Ácido 3,5,6-tricloro-2-piridiniloxiacético	55335-06-3
Spraytex	Carbonato de calcio Dimetil éter Nitrógeno licuado	471-34-1 115-10-6 7727-37-9
IMBIREX	Alcohol Graso etoxilado-0-80	66455-14-9
Volley 88 OL	Fenpropimorfo	67564-91-4
BANAZEB 60 SC	Mancozeb	8018-01-7

6. Nivel inventivo

El examinador indica en su concepto técnico la falta de nivel inventivo de las antiguas reivindicaciones 1-39 a la luz de las enseñanzas técnicas descritas en los documentos US2007/037711 (D1) y US 2014/148339 (D2)

El documento D1 se refiere a una composición que tiene 99,8 % en peso o menos de al menos una partícula, un agente de extensión formador de película y opcionalmente al menos un agente de voluminización. El agente esparcidor formador de película puede estar presente en una cantidad igual o superior al 0,20 % en peso si no está presente un inhibidor del esparcidor o igual o superior a aproximadamente el 0,35 % en peso si está presente un esparcidor. Las composiciones se pueden usar en una composición agrícola y como adyuvante agrícola (D1: resumen; párrafo [0095]). Las composiciones pueden comprender alcohol polivinílico como agente de extensión formador de película, compuestos hidroxipolímeros solubles en agua de alto peso molecular como agentes de extensión, pesticidas como aditivos y agentes espumantes como agente de voluminización (D1: Párrafos [0040], [0093], [0096] y [0130]).

Por su parte, el documento D2 proporciona compuestos útiles como pesticidas y herbicidas. El párrafo [0214] de D2 describe que los adyuvantes que pueden usarse

normalmente en formulaciones pesticidas incluyen, por ejemplo, sustancias que modifican la viscosidad, antiespumantes, agentes complejantes, espesantes.

De acuerdo con la opinión del Examinador, D1 se considera el estado de la técnica más cercano a la invención definida en la reivindicación 1, porque describe composiciones para suministrar películas continuas o semicontinuas de materiales a partir de suspensiones o soluciones mediante la adición de cantidades específicas de agentes de extensión filmógenos. Se cita D1 por revelar que el agente de extensión formador de película puede mejorar o potenciar el rendimiento de un ingrediente activo o aditivo y, por lo tanto, actuar como adyuvante agrícola, adyuvante o coadyuvante de formulación.

El examinador reconoce que el documento D1 no enseña o sugiere la inclusión de un agente formador de complejos en la composición. Sin embargo, el Examinador establece que no hay ningún efecto técnico asociado con la inclusión de agentes formadores de complejos dentro de la formulación del adyuvante. No obstante, una persona versada en la materia estaría motivado para incluir el agente formador de complejos de D2 en la composición de D1 para llegar a la invención actualmente reivindicada, por lo que D2 describe la inclusión de agentes formadores de complejos en una formulación de tratamiento de plantas.

A este respecto, se solicita tener en cuenta que D1 y D2, ni la combinación de esas referencias enseñan o sugieren una composición que comprenda un "espesante asociativo", como lo requiere la reivindicación 1 modificada. En cambio, D1 y D2 se refieren solo en general a "agentes espesantes" y "espesantes", respectivamente. (Ver D1 en ¶¶ [0096], [0100], [0106] y [0113]; ver D2 en ¶¶ [0214] y [0268])

Con respecto a la afirmación del Examinador que una persona versada en la materia habría estado motivada para incluir el agente formador de complejos de D2 en la composición de D1, se resalta que dicha persona con conocimientos normales en la técnica no habría sabido por la divulgación en D2, los agentes formadores de complejos empleados para llegar a la invención actualmente reivindicada. Adicionalmente, en la medida en que un científico capacitado se hubiera sentido motivado a utilizar un agente complejante en la composición de D1, este documento describe que *"la reticulación inhibe el empaquetamiento cerrado de las cadenas de polímero, previniendo la formación de regiones cristalinas"* (D1, párrafo [0038]). Por lo tanto, D1 busca reticular cadenas de polímeros y no en iones metálicos. El documento D1 proporciona un hidroxpolímero modificado reticulado con agentes reticulantes (ver, por ejemplo, la reivindicación 9), y además señala que dicha reticulación imparte propiedades de

esparcimiento (ver D1, ¶ [0052]. D1 afirma que “la esparcimiento no se logra con la técnica anterior de bajo peso molecular como compuestos de polivinilo porque la longitud del polímero es insuficiente para evitar la retracción de las gotas que resulta en depósitos irregulares”). Por lo tanto, un científico experto interesado en la composición de D1 no habría recurrido a D2, que generalmente enseña la inclusión de un agente complejante opcional, como guía a este respecto.

Adicionalmente, respecto a que no hay ningún efecto técnico asociado con la inclusión de agentes formadores de complejos en la invención reivindicada, se presenta la Declaración de Brett Fors, Profesor Adjunto del Departamento de Química y de Biología Química de la Universidad Cornell, quien proporciona datos experimentales que muestran que la composición actualmente reivindicada comprende un espesante asociativo, una sal divalente soluble en agua, un agente de control de espuma, un agente complejante y un agente formador de película proporcionan un efecto técnico (por ejemplo, mejora, adherencia, adherencia y retención de un producto químico de tratamiento de plantas aplicado).

En vista de los argumentos presentados previamente, así como la declaración del Dr. Brett Fors, es posible afirmar que la presente solicitud es inventiva en vista del arte D1 y D2 solos o en combinación, cumpliendo así con los requerimientos establecidos en el Artículo 18 de la Decisión 486.

7. Conclusión

Con los argumentos presentados puede concluirse que:

- i) La presente solicitud es clara, concisa y está debidamente soportada en la descripción, cumpliendo con los requerimientos del Artículo 30 de la Decisión 486;
- ii) La descripción de la solicitud clara y completa, cumpliendo con los requerimiento del Artículo 28 de la Decisión 486;
- iii) Las reivindicaciones actuales son patentables sobre los documentos D1 y D2, cumpliendo así con los requerimientos del Artículo 16 y 18 de la Decisión 486.

Por tanto, atentamente me permito solicitar a ese Despacho otorgar el privilegio de patente solicitado a la solicitud en estudio, toda vez que cumple a cabalidad con los requerimientos de la Decisión 486/00.

En consecuencia, solicitamos a ese Despacho pronunciarse en relación con todos los argumentos presentados en este memorial dando estricta aplicación al principio del debido proceso consagrado en el artículo 29 de la Constitución Nacional.

8. Anexos

- Nuevo capítulo reivindicatorio conformado por diecinueve (19) reivindicaciones.
- Documento nombres químicos de las marcas comerciales
- Documento Declaración Brett Fors con CV y traducciones
- Nueva descripción.
- Comprobante de pago por concepto de la modificación de las reivindicaciones y la descripción.

Señora Directora,



CAROLINA DAZA MONTALVO

C.C. 66.783.790 de Palmira Valle

TP-141563 CSJ

notificaciones@clarkemodet.com.co

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Capistrano Sweet Peppers pk/10

SKU SP216-10

YOUR PRICE

~~\$3.75~~ **\$3.50**

PACK

pk/10

QTY

1

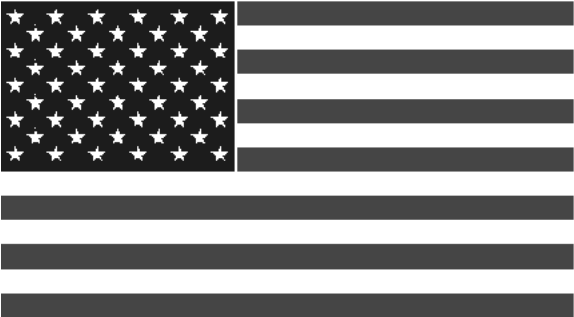
ADD TO CART

AVAILABILITY: IN STOCK

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COUNTRY OF ORIGIN: USA



DESCRIPTION	PLANTING INSTRUCTIONS	GROWING CALENDAR	CUSTOMER REVIEWS
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76 days. Capsicum annuum. Open Pollinated. Plant produces good yields of 4" long by 3 ½" wide sweet peppers. Peppers turn from dark green to red when mature and have thick walls and uniform shape. Great for salads and cooking. Suitable for home gardens.

LOT NO: 101706507 GERMINATION: 90% TEST DATE: 10/20

Seeds Per Pound: 64,000

Plant Height: 24" tall

Planting Season: Spring

Sunlight Requirement: Full Sun

Planting Method: Indoor Sow



A 3D rendering of a grey cardboard box. A large, black, rectangular label with the word 'RUSH' in bold, white, sans-serif capital letters is affixed to the top face. Below the 'RUSH' label, on the front face of the box, are three square icons: a glass (fragile), an umbrella (weather-resistant), and two vertical arrows (upside down). A standard 1D barcode is located on the bottom right corner of the front face.

EXPEDITED SERVICE

Jupiter Sweet Peppers

Insurance Protection

Expedited Service

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Reimer seeds has over 5,000 quality vegetable, flower, and herb seeds for the home gardener and market growers. We do not sell any Genetically Modified seeds. This year we reduced our prices on many items, added new items, and have added additional bulk items by the ounce and pounds! Take time to review our impressive Online Seed Catalog. Sorry, we do not have a printed catalog to mail you. Plan your garden, and then order your varieties for this upcoming season. Please check back often, as we add new items regularly. If you don't see an item you want you can always email us and we'll see if we can bring it into stock!

(https://urldefense.com/v3/ http://www.reimerseeds.com/ ;!!PoWafI1wM8F24!P4rqnNwAGX_KYYXb7gjzFBsDeP4x9VD1rZ8TqcabJsQBWyI2SO0HAUfGymTjI

Reimer seeds is the one source vendor for all of **your gardening needs!**



Material Safety Data Sheet

United Phosphorus, Inc.

NFPA	PPE		

Issued Date 17-Sep-2010

Revision Date 08-Dec-2010

Revision Number: 5

1. PRODUCT AND COMPANY IDENTIFICATION

UPI

630 Freedom Business Center
Suite 402
King of Prussia, PA 19406

Emergency Telephone Number

Chemtrec: (800) 424-9300 (24hrs) or (703) 527-3887
Medical: Rocky Mountain Poison Control Center
(866) 673-6671 (24hrs)

Company Information

UPI

Contact Information

Customer Service
R&D Technical Service

Phone Number

1-800-438-6071
610-878-6100

Available Hrs

8:00 am to 5:00 pm EST
8:00 am - 5:00 pm (EST)

Product Name

EPA Reg

Recommended Use

Product Code

Manzate Pro-Stick
70506-234
fungicide
12-371A

2. HAZARDS IDENTIFICATION

Emergency Overview

May cause allergic skin reaction
Harmful by inhalation, in contact with skin and if swallowed
May cause thyroid damage after repeated exposure based on animal data.

CAUTION

Appearance Yellow.

Physical State Solid.

Odor Slight. Rotten egg-like.

Potential Health Effects

- Inhalation
- Skin contact
- Repeated or long-term exposure may cause adverse effects on the thyroid.

Eyes

May cause slight irritation.

Skin

Repeated or prolonged skin contact may cause allergic reactions with susceptible persons.

Inhalation

May cause irritation of respiratory tract.

Ingestion

May be harmful if swallowed.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Ingredients Name

Chemical Name	CAS-No	Weight %	OSHA PEL
Mancozeb	8018-01-7	75	N/A
Ethylene thiourea	96-45-7	0-0.1	N/A

4. FIRST AID MEASURES

Eye Contact

Hold eye open and rinse slowly and gently with water for 15 - 20 minutes. Remove contact lenses, if present, after 5 minutes, then continue rinsing eye.
Call a poison control center or doctor for treatment advice.

Skin Contact

Take off contaminated clothing.
Rinse skin immediately with plenty of water for 15-20 minutes.
Call poison control center or doctor for treatment advice.

Inhalation

Move person to fresh air.
If person is not breathing, call 911 or an ambulance, then give artificial respiration.
Call a poison control center or doctor for further treatment advice.

Ingestion

Call a physician or Poison Control Center immediately
Have person sip a glass of water if able to swallow
Do not induce vomiting unless told to do so by a poison control center or doctor
Never give anything by mouth to an unconscious person

Notes to Physician

No information available

5. FIRE-FIGHTING MEASURES**Flammable Explosive Properties**

Flash Point	Not available
Autoignition Temperature	205°C / 401°F

Flammability Limits in Air	0.29 g/L (% by volume in air)
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Extinguishing Media	Use: Carbon dioxide (CO2) Foam Dry chemical If stored material becomes wetted or damp it can produce heat and deteriorate, over time, to become a fire hazard.
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Fire/Explosion Hazard	Firefighters and others who may be exposed to products of combustion should wear full fire fighting turn out gear and self-contained breathing apparatus. Fire fighting equipment should be thoroughly decontaminated after use.
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Hazardous Combustion Products	Carbon disulfide, ethylene thiourea (ETU) , Sulfur oxides, Oxides of nitrogen, Oxides of carbon.
--------------------------------------	--

NFPA	Health 1	Flammability 1	Instability 1
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6. ACCIDENTAL RELEASE MEASURES

Personal Precautions	Avoid contact with skin, eyes and clothing. Use personal protective equipment.
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Environmental Precautions	Consult a regulatory specialist to determine appropriate state or local reporting requirements, for assistance in waste characterization and/or hazardous waste disposal and other requirements listed in pertinent environmental permits.. Do not flush into surface water or sanitary sewer system.
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Methods for Clean-up	Sweep up and shovel into suitable containers for disposal.
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7. HANDLING AND STORAGE

Handling	Avoid breathing dust. Keep out of reach of children. Avoid contact with skin, eyes and clothing. Ensure adequate ventilation. Keep away from heat, sparks and open flame. - No smoking.
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Storage	Store in an area where cross-contamination with pesticides, fertilizers, food or feed could not occur. . If allowed to become wet the product will deteriorate and represent a fire hazard.
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8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Exposure Guidelines

Engineering Controls

Investigate engineering techniques to reduce exposures. Local mechanical exhaust ventilation is preferred. Consult ACGIH ventilation manual or NFPA Standard 91 for design of exhaust systems. .

PESTICIDE APPLICATORS & WORKERS. THESE WORKERS MUST REFER TO PRODUCT LABELING AND DIRECTIONS FOR USE IN ACCORDANCE WITH EPA WORKER PROTECTION STANDARD 40 CFR PART 170..

Personal Protective Equipment

Eye/face Protection

Avoid contact with eyes. Goggles.

Skin Protection

Rubber gloves. Wear protective gloves/clothing.

Respiratory Protection

Where airborne exposure is likely, use NIOSH approved respiratory protection equipment appropriate to the material and/or its components. Full facepiece equipment is recommended and, if used, replaces need for face shield and/or chemical goggles. If exposures cannot be kept at a minimum with engineering controls, consult respirator manufacturer to determine appropriate type equipment for given application. Observe respirator use limitations specified by NIOSH or the manufacturer. For emergency and other conditions where there may be a potential for significant exposure, use an approved full face positive-pressure, self-contained breathing apparatus. Respiratory protection programs must comply with 29 CFR 1910.134. .

General Hygiene Considerations

Handle in accordance with good industrial hygiene and safety practice

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	Yellow	Odor	Slight Rotten egg-like
Physical State	Solid	pH	No data available
Boiling Point/Range	Not available	Melting Point/Range	Not available
Specific Gravity	Not available	Solubility	Not available
Evaporation Rate	Not available	Vapor Pressure	Not available
Vapor Density	Not available	VOC Content	Not available
Viscosity	Not available	Molecular Weight	No data available
Bulk Density	40-45 lb/cu ft	Percent Solids	Not available
Percent Volatiles	Not available		

10. STABILITY AND REACTIVITY

Stability

Stable under normal conditions

Conditions to Avoid

To avoid thermal decomposition, do not overheat. Keep away from children.

Incompatible Materials

Strong oxidizing agents. Acids.

Hazardous Decomposition Products

carbon disulfide, ethylene thiourea. Hydrogen sulfide.

Possibility of Hazardous Polymerization

Hazardous polymerisation does not occur

11. TOXICOLOGICAL INFORMATION

Acute Toxicity

Product Information

Manzate Pro Stick :
Oral LD50 (rat) = >5,000 mg/kg
Dermal LD50 (rabbit) = > 2,000 mg/kg
Inhalation LC50 (rat) 4 hr = >5.4 mg/L

Mild to moderate eye irritant. Mild to slight skin irritant. Sensitizer .

Chronic Toxicity

Carcinogenicity

Mancozeb:

The effects in animals from repeated high inhalation dose of mancozeb dust equivalent to 150 - 250 times the AEL include reduced body weight, inflammation of the lungs, and abnormal thyroid function.

Toxic effects in animals from repeated ingestion of high doses of Mancozeb include reduced body weight and thyroid effects. In a different study, repeated dosing caused toxic and neuropathological effects in male and female rats which included compound-related mortality, decreased body weight, impaired hind limb motor activity and histopathological evidence of nerve damage. The no-observable effect level was 125 ppm.

Increased incidences of thyroid tumors and ocular lesions were observed in rats administered 750 ppm (equivalent to approximately 35 mg/kg/day) of mancozeb in their diet for two years. Mancozeb is considered to show weak carcinogenic activity. Tests in some animals indicate that mancozeb may produce embryo and fetal toxicity, but only at maternally toxic doses. Multi-generation studies in animals demonstrate no reproductive toxicity.

Chemical Name	ACGIH	IARC	NTP	OSHA
Ethylene thiourea			X	

IARC: (International Agency for Research on Cancer)

A trace contaminant, Ethylene thiourea (ETU) a breakdown product of Maneb, has been categorized as a probable human carcinogen by NTP.

12. ECOLOGICAL INFORMATION

Ecotoxicity

Mancozeb:

Aquatic toxicity:

96 hour LC50 = rainbow trout 0.73 mg/L

96 hour LC50 = fathead minnows 0.57 mg/L

96 hour LC50 = Bluegill sunfish 0.84 mg/L

72 hour EC50 = freshwater algae = 0.43 mg/L .

13. DISPOSAL CONSIDERATIONS

Waste Disposal Method	Dispose of in accordance with local regulations. Pesticide wastes are acutely hazardous. Improper disposal of excess pesticide or rinsate is a violation of Federal law. If the wastes cannot be disposed of by use or according to label instructions, contact your State Pesticide or Environmental Control Agency, or the Hazardous Waste representative at the nearest EPA Regional Office for guidance. .
Contaminated Packaging	Refer to product label.

14. TRANSPORT INFORMATION

DOT Not regulated when shipped by highway in non-buk containers as per 49 CFR 171.4
When shipped in bulk, by vessel, or internationally use the following shipping description:

Proper Shipping Name	Environmentally hazardous substances, solid, n.o.s. (Mancozeb)
Hazard Class	9
UN-No	UN3077
Packing Group	PG III
Marine Pollutant:	Yes.

ICAO

UN-No	UN3077
Proper Shipping Name	Environmentally hazardous substance, solid, n.o.s (Mancozeb)
Hazard Class	9
Packing Group	PG III

IATA

UN-No	3077
Proper Shipping Name	Environmentally hazardous substances, solid, n.o.s. (Mancozeb)
Hazard Class	9
Packing Group	PG III

IMDG/IMO

Proper Shipping Name	Environmentally hazardous substances, solid, n.o.s. (Mancozeb)
Hazard Class	9
UN-No	3077
Packing Group	PG III
Marine Pollutant	This product contains a chemical which is listed as a marine pollutant according to IMDG/IMO

15. REGULATORY INFORMATION

International Inventories

Mancozeb	
ENCS	Listed
CHINA	Listed
KECL	Listed

12-371A - Manzate Pro-Stick

Mancozeb

Ethylene thiourea

DSL Listed

EINECS/ELINCS Listed

ENCS Listed

CHINA Listed

KECL Listed

USA

Federal Regulations

SARA 313

Y

Chemical Name	CAS-No	Weight %
Mancozeb	8018-01-7	75
Ethylene thiourea	96-45-7	0-0.1

SARA 311/312 Hazardous Categorization

Chronic Health Hazard Yes

Acute Health Hazard Yes

Fire Hazard No

Sudden Release of Pressure Hazard No

Reactive Hazard No

Clean Water Act

Clean Air Act, Section 112 Hazardous Air Pollutants (HAPs) (see 40 CFR 61)

This product contains the following HAPs:

Chemical Name	CAS-No	Weight %	HAPS data	VOC Chemicals	Class 1 Ozone Depletors	Class 2 Ozone Depletors
Mancozeb	8018-01-7	75	Listed.			
Ethylene thiourea	96-45-7	0-0.1	Listed.			

CERCLA

Chemical Name	RQ
Mancozeb	Listed.
Ethylene thiourea	Listed.

RCRA

Chemical Name	RCRA - D Series Wastes	RCRA - P Series Wastes	RCRA - U Series Wastes
Ethylene thiourea			U116

Pesticide Information

State Regulations

California Proposition 65

This product contains the following Proposition 65 chemicals:

Chemical Name	CAS-No	Category	California Prop. 65
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12-371A - Manzate Pro-Stick

Chemical Name	CAS-No	Category	California Prop. 65
Mancozeb	8018-01-7		Listed. Listed: January 1, 1990 Carcinogenic.
Ethylene thiourea	96-45-7		Listed. Listed: January 1, 1988 Carcinogenic. Listed: January 1, 1993 Developmental toxin. 20 ug/day

State Right-to-Know

Chemical Name	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Mancozeb		Substance no. 2370 Listed. Substance no. 2369 Listed. Substance no. 2371 Listed. Substance no. 2372 Listed. Substance no. 2324 Listed.		Listed.	Listed.
Ethylene thiourea	Listed.	Substance no. 0883 Listed. Substance no. 0883 Special hazard.	Listed.	Listed.	Listed.

International Regulations

Mexico - Grade

Not available

Canada

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR.

WHMIS Hazard Class

Not determined

Chemical Name	NPRI
Mancozeb	X
Ethylene thiourea	X

16. OTHER INFORMATION

Revision Date

08-Dec-2010

Revision Summary

Update section 14

UPI, Inc. believes that the information and recommendations contained herein (including data and statements) are accurate as of the date hereof. NO WARRANTY OF FITNESS FOR ANY PARTICULAR PURPOSE, WARRANTY OF MERCHANTABILITY, OR ANY OTHER WARRANTY, EXPRESSED OR IMPLIED, IS MADE CONCERNING THE INFORMATION PROVIDED HEREIN. The information provided herein relates only to the specific product designated and may not be valid where such product is used in combination with other materials or in any process. Further, since the conditions and methods of use are beyond the control of UPI, Inc. UPI, Inc. expressly disclaims any and all liability as to any results obtained or arising from any use of the product or reliance on such information.

End of MSDS

**DuPont™ Kocide® 3000 Fungicide/Bactericide**

Version 2.0

Revision Date 05/28/2015

Ref. 130000024626

This SDS adheres to the standards and regulatory requirements of the United States and may not meet the regulatory requirements in other countries.

SECTION 1. PRODUCT AND COMPANY IDENTIFICATION

Product name	:	DuPont™ Kocide® 3000 Fungicide/Bactericide
Tradename/Synonym	:	B12015094 GX-569 30WG DPX-GFJ52 46.1WG Kocide Opti Kocide 46.1 DF
Product Grade/Type	:	(Cu 30%)
Product Use	:	Fungicide
Restrictions on use	:	Do not use product for anything outside of the above specified uses
Manufacturer/Supplier	:	DuPont 4417 Lancaster Pike Wilmington, DE 19805, USA
Product Information	:	1-800-441-7515 (outside the U.S. 1-302-774-1000)
Medical Emergency	:	1-800-441-3637 (outside the U.S. 1-302-774-1139)
Transport Emergency	:	CHEMTREC: +1-800-424-9300 (outside the U.S. +1-703-527-3887)

SECTION 2. HAZARDS IDENTIFICATION**Product hazard category**

Acute toxicity (Oral)	Category 4
Acute toxicity (Inhalation)	Category 4
Serious eye damage/eye irritation	Category 2A

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Label content

Pictogram

:



Signal word

: Warning

Hazardous warnings

: Harmful if swallowed or if inhaled
Causes serious eye irritation.

Hazardous prevention
measures

: Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
Wash skin thoroughly after handling.
Do not eat, drink or smoke when using this product.
Use only outdoors or in a well-ventilated area.
Wear eye protection/ face protection.
IF SWALLOWED: Call a POISON CENTER or doctor/ physician if you feel unwell.
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
Call a POISON CENTER or doctor/ physician if you feel unwell.
Rinse mouth.
If eye irritation persists: Get medical advice/ attention.
Dispose of contents/ container to an approved waste disposal plant.

Other hazards

If you mill or grind this product you may change its toxicological properties.

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SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Component	CAS-No.	Concentration
Copper Hydroxide	20427-59-2	46.1 %
Clay		1 - 5 %
2-Propenoic Acid, Homopolymer		5 - 10 %
Other Ingredients		38.9 - 47.9 %

The specific chemical identity and/or exact percentage (concentration) of composition has been withheld as a trade secret.

SECTION 4. FIRST AID MEASURES

- General advice : Have the product container or label with you when calling a poison control center or doctor, or going for treatment.
For medical emergencies involving this product, call toll free 1-800-441-3637.
See Label for Additional Precautions and Directions for Use.
- Inhalation : Move to fresh air. If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth-to-mouth, if possible. Call a poison control center or doctor for treatment advice.
- Skin contact : Take off all contaminated clothing immediately. Rinse skin immediately with plenty of water for 15-20 minutes. Call a poison control center or doctor for treatment advice.

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Eye contact	: Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. Call a poison control center or doctor for treatment advice.
Ingestion	: Call a poison control center or doctor for treatment advice. Have person sip a glass of water if able to swallow. DO NOT induce vomiting unless directed to do so by a physician or poison control center. Never give anything by mouth to an unconscious person.
Most important symptoms/effects, acute and delayed	: No applicable data available.
Protection of first-aiders	: No applicable data available.
Notes to physician	: Probable mucosal damage may contraindicate the use of gastric lavage.

SECTION 5. FIREFIGHTING MEASURES

Suitable extinguishing media	: Water spray, Dry chemical, Foam, Carbon dioxide (CO2)
Unsuitable extinguishing media	: High volume water jet, (contamination risk)
Specific hazards	: No applicable data available.
Special protective equipment for firefighters	: Wear full protective equipment.
Further information	: (on small fires) If area is heavily exposed to fire and if conditions permit, let fire burn itself out since water may increase the area contaminated. Cool containers/tanks with water spray. Runoff from fire control may be a pollution hazard. Control Runoff.

SECTION 6. ACCIDENTAL RELEASE MEASURES

NOTE: Review FIRE FIGHTING MEASURES and HANDLING (PERSONNEL) sections before proceeding with clean-up. Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean-up.

Safeguards (Personnel)	: Evacuate personnel, thoroughly ventilate area, use self-contained breathing apparatus. Use personal protective equipment.
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- Environmental precautions : Prevent material from entering sewers, waterways, or low areas.
- Spill Cleanup : Shovel or sweep up. Avoid dust formation. Shovel into suitable container for disposal.
Water Spill: If feasible, copper may be precipitated/-ultrafiltrated with caustics or other chemicals and resulting sludge disposed of in a chemical landfill.
- Accidental Release Measures : Follow applicable Federal, State/Provincial and Local laws/regulations.

SECTION 7. HANDLING AND STORAGE

- Handling (Personnel) : Wash hands thoroughly with soap and water after handling and before eating, drinking, chewing gum, using tobacco, or using the toilet. Remove clothing/PPE immediately if material gets inside. Wash thoroughly and put on clean clothing. Remove personal protective equipment immediately after handling this product. Wash the outside of gloves before removing. As soon as possible, wash thoroughly and change into clean clothing.
- Handling (Physical Aspects) : Keep away from heat and sources of ignition.
- Dust explosion class : No applicable data available.
- Storage : Do not contaminate water, other pesticides, fertilizer, food or feed in storage. Store in a cool, dry place. Keep out of the reach of children.
- Storage period : No applicable data available.
- Storage temperature : No applicable data available.

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

- Engineering controls : Ensure adequate ventilation.
- Personal protective equipment
 - Skin and body protection : Applicators and other handlers must wear:
 - Long sleeved shirt and long pants
 - Shoes plus socks
 - Chemical resistant gloves made of any waterproof material
 - Natural Rubber
 - PPE required for early entry to treated areas that is permitted under the Worker Protection Standard and that involves contact with anything that has

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been treated, such as plants, soil, or water, is:

Coveralls

Chemical resistant gloves made of any waterproof material, such as polyvinyl chloride, nitrile rubber, or butyl rubber

Shoes plus socks

Protective measures : Discard clothing and other absorbent materials that have been drenched or heavily contaminated with this product. Do not reuse them. Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables exist, use detergent and hot water. Keep and wash PPE separately from other laundry.

Exposure Guidelines

Exposure Limit Values

Copper Hydroxide

TLV	(ACGIH)	0.2 mg/m3	TWA Fume. as Cu
TLV	(ACGIH)	1 mg/m3	TWA Dust and mist. as Cu
AEL *	(DUPONT)	1.5 mg/m3	8 & 12 hr. TWA

Clay

No applicable data available.

2-Propenoic Acid, Homopolymer

No applicable data available.

* AEL is DuPont's Acceptable Exposure Limit. Where governmentally imposed occupational exposure limits which are lower than the AEL are in effect, such limits shall take precedence.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance

Physical state : solid
Form : solid, granular
Color : blue

Odor : characteristic copper odor

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Odor threshold	: not determined
pH	: 7.5 - 9.5
Melting point/range	: No applicable data available.
Boiling point/boiling range	: No applicable data available.
Flash point	: No applicable data available.
Evaporation rate	: No applicable data available.
Flammability (solid, gas)	: Does not sustain combustion.
Upper explosion limit	: No applicable data available.
Lower explosion limit	: No applicable data available.
Vapour Pressure	: No applicable data available.
Vapour density	: No applicable data available.
Specific gravity (Relative density)	: No applicable data available.
Water solubility	: dispersible
Solubility(ies)	: No applicable data available.
Partition coefficient: n-octanol/water	: No applicable data available.
Auto-ignition temperature	: No applicable data available.
Decomposition temperature	: No applicable data available.
Viscosity, kinematic	: No applicable data available.
Viscosity, dynamic	: No applicable data available.

SECTION 10. STABILITY AND REACTIVITY

Reactivity : No hazards to be specially mentioned.



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Chemical stability	:	The product is chemically stable under recommended conditions of storage, use and temperature. Stable at normal temperatures and storage conditions.
Possibility of hazardous reactions	:	No applicable data available.
Conditions to avoid	:	No applicable data available.
Incompatible materials	:	None reasonably foreseeable.
Hazardous decomposition products	:	Hazardous thermal decomposition products:: Copper oxides

SECTION 11. TOXICOLOGICAL INFORMATION

DuPont™ Kocide® 3000 Fungicide/Bactericide

Inhalation 4 h LC50 : > 2.08 mg/l , Rat

Dermal LD50 : > 2,000 mg/kg , Rat

Oral LD50 : 1,847 mg/kg , Rat

Skin irritation : No skin irritation, Rabbit

Eye irritation : Irritating to eyes., Rabbit

Sensitisation : Animal test did not cause sensitization by skin contact., Guinea pig

Copper Hydroxide

Repeated dose toxicity :
No toxicological effects warranting significant target organ toxicity classification were seen below the recommended guidance values for classification., The following effects occurred at levels of exposure that significantly exceed those expected under labeled usage conditions.

Oral
Rat

-
Liver effects, Kidney effects, microcytic anemia

Information given is based on data obtained from similar substances.

Oral - feed

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Rat
-
Spleen effects

Information given is based on data obtained from similar substances.

Carcinogenicity : Not classifiable as a human carcinogen.
Animal testing did not show any carcinogenic effects.
Information given is based on data obtained from similar substances.

Mutagenicity : Weight of evidence does not support classification as a germ cell
mutagen.
Information given is based on data obtained from similar substances.

Reproductive toxicity : No toxicity to reproduction
Animal testing did not show any effects on fertility.
Information given is based on data obtained from similar substances.

Teratogenicity : The following effects occurred at levels of exposure that significantly
exceed those expected under labeled usage conditions.
Animal testing showed effects on embryo-fetal development at levels
equal to or above those causing maternal toxicity.

2-Propenoic Acid, Homopolymer
Repeated dose toxicity : Ingestion
Rat
- 28 d
NOAEL: 1,136 mg/kg
No toxicologically significant effects were found., Information given is
based on data obtained from similar substances.

Mutagenicity : Animal testing did not show any mutagenic effects.
Tests on bacterial or mammalian cell cultures did not show mutagenic
effects.

Reproductive toxicity : No toxicity to reproduction
Animal testing showed no reproductive toxicity.

Teratogenicity : Animal testing showed no developmental toxicity.
Information given is based on data obtained from similar substances.

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Carcinogenicity

The carcinogenicity classifications for this product and/or its ingredients have been determined according to HazCom 2012, Appendix A.6. The classifications may differ from those listed in the National Toxicology Program (NTP) Report on Carcinogens (latest edition) or those found to be a potential carcinogen in the International Agency for Research on Cancer (IARC) Monographs (latest edition).

None of the components present in this material at concentrations equal to or greater than 0.1% are listed by IARC, NTP, or OSHA, as a carcinogen.

SECTION 12. ECOLOGICAL INFORMATION**Aquatic Toxicity****DuPont™ Kocide® 3000 Fungicide/Bactericide**

96 h LC50 : Oncorhynchus mykiss (rainbow trout) 0.24 mg/l

48 h EC50 : Daphnia magna (Water flea) 0.118 mg/l

Copper Hydroxide

72 h ErC50 : Pseudokirchneriella subcapitata (green algae) 0.00939 mg/l

90 d : NOEC 0.0017 mg/l

21 d : NOEC 0.03 mg/l

2-Propenoic Acid, Homopolymer

72 h EC50 : Selenastrum capricornutum (green algae) 40 mg/l see user defined free text
Information given is based on data obtained from similar substances.

96 h NOEC : Desmodesmus subspicatus (green algae) 32.8 mg/l OECD Test Guideline 201
Information given is based on data obtained from similar substances.

28 d : NOEC Danio rerio (zebra fish) > 450 mg/l OECD Test Guideline 204
Information given is based on data obtained from similar substances.

21 d : NOEC Daphnia magna (Water flea) 58 mg/l see user defined free text
Information given is based on data obtained from similar substances.

Environmental Fate**2-Propenoic Acid, Homopolymer**

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Biodegradability : Not rapidly biodegradable
Information given is based on data obtained from similar substances.

Bioaccumulation : Bioaccumulation is unlikely.
Information given is based on data obtained from similar substances.

Additional ecological information : Environmental Hazards: For Terrestrial Uses: Do not apply directly to water, or to areas where surface water is present, or to intertidal areas below the mean high water mark. Do not contaminate water when cleaning equipment or disposing of equipment washwaters or rinsate. Drift and runoff from treated areas may be hazardous to fish and aquatic organisms in adjacent aquatic sites. See product label for additional application instructions relating to environmental precautions.

SECTION 13. DISPOSAL CONSIDERATIONS

Waste disposal methods - Product : Pesticide wastes are acutely hazardous. Improper disposal of excess pesticide, spray mixture, or rinsate is a violation of Federal Law. If these wastes cannot be disposed of by use according to label instructions, contact your State Pesticide or Environmental Control Agency, or the Hazardous Waste representative at the nearest EPA Regional Office for guidance.

Waste disposal methods - Container : Refer to the product label for instructions.
Do not transport if this container is damaged or leaking.

In the event of a major spill, fire or other emergency, call 1-800-441-3637 day or night.

Contaminated packaging : No applicable data available.

SECTION 14. TRANSPORT INFORMATION

IATA_C	UN number	: 3077
	Proper shipping name	: Environmentally hazardous substance, solid, n.o.s. (Copper hydroxide)
	Class	: 9
	Packing group	: III
	Labelling No.	: 9MI

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IMDG	UN number	: 3077
	Proper shipping name	: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (Copper hydroxide)
	Class	: 9
	Packing group	: III
	Labelling No.	: 9

Not regulated by DOT/49 CFR unless shipped in bulk package or by water.

Marine Pollutants assigned UN number 3077 and 3082 in single or combination packaging containing a net quantity per single or inner packaging of 5 L or less for liquids or having a net mass per single or inner packaging of 5 KG or less for solids may be transported as non-dangerous goods as provided in section 2.10.2.7 of IMDG code, IATA special provision A197, and ADR/RID special provision 375.

SECTION 15. REGULATORY INFORMATION

Other regulations : Very toxic to aquatic organisms.

SARA 313 Regulated Chemical(s) : Copper Hydroxide

PA Right to Know Regulated Chemical(s) : Substances on the Pennsylvania Hazardous Substances List present at a concentration of 1% or more (0.01% for Special Hazardous Substances): Sodium sulphate

Title III hazard classification : Acute Health Hazard: Yes
Chronic Health Hazard: No
Fire: No
Reactivity/Physical hazard: No
Pressure: No

EPA Reg. No. : 352-662
In the United States this product is regulated by the US Environmental Protection Agency (EPA) under the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA). It is a violation of Federal law to use this product in a manner inconsistent with its labeling. Read and follow all label directions. This product is excluded from listing requirements under EPA/TSCA.

California Prop. 65 : WARNING! This product contains a chemical or chemicals known to the State of California to cause cancer.

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WARNING! This product contains a chemical or chemicals known to the State of California to cause birth defects or other reproductive harm.

SECTION 16. OTHER INFORMATION

NFPA

Health	:	2
Flammability	:	1
Reactivity/Physical hazard	:	0

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® Registered trademark of E.I. du Pont de Nemours and Company

Revision Date : 05/28/2015

Contact person : DuPont Crop Protection, Wilmington, DE, 19898, Phone: 1-888-638-7668

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

Significant change from previous version is denoted with a double bar.

SAFETY DATA SHEET

DOW AGROSCIENCES LLC

Product name: RALLY™ 40WSP Fungicide

Issue Date: 05/15/2015

Print Date: 05/19/2015

DOW AGROSCIENCES LLC encourages and expects you to read and understand the entire (M)SDS, as there is important information throughout the document. We expect you to follow the precautions identified in this document unless your use conditions would necessitate other appropriate methods or actions.

1. IDENTIFICATION

Product name: RALLY™ 40WSP Fungicide

Recommended use of the chemical and restrictions on use

Identified uses: End use fungicide product

COMPANY IDENTIFICATION

DOW AGROSCIENCES LLC
9330 ZIONSVILLE RD
INDIANAPOLIS IN 46268-1053
UNITED STATES

Customer Information Number:

800-992-5994

info@dow.com

EMERGENCY TELEPHONE NUMBER

24-Hour Emergency Contact: 800-992-5994

Local Emergency Contact: 352-323-3500

2. HAZARDS IDENTIFICATION

Hazard classification

This material is hazardous under the criteria of the Federal OSHA Hazard Communication Standard 29CFR 1910.1200.

Combustible dust

Eye irritation - Category 2A

Carcinogenicity - Category 1A

Reproductive toxicity - Category 2

Specific target organ toxicity - repeated exposure - Category 2 - Oral

Label elements

Hazard pictograms



Signal word: **DANGER!**

Hazards

May form combustible dust concentrations in air

Causes serious eye irritation.

May cause cancer.

Suspected of damaging fertility or the unborn child.

May cause damage to organs (Liver) through prolonged or repeated exposure if swallowed.

Precautionary statements

Prevention

Obtain special instructions before use.

Do not handle until all safety precautions have been read and understood.

Do not breathe dust/ fume/ gas/ mist/ vapours/ spray.

Wash skin thoroughly after handling.

Wear eye protection/ face protection.

Use personal protective equipment as required.

Response

IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

IF exposed or concerned: Get medical advice/ attention.

If eye irritation persists: Get medical advice/ attention.

Storage

Store locked up.

Disposal

Dispose of contents/ container to an approved waste disposal plant.

Other hazards

no data available

3. COMPOSITION/INFORMATION ON INGREDIENTS

This product is a mixture.

Component	CASRN	Concentration
Myclobutanil	88671-89-0	40.0%
Kaolin	1332-58-7	>= 1.5 - <= 39.8 %

Calcium polysilicate	1344-95-2	4.0%
Silica, crystalline (quartz)	14808-60-7	0.4%
Titanium dioxide	13463-67-7	1.1%
Balance	Not available	>= 14.7 - <= 53.0 %

4. FIRST AID MEASURES

Description of first aid measures

General advice: First Aid responders should pay attention to self-protection and use the recommended protective clothing (chemical resistant gloves, splash protection). If potential for exposure exists refer to Section 8 for specific personal protective equipment.

Inhalation: Move person to fresh air. If person is not breathing, call an emergency responder or ambulance, then give artificial respiration; if by mouth to mouth use rescuer protection (pocket mask etc). Call a poison control center or doctor for treatment advice.

Skin contact: Take off contaminated clothing. Rinse skin immediately with plenty of water for 15-20 minutes. Call a poison control center or doctor for treatment advice. Suitable emergency safety shower facility should be available in work area.

Eye contact: Hold eyes open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eyes. Call a poison control center or doctor for treatment advice. Suitable emergency eye wash facility should be immediately available.

Ingestion: Call a poison control center or doctor immediately for treatment advice. Have person sip a glass of water if able to swallow. Do not induce vomiting unless told to do so by the poison control center or doctor. Never give anything by mouth to an unconscious person.

Most important symptoms and effects, both acute and delayed: Aside from the information found under Description of first aid measures (above) and Indication of immediate medical attention and special treatment needed (below), any additional important symptoms and effects are described in Section 11: Toxicology Information.

Indication of any immediate medical attention and special treatment needed

Notes to physician: Repeated excessive exposure may aggravate preexisting lung disease. May cause asthma-like (reactive airways) symptoms. Bronchodilators, expectorants, antitussives and corticosteroids may be of help. Maintain adequate ventilation and oxygenation of the patient. No specific antidote. Treatment of exposure should be directed at the control of symptoms and the clinical condition of the patient. Have the Safety Data Sheet, and if available, the product container or label with you when calling a poison control center or doctor, or going for treatment.

5. FIREFIGHTING MEASURES

Suitable extinguishing media: Water fog or fine spray. Dry chemical fire extinguishers. Carbon dioxide fire extinguishers. Foam. General purpose synthetic foams (including AFFF type) or protein foams are preferred if available. Alcohol resistant foams (ATC type) may function.

Unsuitable extinguishing media: Do not use direct water stream. May spread fire.

Special hazards arising from the substance or mixture

Hazardous combustion products: During a fire, smoke may contain the original material in addition to combustion products of varying composition which may be toxic and/or irritating. Combustion products may include and are not limited to: Nitrogen oxides. Hydrogen cyanide. Hydrogen chloride. Carbon monoxide. Carbon dioxide.

Unusual Fire and Explosion Hazards: Violent steam generation or eruption may occur upon application of direct water stream to hot liquids. Do not permit dust to accumulate. When suspended in air dust can pose an explosion hazard. Minimize ignition sources. If dust layers are exposed to elevated temperatures, spontaneous combustion may occur.

Advice for firefighters

Fire Fighting Procedures: Keep people away. Isolate fire and deny unnecessary entry. Soak thoroughly with water to cool and prevent re-ignition. Use water spray to cool fire exposed containers and fire affected zone until fire is out and danger of reignition has passed. Do not use direct water stream. May spread fire. Hand held dry chemical or carbon dioxide extinguishers may be used for small fires. Dust explosion hazard may result from forceful application of fire extinguishing agents. Burning liquids may be moved by flushing with water to protect personnel and minimize property damage. Contain fire water run-off if possible. Fire water run-off, if not contained, may cause environmental damage. Review the "Accidental Release Measures" and the "Ecological Information" sections of this (M)SDS.

Special protective equipment for firefighters: Wear positive-pressure self-contained breathing apparatus (SCBA) and protective fire fighting clothing (includes fire fighting helmet, coat, trousers, boots, and gloves). Avoid contact with this material during fire fighting operations. If contact is likely, change to full chemical resistant fire fighting clothing with self-contained breathing apparatus. If this is not available, wear full chemical resistant clothing with self-contained breathing apparatus and fight fire from a remote location. For protective equipment in post-fire or non-fire clean-up situations, refer to the relevant sections.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures: Isolate area. Keep unnecessary and unprotected personnel from entering the area. Refer to section 7, Handling, for additional precautionary measures. Keep upwind of spill. Spilled material may cause a slipping hazard. Ventilate area of leak or spill. Use appropriate safety equipment. For additional information, refer to Section 8, Exposure Controls and Personal Protection.

Environmental precautions: Prevent from entering into soil, ditches, sewers, waterways and/or groundwater. See Section 12, Ecological Information. Spills or discharge to natural waterways is likely to kill aquatic organisms.

Methods and materials for containment and cleaning up: Contain spilled material if possible. Small spills: Sweep up. Collect in suitable and properly labeled containers. Large spills: Contact Dow AgroSciences for clean-up assistance. See Section 13, Disposal Considerations, for additional information.

7. HANDLING AND STORAGE

Precautions for safe handling: Keep out of reach of children. Keep away from heat, sparks and flame. Do not swallow. Avoid contact with eyes, skin, and clothing. Avoid breathing dust or mist. Wash thoroughly after handling. Keep container closed. Use with adequate ventilation. Good housekeeping and controlling of dusts are necessary for safe handling of product. See Section 8, EXPOSURE CONTROLS AND PERSONAL PROTECTION.

Good housekeeping and controlling of dusts are necessary for safe handling of product.

Conditions for safe storage: Avoid moisture. Store in a dry place. Store in original container. Do not store near food, foodstuffs, drugs or potable water supplies.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters

Exposure limits are listed below, if they exist.

Component	Regulation	Type of listing	Value/Notation
Myclobutanil	Dow IHG	TWA	0.5 mg/m3
Kaolin	ACGIH	TWA Respirable fraction	2 mg/m3
	OSHA Z-1	TWA total dust	15 mg/m3
	OSHA Z-1	TWA respirable fraction	5 mg/m3
	OSHA Z-1	TWA total dust	15 mg/m3
Calcium polysilicate	OSHA Z-1	TWA respirable fraction	5 mg/m3
	ACGIH	TWA	10 mg/m3
Silica, crystalline (quartz)	OSHA Z-1		
	OSHA Z-3	TWA total dust	30 mg/m3 / %SiO ₂ +2
	OSHA Z-3	TWA respirable	10 mg/m3 / %SiO ₂ +2
	OSHA Z-3	TWA respirable	250 mppcf / %SiO ₂ +5
	ACGIH	TWA Respirable fraction	0.025 mg/m3 , Silica
Titanium dioxide	OSHA Z-1	TWA total dust	15 mg/m3
	ACGIH	TWA	10 mg/m3 , Titanium dioxide

RECOMMENDATIONS IN THIS SECTION ARE FOR MANUFACTURING, COMMERCIAL BLENDING AND PACKAGING WORKERS. APPLICATORS AND HANDLERS SHOULD SEE THE PRODUCT LABEL FOR PROPER PERSONAL PROTECTIVE EQUIPMENT AND CLOTHING.

Exposure controls

Engineering controls: Use engineering controls to maintain airborne level below exposure limit requirements or guidelines. If there are no applicable exposure limit requirements or guidelines, use only with adequate ventilation. Local exhaust ventilation may be necessary for some operations.

Individual protection measures

Eye/face protection: Use chemical goggles.

Skin protection

Hand protection: Use gloves chemically resistant to this material when prolonged or frequently repeated contact could occur. Examples of preferred glove barrier

materials include: Polyvinyl chloride ("PVC" or "vinyl"). Neoprene. Nitrile/butadiene rubber ("nitrile" or "NBR"). NOTICE: The selection of a specific glove for a particular application and duration of use in a workplace should also take into account all relevant workplace factors such as, but not limited to: Other chemicals which may be handled, physical requirements (cut/puncture protection, dexterity, thermal protection), potential body reactions to glove materials, as well as the instructions/specifications provided by the glove supplier.

Other protection: Wear clean, body-covering clothing.

Respiratory protection: Respiratory protection should be worn when there is a potential to exceed the exposure limit requirements or guidelines. If there are no applicable exposure limit requirements or guidelines, wear respiratory protection when adverse effects, such as respiratory irritation or discomfort have been experienced, or where indicated by your risk assessment process. In dusty or misty atmospheres, use an approved particulate respirator. The following should be effective types of air-purifying respirators: Organic vapor cartridge with a particulate pre-filter.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance

Physical state	Powder
Color	Tan
Odor	Mild
Odor Threshold	No test data available
pH	7.5 - 8.5 <i>Calculated.</i> (aqueous suspension)
Melting point/range	No test data available
Freezing point	Not applicable
Boiling point (760 mmHg)	Not applicable
Flash point	closed cup Not applicable
Evaporation Rate (Butyl Acetate = 1)	Not applicable
Flammability (solid, gas)	May form combustible dust concentrations in air
Lower explosion limit	Not applicable
Upper explosion limit	Not applicable
Vapor Pressure	> 266.6 hPa at 25 °C (77 °F) Solvent
Relative Vapor Density (air = 1)	Not applicable
Relative Density (water = 1)	Not applicable
Water solubility	Dispersible
Partition coefficient: n-octanol/water	no data available
Auto-ignition temperature	Not applicable
Decomposition temperature	No test data available
Dynamic Viscosity	Not applicable
Kinematic Viscosity	Not applicable
Explosive properties	no data available
Oxidizing properties	no data available
Liquid Density	0.3 - 0.35 g/cm ³ <i>Calculated.</i>

Bulk density 0.255 g/cm³
Molecular weight no data available

NOTE: The physical data presented above are typical values and should not be construed as a specification.

10. STABILITY AND REACTIVITY

Reactivity: no data available

Chemical stability: Stable under recommended storage conditions. See Storage, Section 7.

Possibility of hazardous reactions: Polymerization will not occur.

Conditions to avoid: Active ingredient decomposes at elevated temperatures. Generation of gas during decomposition can cause pressure in closed systems. Avoid moisture. Avoid direct sunlight.

Incompatible materials: Avoid contact with: Strong oxidizers.

Hazardous decomposition products: Decomposition products depend upon temperature, air supply and the presence of other materials. Decomposition products can include and are not limited to: Hydrogen chloride. Hydrogen cyanide.

11. TOXICOLOGICAL INFORMATION

Toxicological information appears in this section when such data is available.

Acute toxicity

Acute oral toxicity

Low toxicity if swallowed. Small amounts swallowed incidentally as a result of normal handling operations are not likely to cause injury; however, swallowing larger amounts may cause injury.

As product: Single dose oral LD₅₀ has not been determined.

Based on information for component(s):
LD₅₀, Rat, > 2,500 mg/kg Estimated.

Acute dermal toxicity

Prolonged skin contact is unlikely to result in absorption of harmful amounts.

As product: The dermal LD₅₀ has not been determined.

Based on information for component(s):
LD₅₀, Rabbit, > 5,000 mg/kg Estimated.

Acute inhalation toxicity

No adverse effects are anticipated from single exposure to dust. Dust may cause irritation of the upper respiratory tract (nose and throat) and lungs.

As product: The LC50 has not been determined.

For the active ingredient(s):
LC50, Rat, 4 Hour, dust/mist, > 5.88 mg/l

Skin corrosion/irritation

Brief contact is essentially nonirritating to skin.

Serious eye damage/eye irritation

May cause moderate eye irritation.
May cause moderate corneal injury.

Sensitization

For the active ingredient(s):
Did not cause allergic skin reactions when tested in guinea pigs.

For respiratory sensitization:
No relevant data found.

Specific Target Organ Systemic Toxicity (Single Exposure)

Evaluation of available data suggests that this material is not an STOT-SE toxicant.

Specific Target Organ Systemic Toxicity (Repeated Exposure)

For the active ingredient(s):
In animals, effects have been reported on the following organs:
Liver.
Testes.
Adrenal gland.
Kidney.
Thyroid.
Repeated excessive exposure to crystalline silica may cause silicosis, a progressive and disabling disease of the lungs.

Carcinogenicity

Crystalline silica has been shown to cause cancer in laboratory animals and humans. Lung fibrosis and tumors have been observed in rats exposed to titanium dioxide in two lifetime inhalation studies. Effects are believed to be due to overloading of the normal respiratory clearance mechanisms caused by the extreme study conditions. Workers exposed to titanium dioxide in the workplace have not shown an unusual incidence of chronic respiratory disease or lung cancer. Titanium dioxide was not carcinogenic in laboratory animals in lifetime feeding studies. For the active ingredient(s): Did not cause cancer in laboratory animals.

Teratogenicity

For the active ingredient(s): Has been toxic to the fetus in lab animals at doses nontoxic to the mother. Did not cause birth defects in laboratory animals.

Reproductive toxicity

For the active ingredient(s): In laboratory animal studies, effects on reproduction have been seen only at doses that produced significant toxicity to the parent animals.

Mutagenicity

For the active ingredient(s): In vitro genetic toxicity studies were negative. Animal genetic toxicity studies were negative.

For the minor component(s): In vitro genetic toxicity studies were negative in some cases and positive in other cases. Animal genetic toxicity studies were negative.

Aspiration Hazard

Based on physical properties, not likely to be an aspiration hazard.

Carcinogenicity**Component****List****Classification****Silica, crystalline (quartz)**

IARC

Group 1: Carcinogenic to humans

ACGIH

A2: Suspected human carcinogen

Titanium dioxide

IARC

Group 2B: Possibly carcinogenic to humans

12. ECOLOGICAL INFORMATION

Ecotoxicological information appears in this section when such data is available.

Toxicity**Myclobutanil****Acute toxicity to fish**

Material is highly toxic to aquatic organisms on an acute basis (LC50/EC50 between 0.1 and 1 mg/L in the most sensitive species tested).

LC50, *Oncorhynchus mykiss* (rainbow trout), static test, 96 Hour, 2 mg/l, OECD Test Guideline 203 or Equivalent

Acute toxicity to aquatic invertebrates

EC50, *Daphnia magna* (Water flea), static test, 48 Hour, 17 mg/l, OECD Test Guideline 202 or Equivalent

LC50, saltwater mysid *Mysidopsis bahia*, 96 Hour, 0.24 mg/l

EC50, eastern oyster (*Crassostrea virginica*), flow-through test, 96 Hour, 0.72 mg/l

Acute toxicity to algae/aquatic plants

ErC50, alga *Scenedesmus* sp., 96 Hour, Growth rate inhibition, 2.655 mg/l, OECD Test Guideline 201 or Equivalent

Toxicity to Above Ground Organisms

Material is practically non-toxic to birds on a dietary basis (LC50 > 5000 ppm).

Material is slightly toxic to birds on an acute basis (LD50 between 501 and 2000 mg/kg).

dietary LC50, *Colinus virginianus* (Bobwhite quail), 8 d, mg/kg diet., > 5,000 ppm

oral LD50, *Colinus virginianus* (Bobwhite quail), 510mg/kg bodyweight.

contact LD50, *Apis mellifera* (bees), 48 Hour, 39.6micrograms/bee

oral LD50, *Apis mellifera* (bees), 48 Hour, 33.9micrograms/bee

Toxicity to soil-dwelling organisms

LC50, Earthworm, *Lumbricus terrestris*, 14 d, 250 mg/kg

Kaolin**Acute toxicity to fish**

Not expected to be acutely toxic to aquatic organisms.

Calcium polysilicate

Acute toxicity to fish

No relevant data found.

Silica, crystalline (quartz)

Acute toxicity to fish

Not expected to be acutely toxic to aquatic organisms.

Titanium dioxide

Acute toxicity to fish

Material is practically non-toxic to aquatic organisms on an acute basis (LC50/EC50/EL50/LL50 >100 mg/L in the most sensitive species tested).

NOEC mortality, *Leuciscus idus* (Golden orfe), static test, 48 Hour, > 1,000 mg/l

Acute toxicity to aquatic invertebrates

EC50, *Daphnia magna* (Water flea), static test, 48 Hour, > 1,000 mg/l

Balance

Acute toxicity to fish

No relevant data found.

Persistence and degradability

Myclobutanil

Biodegradability: Based on stringent OECD test guidelines, this material cannot be considered as readily biodegradable; however, these results do not necessarily mean that the material is not biodegradable under environmental conditions.

10-day Window: Fail

Biodegradation: 22.4 %

Exposure time: 28 d

Method: OECD Test Guideline 301D or Equivalent

Stability in Water (1/2-life)

, > 365 d

Photodegradation

Atmospheric half-life: 7.6 Hour

Method: Measured

Kaolin

Biodegradability: Biodegradation is not applicable.

Calcium polysilicate

Biodegradability: Biodegradation is not applicable.

Silica, crystalline (quartz)

Biodegradability: Biodegradation is not applicable.

Titanium dioxide

Biodegradability: Biodegradation is not applicable.

Balance

Biodegradability: No relevant data found.

Bioaccumulative potential

Myclobutanil

Bioaccumulation: Bioconcentration potential is low (BCF < 100 or Log Pow < 3).

Partition coefficient: n-octanol/water(log Pow): 3.17 Measured

Bioconcentration factor (BCF): 8.3 Oncorhynchus mykiss (rainbow trout)

Kaolin

Bioaccumulation: Partitioning from water to n-octanol is not applicable.

Calcium polysilicate

Bioaccumulation: Partitioning from water to n-octanol is not applicable.

Silica, crystalline (quartz)

Bioaccumulation: Partitioning from water to n-octanol is not applicable.

Titanium dioxide

Bioaccumulation: Partitioning from water to n-octanol is not applicable.

Balance

Bioaccumulation: No relevant data found.

Mobility in soil

Myclobutanil

Potential for mobility in soil is low (Koc between 500 and 2000).

Given its very low Henry's constant, volatilization from natural bodies of water or moist soil is not expected to be an important fate process.

Partition coefficient(Koc): 517

Kaolin

No relevant data found.

Calcium polysilicate

No relevant data found.

Silica, crystalline (quartz)

No relevant data found.

Titanium dioxide

No data available.

Balance

No relevant data found.

13. DISPOSAL CONSIDERATIONS

Disposal methods: If wastes and/or containers cannot be disposed of according to the product label directions, disposal of this material must be in accordance with your local or area regulatory authorities. This information presented below only applies to the material as supplied. The

identification based on characteristic(s) or listing may not apply if the material has been used or otherwise contaminated. It is the responsibility of the waste generator to determine the toxicity and physical properties of the material generated to determine the proper waste identification and disposal methods in compliance with applicable regulations. If the material as supplied becomes a waste, follow all applicable regional, national and local laws.

14. TRANSPORT INFORMATION

DOT

Not regulated for transport

Classification for SEA transport (IMO-IMDG):

Proper shipping name	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S.(Myclobutanil)
UN number	UN 3077
Class	9
Packing group	III
Marine pollutant	Myclobutanil
Transport in bulk according to Annex I or II of MARPOL 73/78 and the IBC or IGC Code	Consult IMO regulations before transporting ocean bulk

Classification for AIR transport (IATA/ICAO):

Proper shipping name	Environmentally hazardous substance, solid, n.o.s.(Myclobutanil)
UN number	UN 3077
Class	9
Packing group	III

This information is not intended to convey all specific regulatory or operational requirements/information relating to this product. Transportation classifications may vary by container volume and may be influenced by regional or country variations in regulations. Additional transportation system information can be obtained through an authorized sales or customer service representative. It is the responsibility of the transporting organization to follow all applicable laws, regulations and rules relating to the transportation of the material.

15. REGULATORY INFORMATION

OSHA Hazard Communication Standard

This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

Superfund Amendments and Reauthorization Act of 1986 Title III (Emergency Planning and Community Right-to-Know Act of 1986) Sections 311 and 312

Acute Health Hazard

Chronic Health Hazard

Superfund Amendments and Reauthorization Act of 1986 Title III (Emergency Planning and Community Right-to-Know Act of 1986) Section 313

Components

Myclobutanil

CASRN

88671-89-0

California Proposition 65 (Safe Drinking Water and Toxic Enforcement Act of 1986)

WARNING: This product contains a chemical(s) known to the State of California to cause cancer.

California Proposition 65 (Safe Drinking Water and Toxic Enforcement Act of 1986)

WARNING: This product contains a chemical(s) known to the State of California to cause birth defects or other reproductive harm.

Pennsylvania (Worker and Community Right-To-Know Act): Pennsylvania Hazardous Substances List and/or Pennsylvania Environmental Hazardous Substance List:

The following product components are cited in the Pennsylvania Hazardous Substance List and/or the Pennsylvania Environmental Substance List, and are present at levels which require reporting.

Components

CASRN

Kaolin

1332-58-7

Calcium polysilicate

1344-95-2

Titanium dioxide

13463-67-7

Pennsylvania (Worker and Community Right-To-Know Act): Pennsylvania Special Hazardous Substances List:

To the best of our knowledge, this product does not contain chemicals at levels which require reporting under this statute.

United States TSCA Inventory (TSCA)

This product contains chemical substance(s) exempt from U.S. EPA TSCA Inventory requirements. It is regulated as a pesticide subject to Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) requirements.

Federal Insecticide, Fungicide and Rodenticide Act

EPA Registration Number: 62719-410

This chemical is a pesticide product registered by the Environmental Protection Agency and is subject to certain labeling requirements under federal pesticide law. These requirements differ from the classification criteria and hazard information required for safety data sheets, and for workplace labels of non-pesticide chemicals. Following is the hazard information as required on the pesticide label:

CAUTION

Harmful if swallowed

Causes moderate eye irritation

Harmful if absorbed through skin

16. OTHER INFORMATION

Hazard Rating System

NFPA

Health	Fire	Reactivity
2	0	0

Revision

Identification Number: 101189373 / A211 / Issue Date: 05/15/2015 / Version: 7.0

DAS Code: GF-1778

Most recent revision(s) are noted by the bold, double bars in left-hand margin throughout this document.

Legend

ACGIH	USA. ACGIH Threshold Limit Values (TLV)
Dow IHG	Dow Industrial Hygiene Guideline
OSHA Z-1	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
OSHA Z-3	USA. Occupational Exposure Limits (OSHA) - Table Z-3 Mineral Dusts
TWA	8-hour, time-weighted average

Information Source and References

This SDS is prepared by Product Regulatory Services and Hazard Communications Groups from information supplied by internal references within our company.

DOW AGROSCIENCES LLC urges each customer or recipient of this (M)SDS to study it carefully and consult appropriate expertise, as necessary or appropriate, to become aware of and understand the data contained in this (M)SDS and any hazards associated with the product. The information herein is provided in good faith and believed to be accurate as of the effective date shown above. However, no warranty, express or implied, is given. Regulatory requirements are subject to change and may differ between various locations. It is the buyer's/user's responsibility to ensure that his activities comply with all federal, state, provincial or local laws. The information presented here pertains only to the product as shipped. Since conditions for use of the product are not under the control of the manufacturer, it is the buyer's/user's duty to determine the conditions necessary for the safe use of this product. Due to the proliferation of sources for information such as manufacturer-specific (M)SDSs, we are not and cannot be responsible for (M)SDSs obtained from any source other than ourselves. If you have obtained an (M)SDS from another source or if you are not sure that the (M)SDS you have is current, please contact us for the most current version.

SAFETY DATA SHEET

DOW AGROSCIENCES LLC

Product name: QUINTEC™ Fungicide

Issue Date: 05/19/2015

Print Date: 05/26/2015

DOW AGROSCIENCES LLC encourages and expects you to read and understand the entire (M)SDS, as there is important information throughout the document. We expect you to follow the precautions identified in this document unless your use conditions would necessitate other appropriate methods or actions.

1. IDENTIFICATION

Product name: QUINTEC™ Fungicide

Recommended use of the chemical and restrictions on use

Identified uses: End use fungicide product

COMPANY IDENTIFICATION

DOW AGROSCIENCES LLC
9330 ZIONSVILLE RD
INDIANAPOLIS IN 46268-1053
UNITED STATES

Customer Information Number:

800-992-5994

info@dow.com

EMERGENCY TELEPHONE NUMBER

24-Hour Emergency Contact: 800-992-5994

Local Emergency Contact: 352-323-3500

2. HAZARDS IDENTIFICATION

Hazard classification

This material is hazardous under the criteria of the Federal OSHA Hazard Communication Standard 29CFR 1910.1200.

Skin sensitisation - Category 1

Label elements

Hazard pictograms



Signal word: **WARNING!**

Hazards

May cause an allergic skin reaction.

Precautionary statements**Prevention**

Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.

Contaminated work clothing should not be allowed out of the workplace.

Wear protective gloves.

Response

IF ON SKIN: Wash with plenty of soap and water.

If skin irritation or rash occurs: Get medical advice/ attention.

Wash contaminated clothing before reuse.

Disposal

Dispose of contents/ container to an approved waste disposal plant.

Other hazards

no data available

3. COMPOSITION/INFORMATION ON INGREDIENTS

This product is a mixture.

Component	CASRN	Concentration
Quinoxifen	124495-18-7	22.58%
Propylene glycol	57-55-6	6.7%
Balance	Not available	70.72%

4. FIRST AID MEASURES

Description of first aid measures

General advice: First Aid responders should pay attention to self-protection and use the recommended protective clothing (chemical resistant gloves, splash protection). If potential for exposure exists refer to Section 8 for specific personal protective equipment.

Inhalation: Move person to fresh air. If person is not breathing, call an emergency responder or ambulance, then give artificial respiration; if by mouth to mouth use rescuer protection (pocket mask etc). Call a poison control center or doctor for treatment advice.

Skin contact: Take off contaminated clothing. Wash skin with soap and plenty of water for 15-20 minutes. Call a poison control center or doctor for treatment advice. Wash clothing before reuse. Shoes and other leather items which cannot be decontaminated should be disposed of properly.

Eye contact: Hold eyes open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eyes. Call a poison control center or doctor for treatment advice.

Ingestion: No emergency medical treatment necessary.

Most important symptoms and effects, both acute and delayed: Aside from the information found under Description of first aid measures (above) and Indication of immediate medical attention and special treatment needed (below), any additional important symptoms and effects are described in Section 11: Toxicology Information.

Indication of any immediate medical attention and special treatment needed

Notes to physician: No specific antidote. Treatment of exposure should be directed at the control of symptoms and the clinical condition of the patient. Have the Safety Data Sheet, and if available, the product container or label with you when calling a poison control center or doctor, or going for treatment.

5. FIREFIGHTING MEASURES

Suitable extinguishing media: To extinguish combustible residues of this product use water fog, carbon dioxide, dry chemical or foam. Dry chemical fire extinguishers. Carbon dioxide fire extinguishers. Foam. Alcohol resistant foams (ATC type) are preferred. General purpose synthetic foams (including AFFF) or protein foams may function, but will be less effective.

Unsuitable extinguishing media: no data available

Special hazards arising from the substance or mixture

Hazardous combustion products: Under fire conditions some components of this product may decompose. The smoke may contain unidentified toxic and/or irritating compounds. Combustion products may include and are not limited to: Nitrogen oxides. Hydrogen fluoride. Hydrogen chloride. Carbon monoxide. Carbon dioxide.

Unusual Fire and Explosion Hazards: This material will not burn until the water has evaporated. Residue can burn.

Advice for firefighters

Fire Fighting Procedures: Keep people away. Isolate fire and deny unnecessary entry. Use water spray to cool fire exposed containers and fire affected zone until fire is out and danger of reignition has passed. Burning liquids may be extinguished by dilution with water. Burning liquids may be moved by flushing with water to protect personnel and minimize property damage. To extinguish combustible residues of this product use water fog, carbon dioxide, dry chemical or foam. Contain fire water run-off if possible. Fire water run-off, if not contained, may cause environmental damage. Review the "Accidental Release Measures" and the "Ecological Information" sections of this (M)SDS.

Special protective equipment for firefighters: Wear positive-pressure self-contained breathing apparatus (SCBA) and protective fire fighting clothing (includes fire fighting helmet, coat, trousers, boots, and gloves). Avoid contact with this material during fire fighting operations. If contact is likely, change to full chemical resistant fire fighting clothing with self-contained breathing apparatus. If this is not available, wear full chemical resistant clothing with self-contained breathing apparatus and fight fire from a remote location. For protective equipment in post-fire or non-fire clean-up situations, refer to the relevant sections.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures: Use appropriate safety equipment. For additional information, refer to Section 8, Exposure Controls and Personal Protection.

Environmental precautions: Prevent from entering into soil, ditches, sewers, waterways and/or groundwater. See Section 12, Ecological Information. Spills or discharge to natural waterways is likely to kill aquatic organisms.

Methods and materials for containment and cleaning up: Contain spilled material if possible. Small spills: Absorb with materials such as: Clay. Dirt. Sand. Sweep up. Collect in suitable and properly labeled containers. Large spills: Contact Dow AgroSciences for clean-up assistance. See Section 13, Disposal Considerations, for additional information.

7. HANDLING AND STORAGE

Precautions for safe handling: Keep out of reach of children. Keep away from heat, sparks and flame. Do not swallow. Avoid contact with eyes, skin, and clothing. Avoid breathing vapor or mist. Avoid prolonged or repeated contact with skin. Wash thoroughly after handling. Use with adequate ventilation. Containers, even those that have been emptied, can contain vapors. Do not cut, drill, grind, weld, or perform similar operations on or near empty containers. See Section 8, EXPOSURE CONTROLS AND PERSONAL PROTECTION.

Conditions for safe storage: Store in a dry place. Store in original container. Keep container tightly closed when not in use. Do not store near food, foodstuffs, drugs or potable water supplies.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters

Exposure limits are listed below, if they exist.

Component	Regulation	Type of listing	Value/Notation
Quinoxifen	Dow IHG	TWA	5 mg/m3
	Dow IHG	TWA	Skin Sensitizer
Propylene glycol	US WEEL	TWA	10 mg/m3

RECOMMENDATIONS IN THIS SECTION ARE FOR MANUFACTURING, COMMERCIAL BLENDING AND PACKAGING WORKERS. APPLICATORS AND HANDLERS SHOULD SEE THE PRODUCT LABEL FOR PROPER PERSONAL PROTECTIVE EQUIPMENT AND CLOTHING.

Exposure controls

Engineering controls: Use local exhaust ventilation, or other engineering controls to maintain airborne levels below exposure limit requirements or guidelines. If there are no applicable exposure limit requirements or guidelines, general ventilation should be sufficient for most operations. Local exhaust ventilation may be necessary for some operations.

Individual protection measures

Eye/face protection: Use safety glasses (with side shields).

Skin protection

Hand protection: Use gloves chemically resistant to this material. Examples of preferred glove barrier materials include: Chlorinated polyethylene. Neoprene. Polyethylene. Ethyl vinyl alcohol laminate ("EVAL"). Viton. Examples of acceptable

glove barrier materials include: Butyl rubber. Natural rubber ("latex"). Nitrile/butadiene rubber ("nitrile" or "NBR"). Polyvinyl chloride ("PVC" or "vinyl").
NOTICE: The selection of a specific glove for a particular application and duration of use in a workplace should also take into account all relevant workplace factors such as, but not limited to: Other chemicals which may be handled, physical requirements (cut/puncture protection, dexterity, thermal protection), potential body reactions to glove materials, as well as the instructions/specifications provided by the glove supplier.

Other protection: Use protective clothing chemically resistant to this material. Selection of specific items such as face shield, boots, apron, or full body suit will depend on the task.

Respiratory protection: Respiratory protection should be worn when there is a potential to exceed the exposure limit requirements or guidelines. If there are no applicable exposure limit requirements or guidelines, wear respiratory protection when adverse effects, such as respiratory irritation or discomfort have been experienced, or where indicated by your risk assessment process. For most conditions no respiratory protection should be needed; however, if discomfort is experienced, use an approved air-purifying respirator. The following should be effective types of air-purifying respirators: Organic vapor cartridge with a particulate pre-filter.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	
Physical state	Liquid.
Color	Off-white
Odor	Faint
Odor Threshold	No test data available
pH	8.0 1% pH Electrode (1% aqueous suspension)
Melting point/range	Not applicable
Freezing point	No test data available
Boiling point (760 mmHg)	No test data available
Flash point	closed cup > 93.3 °C (> 199.9 °F) <i>Setaflash Closed Cup ASTM D3828</i>
Evaporation Rate (Butyl Acetate = 1)	No test data available
Flammability (solid, gas)	no data available
Lower explosion limit	No test data available
Upper explosion limit	No test data available
Vapor Pressure	No test data available
Relative Vapor Density (air = 1)	No test data available
Relative Density (water = 1)	no data available
Water solubility	No test data available
Partition coefficient: n-octanol/water	no data available
Auto-ignition temperature	No test data available
Decomposition temperature	No test data available
Dynamic Viscosity	130 mPa.s

Kinematic Viscosity	117 mm ² /s
Explosive properties	No
Oxidizing properties	No significant increase (>5C) in temperature.
Liquid Density	1.11 g/cm ³ at 21 °C (70 °F) <i>Digital density meter</i>
Molecular weight	no data available

NOTE: The physical data presented above are typical values and should not be construed as a specification.

10. STABILITY AND REACTIVITY

Reactivity: No dangerous reaction known under conditions of normal use.

Chemical stability: Stable under recommended storage conditions. See Storage, Section 7.

Possibility of hazardous reactions: Polymerization will not occur.

Conditions to avoid: Active ingredient decomposes at elevated temperatures. Generation of gas during decomposition can cause pressure in closed systems.

Incompatible materials: Avoid contact with: Strong acids. Strong bases. Strong oxidizers.

Hazardous decomposition products: Decomposition products depend upon temperature, air supply and the presence of other materials. Decomposition products can include and are not limited to: Hydrogen chloride. Hydrogen fluoride. Nitrogen oxides.

11. TOXICOLOGICAL INFORMATION

Toxicological information appears in this section when such data is available.

Acute toxicity

Acute oral toxicity

Very low toxicity if swallowed. Harmful effects not anticipated from swallowing small amounts.

As product: Single dose oral LD50 has not been determined.

For similar material(s):

LD50, Rat, > 2,000 mg/kg No deaths occurred at this concentration.

Acute dermal toxicity

Prolonged skin contact is unlikely to result in absorption of harmful amounts.

As product: The dermal LD50 has not been determined.

For similar material(s):

LD50, Rat, > 2,000 mg/kg No deaths occurred at this concentration.

Acute inhalation toxicity

No adverse effects are anticipated from single exposure to mist. Based on the available data, respiratory irritation was not observed.

As product: The LC50 has not been determined.

For similar material(s):
LC50, Rat, Mist, > 5 mg/l Estimated.

Skin corrosion/irritation

Brief contact is essentially nonirritating to skin.

Serious eye damage/eye irritation

Essentially nonirritating to eyes.

Sensitization

For the active ingredient(s):
Has caused allergic skin reactions when tested in guinea pigs.
For similar material(s):
Did not demonstrate the potential for contact allergy in mice.

For respiratory sensitization:
No relevant information found.

Specific Target Organ Systemic Toxicity (Single Exposure)

Evaluation of available data suggests that this material is not an STOT-SE toxicant.

Specific Target Organ Systemic Toxicity (Repeated Exposure)

For the active ingredient(s):
In animals, effects have been reported on the following organs:
Kidney.
Liver.
Blood.

Carcinogenicity

For the active ingredient(s): Did not cause cancer in laboratory animals.

Teratogenicity

For the active ingredient(s): Did not cause birth defects or other effects in the fetus even at doses which caused toxic effects in the mother.

Reproductive toxicity

For the active ingredient(s): In animal studies, did not interfere with reproduction.

Mutagenicity

For the active ingredient(s): In vitro genetic toxicity studies were negative. Animal genetic toxicity studies were negative.

Aspiration Hazard

Based on physical properties, not likely to be an aspiration hazard.

12. ECOLOGICAL INFORMATION

Ecotoxicological information appears in this section when such data is available.

Toxicity

Acute toxicity to fish

Material is highly toxic to aquatic organisms on an acute basis (LC50/EC50 between 0.1 and 1 mg/L in the most sensitive species tested).

For similar material(s):

LC50, *Oncorhynchus mykiss* (rainbow trout), 96 Hour, > 100 mg/l

Acute toxicity to aquatic invertebrates

For similar material(s):

EC50, *Daphnia magna* (Water flea), 48 Hour, 0.2 mg/l

Acute toxicity to algae/aquatic plants

For similar material(s):

ErC50, *Pseudokirchneriella subcapitata* (green algae), 72 Hour, 0.28 mg/l

Toxicity to soil-dwelling organisms

LC50, *Eisenia fetida* (earthworms), 14 d, > 1,000 mg/kg

Persistence and degradability

Quinoxifen

Biodegradability: Based on stringent OECD test guidelines, this material cannot be considered as readily biodegradable; however, these results do not necessarily mean that the material is not biodegradable under environmental conditions.

10-day Window: Fail

Biodegradation: 2 - 3 %

Exposure time: 28 d

Method: OECD Test Guideline 301B or Equivalent

Stability in Water (1/2-life)

Hydrolysis, half-life, > 1 year

Photodegradation

Atmospheric half-life: 1.88 d

Propylene glycol

Biodegradability: Material is readily biodegradable. Passes OECD test(s) for ready biodegradability. Biodegradation may occur under anaerobic conditions (in the absence of oxygen).

10-day Window: Pass

Biodegradation: 81 %

Exposure time: 28 d

Method: OECD Test Guideline 301F or Equivalent

10-day Window: Not applicable

Biodegradation: 96 %

Exposure time: 64 d

Method: OECD Test Guideline 306 or Equivalent

Theoretical Oxygen Demand: 1.68 mg/mg

Chemical Oxygen Demand: 1.53 mg/mg

Biological oxygen demand (BOD)

Incubation Time	BOD
5 d	69.000 %
10 d	70.000 %
20 d	86.000 %

Photodegradation

Atmospheric half-life: 10 Hour

Method: Estimated.

Balance

Biodegradability: No relevant data found.

Bioaccumulative potential

Quinoxifen

Bioaccumulation: Bioconcentration potential is high (BCF > 3000 or Log Pow between 5 and 7).

Partition coefficient: n-octanol/water(log Pow): 4.66 Measured

Bioconcentration factor (BCF): 5,040 Fish. Measured

Propylene glycol

Bioaccumulation: Bioconcentration potential is low (BCF < 100 or Log Pow < 3).

Partition coefficient: n-octanol/water(log Pow): -1.07 Measured

Bioconcentration factor (BCF): 0.09 Estimated.

Balance

Bioaccumulation: No relevant data found.

Mobility in soil

Quinoxifen

Expected to be relatively immobile in soil (Koc > 5000).

Partition coefficient(Koc): 22929 Estimated.

Propylene glycol

Given its very low Henry's constant, volatilization from natural bodies of water or moist soil is not expected to be an important fate process.

Potential for mobility in soil is very high (Koc between 0 and 50).

Partition coefficient(Koc): < 1 Estimated.

Balance

No relevant data found.

13. DISPOSAL CONSIDERATIONS

Disposal methods: If wastes and/or containers cannot be disposed of according to the product label directions, disposal of this material must be in accordance with your local or area regulatory authorities. This information presented below only applies to the material as supplied. The identification based on characteristic(s) or listing may not apply if the material has been used or otherwise contaminated. It is the responsibility of the waste generator to determine the toxicity and physical properties of the material generated to determine the proper waste identification and disposal methods in compliance with applicable regulations. If the material as supplied becomes a waste, follow all applicable regional, national and local laws.

14. TRANSPORT INFORMATION

DOT

Not regulated for transport

Classification for SEA transport (IMO-IMDG):

Proper shipping name	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S.(Quinoxifen)
UN number	UN 3082
Class	9
Packing group	III
Marine pollutant	Quinoxifen
Transport in bulk according to Annex I or II of MARPOL 73/78 and the IBC or IGC Code	Consult IMO regulations before transporting ocean bulk

Classification for AIR transport (IATA/ICAO):

Proper shipping name	Environmentally hazardous substance, liquid, n.o.s.(Quinoxifen)
UN number	UN 3082
Class	9
Packing group	III

This information is not intended to convey all specific regulatory or operational requirements/information relating to this product. Transportation classifications may vary by container volume and may be influenced by regional or country variations in regulations. Additional transportation system information can be obtained through an authorized sales or customer service representative. It is the responsibility of the transporting organization to follow all applicable laws, regulations and rules relating to the transportation of the material.

15. REGULATORY INFORMATION

OSHA Hazard Communication Standard

This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

Superfund Amendments and Reauthorization Act of 1986 Title III (Emergency Planning and Community Right-to-Know Act of 1986) Sections 311 and 312

Fire Hazard
Acute Health Hazard
Chronic Health Hazard

Superfund Amendments and Reauthorization Act of 1986 Title III (Emergency Planning and Community Right-to-Know Act of 1986) Section 313

This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

California Proposition 65 (Safe Drinking Water and Toxic Enforcement Act of 1986)

This product contains no listed substances known to the State of California to cause cancer, birth defects or other reproductive harm, at levels which would require a warning under the statute.

Pennsylvania (Worker and Community Right-To-Know Act): Pennsylvania Hazardous Substances List and/or Pennsylvania Environmental Hazardous Substance List:

The following product components are cited in the Pennsylvania Hazardous Substance List and/or the Pennsylvania Environmental Substance List, and are present at levels which require reporting.

Components	CASRN
Propylene glycol	57-55-6

Pennsylvania (Worker and Community Right-To-Know Act): Pennsylvania Special Hazardous Substances List:

To the best of our knowledge, this product does not contain chemicals at levels which require reporting under this statute.

United States TSCA Inventory (TSCA)

This product contains chemical substance(s) exempt from U.S. EPA TSCA Inventory requirements. It is regulated as a pesticide subject to Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) requirements.

Federal Insecticide, Fungicide and Rodenticide Act

EPA Registration Number: 62719-375

This chemical is a pesticide product registered by the Environmental Protection Agency and is subject to certain labeling requirements under federal pesticide law. These requirements differ from the classification criteria and hazard information required for safety data sheets, and for workplace labels of non-pesticide chemicals. Following is the hazard information as required on the pesticide label:

CAUTION

Harmful if swallowed
Harmful if absorbed through skin

16. OTHER INFORMATION

Hazard Rating System**NFPA**

Health	Fire	Reactivity
0	1	0

Revision

Identification Number: 101204286 / A211 / Issue Date: 05/19/2015 / Version: 5.0

DAS Code: EF-1295

Most recent revision(s) are noted by the bold, double bars in left-hand margin throughout this document.

Legend

Dow IHG	Dow Industrial Hygiene Guideline
TWA	8-hr TWA
US WEEL	USA. Workplace Environmental Exposure Levels (WEEL)

Information Source and References

This SDS is prepared by Product Regulatory Services and Hazard Communications Groups from information supplied by internal references within our company.

DOW AGROSCIENCES LLC urges each customer or recipient of this (M)SDS to study it carefully and consult appropriate expertise, as necessary or appropriate, to become aware of and understand the data contained in this (M)SDS and any hazards associated with the product. The information herein is provided in good faith and believed to be accurate as of the effective date shown above. However, no warranty, express or implied, is given. Regulatory requirements are subject to change and may differ between various locations. It is the buyer's/user's responsibility to ensure that his activities comply with all federal, state, provincial or local laws. The information presented here pertains only to the product as shipped. Since conditions for use of the product are not under the control of the manufacturer, it is the buyer's/user's duty to determine the conditions necessary for the safe use of this product. Due to the proliferation of sources for information such as manufacturer-specific (M)SDSs, we are not and cannot be responsible for (M)SDSs obtained from any source other than ourselves. If you have obtained an (M)SDS from another source or if you are not sure that the (M)SDS you have is current, please contact us for the most current version.

**1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION**

Product Name: Mycoshield®
EPA Reg. No.: 55146-97
Product Type: Agricultural Antibiotic
Company Name: Nufarm Americas Inc.
11901 S. Austin Avenue
Alsip, IL 60803
1-800-345-3330

Telephone Numbers: For Chemical Emergency, Spill, Leak, Fire, Exposure, or Accident,
Call CHEMTREC Day or Night: 1-800-424-9300
For Medical Emergencies Only, Call 1-877-325-1840

This product is an EPA FIFRA registered pesticide. Some classifications on this SDS are not exactly the same as on the FIFRA label. Certain sections are superseded by federal law governed by EPA for a registered pesticide. Please see Section 15. REGULATORY INFORMATION for explanation.

2. HAZARDS IDENTIFICATION**PHYSICAL HAZARDS:**

Not hazardous

HEALTH HAZARDS:

Eye Irritation	Category 2A
Skin Sensitization	Category 1B
Respiratory Sensitization	Category 1
Carcinogen	Category 1
Specific Target Organ Toxicity – Repeat Exposure	Category 1

ENVIRONMENTAL HAZARDS:

Hazardous to aquatic environment, acute	Category 1
Hazardous to aquatic environment, chronic	Category 1

SIGNAL WORD:

DANGER

HAZARD STATEMENTS:

Causes serious eye irritation. May cause allergy or asthma symptoms or breathing difficulties if inhaled. May cause an allergic skin reaction. May cause cancer by inhalation. Causes damage to lung through prolonged or repeated inhalation. Very toxic to aquatic life with long lasting effects.

**PRECAUTIONARY STATEMENTS**

Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Wash thoroughly after handling. Avoid breathing dust. Do not eat, drink, or smoke when using this product. Contaminated clothing should not be allowed out of the workplace. Wear protective gloves, protective clothing, and eye protection. In case of inadequate ventilation, wear respiratory protection.

IF exposed or concerned: Get medical advice.

IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice.

SAFETY DATA SHEET

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IF ON SKIN: Wash with plenty of water. If skin irritation or rash occurs: Get medical advice. Take off contaminated clothing and wash it before reuse.

IF INHALED: Remove person to fresh air and keep comfortable for breathing. If experiencing respiratory symptoms: Call a POISON CENTER or doctor.

Store locked up.

Dispose of contents in accordance with local, state, and federal regulations.

3. COMPOSITION / INFORMATION ON INGREDIENTS

COMPONENTS	CAS NO.	% BY WEIGHT
Oxytetracycline Calcium	7179-50-2	33.5 – 62.5
Crystalline silica (quartz)	14808-60-7	18.8 – 24
Pyrophyllite	12269-78-2	< 16
Mica	12001-26-2	6.8 – 10
Kaolin	1332-58-7	0.4 – 2
Other Ingredients	Trade Secret	Trade Secret

Synonyms: 4-(dimethylamino)-1,4,4a,5,5a,6,11,12a-octahydro-3,5,6,10,12,12a-hexahydroxy-6-methyl-1,11-dioxo-2-naphthacenecarboxamide calcium salt

Ingredients not precisely identified are proprietary or non-hazardous. Values are not product specifications.

4. FIRST AID MEASURES

If in Eyes: Hold eye open and rinse slowly and gently with water for several minutes. Remove contact lenses, if present, then continue rinsing eye. Get medical attention if irritation persists.

If on Skin or Clothing: Take off contaminated clothing. Wash thoroughly with soap and water. Get medical attention if irritation or rash develops and persists.

If Inhaled: Move person to fresh air. If symptoms develop, get medical advice. Seek immediate medical attention if allergic symptoms or breathing difficulties develop.

If Swallowed: Have person sip a glass of water if able to swallow. Do not induce vomiting unless told to do so by the poison control center or doctor. Do not give anything by mouth to an unconscious person. If symptoms develop, get medical advice.

Most Important symptoms/effects, acute and delayed: May cause eye irritation. Allergic reactions, possibly serious, may develop in individuals who are sensitive to tetracyclines. Prolonged or frequently repeated skin contact may cause allergic reactions in some individuals. Ingestion may cause gastrointestinal irritation. May cause cancer or lung damage through prolonged or repeated inhalation.

Indication of Immediate medical attention and special treatment if needed: Seek immediate medical attention if allergic symptoms or breathing difficulties develop

5. FIRE FIGHTING MEASURES

Extinguishing Media: Recommended for large fires: foam or water spray. Recommended for small fires: dry chemical or carbon dioxide.

Special Fire Fighting Procedures: Firefighters should wear NIOSH approved self-contained breathing apparatus and full fire-fighting turn out gear. Dike area to prevent runoff and contamination of water sources. Dispose of fire control water later.

Unusual Fire and Explosion Hazards: Avoid generating dust; fine dust dispersed in air in sufficient concentrations, and in the presence of an ignition source, is a potential dust explosion hazard.

Hazardous Decomposition Materials (Under Fire Conditions): May produce gases such as oxides of carbon, nitrogen and calcium.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions: Wear appropriate protective gear for the situation. See Personal Protection information in Section 8.

Environmental Precautions: Prevent material from entering public sewer systems or any waterways. Do not flush to drain. Large spills to soil or similar surfaces may necessitate removal of topsoil. The affected area should be removed and placed in an appropriate container for disposal.

SAFETY DATA SHEET

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Methods for Containment: Dike spill using absorbent or impervious materials such as earth, sand or clay. Collect and contain contaminated absorbent and dike material for disposal.

Methods for Cleanup and Disposal: Avoid creation of dusty conditions. If dry, sweep or scoop up material and place into container for disposal. If wet, pump any free liquid into an appropriate closed container. Decontaminate tools and equipment following cleanup. See Section 13: DISPOSAL CONSIDERATIONS for more information.

Other Information: Dust deposits should not be allowed to accumulate on surfaces, as these may form an explosive mixture if they are released into the atmosphere in sufficient concentration.

Avoid dispersal of dust in the air (i.e., clearing dust surfaces with compressed air).

Large spills may be reportable to the National Response Center (800-424-8802) and to state and/or local agencies.

7. HANDLING AND STORAGE

HANDLING:

Minimize dust generation and accumulation. Routine housekeeping should be instituted to ensure that dusts do not accumulate on surfaces. Dry powders can build static electricity charges when subjected to the friction of transfer and mixing operations. Provide adequate precautions, such as electrical grounding and bonding, or inert atmospheres.

Do not breathe dust. Handle and open container in a manner as to prevent spillage. If the container is leaking or material is spilled for any reason or cause, carefully dispose of as directed for pesticides in Section 13.

Users should wash hands before eating, drinking, chewing gum, using tobacco, or using the toilet. Remove clothing/Personal Protective Equipment (PPE) immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing. If pesticide gets on skin, wash immediately with soap and water. Remove PPE immediately after handling this product. Wash the outside of gloves before removing. Avoid contact with skin, eyes, or clothing. Wash thoroughly with soap and water after handling.

STORAGE:

Keep container tightly closed and in a dry place. Product is temperature sensitive. Store below 77° F (25° C) with minimum exposure to the atmosphere. Do not contaminate water, foodstuffs, feed or seed by storage, disposal or cleaning of equipment.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Engineering Controls:

Ensure that dust-handling systems (such as exhaust ducts, dust collectors, vessels, and processing equipment) are designed in a manner to prevent the escape of dust into the work area (i.e., there is no leakage from the equipment).

Where engineering controls are indicated by specific use conditions or a potential for excessive exposure, use local exhaust ventilation at the point of generation.

Personal Protective Equipment:

Eye/Face Protection: To avoid contact with eyes, wear chemical goggles. An emergency eyewash or water supply should be readily accessible to the work area.

Skin Protection: To avoid contact with skin wear long-sleeved shirt and long pants, shoes, socks, and chemical resistant gloves. Washing facilities should be readily accessible to the work area.

Respiratory Protection: Wear an NIOSH approved TC-21C dust filtering respirator.

General Hygiene Considerations: Personal hygiene is an important work practice exposure control measure and the following general measures should be taken when working with or handling this material: 1) do not store, use and/or consume foods, beverages, tobacco products, or cosmetics in areas where this material is stored; 2) wash hands and face carefully before eating, drinking, using tobacco, applying cosmetics or using the toilet.

Exposure Guidelines:

Component	OSHA		ACGIH		Unit
	TWA	STEL	TWA	STEL	
Oxytetracycline calcium	NE	NE	NE	NE	
Crystalline silica (quartz)	30 / %SiO ₂ +2 (T) 10 / %SiO ₂ +2 (R)	NE	0.025 (R)	NE	mg/m ³
Pyrophyllite (As PNOR)	15 (T)	NE	NE	NE	mg/m ³

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	5 (R)				
Mica	20 mppcf	NE	3(R)	NE	mg/m ³
Kaolin	5(R) 15 (T)	NE	2 (R)	NE	mg/m ³
Other Ingredients	NE	NE	NE	NE	

R = Respirable Fraction

T = Total Dust

PNOR= as Particulates Not Otherwise Regulated

NE = Not Established

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	Light to dark brown powder
Odor:	Musty
Odor threshold:	No data available
pH:	3.84 (1% w/w dispersion in DIW)
Melting point:	No data available
Initial boiling point and boiling range	No data available
Flash point:	No applicable due to product form (solid)
Evaporation rate:	No data available
Flammability (solid, gas):	No data available
Upper/lower flammability or explosive limits:	No data available
Vapor pressure:	No data available
Vapor density:	No data available
Relative density:	0.68 g/mL
Solubility(ies):	No data available
Partition coefficient: n-octanol/water:	No data available
Autoignition temperature:	No data available
Decomposition temperature:	No data available
Viscosity:	Not applicable due to product form (solid)

Note: Physical data are typical values, but may vary from sample to sample. A typical value should not be construed as a guaranteed analysis or as a specification.

10. STABILITY AND REACTIVITY**Reactivity:** Not reactive.**Chemical Stability:** This material is stable under normal handling and storage conditions.**Possibility of Hazardous Reactions:** Hazardous polymerization will not occur.**Conditions to Avoid:** Keep away from heat, sparks and open flame. Minimize dust generate and accumulation.**Incompatible Materials:** Strong oxidizing agents: bases and acids.**Hazardous Decomposition Products:** Under fire conditions may produce gases such as oxides of carbon, nitrogen and calcium**11. TOXICOLOGICAL INFORMATION****Likely Routes of Exposure:** Inhalation, ingestion, eye and skin contact.**Symptoms of Exposure:****Eye Contact:** Causes substantial but temporary eye injury.**Skin Contact:** Slightly toxic and non-irritating based on toxicity studies. Prolonged or frequently repeated skin contact may cause allergic reactions in some individuals.**Ingestion:** Slightly toxic based on toxicity studies.**Inhalation:** Low inhalation toxicity. May cause allergic respiratory reaction and difficulty breathing. Prolonged or repeated inhalation may cause lung damage or cancer.**Delayed, immediate and chronic effects of exposure:** Inhalation of product may aggravate existing chronic respiratory problems such as asthma, emphysema or bronchitis. Skin contact may aggravate existing skin disease.**Toxicological Data:**

Data from laboratory studies conducted on Oxytetracycline Calcium Technical:

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Oral: Rat LD₅₀: >5,000 mg/kg

Dermal: Rat LD₅₀: >2,000 mg/kg

Inhalation: Rat 4-hr LC₅₀: Not Data Available

Eye Irritation: Rabbit: Severe Irritation

Skin Irritation: Rabbit: Slightly Irritating

Skin Sensitization: Sensitizing

Subchronic (Target Organ) Effects: For oxytetracycline, gastrointestinal irritation with nausea, epigastric pain and burning, vomiting, abdominal pain, transitory yellowish-brown discoloration of the tongue, anorexia and diarrhea have been reported following oral administration. Blood disorders (delay in coagulation) have also been reported. Possible hypersensitization and superinfections due to overgrowth of organisms not affected by the antibiotic agent. Three types of renal disease are associated with overexposure: Acute Non-Oliguric Renal Failure (individuals with pre-existing pancreatitis or fatty liver); Uremia (individuals with pre-existing impaired renal function) and Reversible Nephrotoxicity (due to out-dated or degraded tetracyclines).

Carcinogenicity / Chronic Health Effects: Prolonged overexposure to oxytetracycline may cause effects to skin and digestive tract. Oxytetracycline did not cause cancer in laboratory animals.

Reproductive Toxicity: None observed.

Developmental Toxicity: Adverse effects were reported in mother (severe hepatic damage) and fetus (retardation of skeletal developmental, discoloration of teeth and enamel hypoplasia).

Genotoxicity: None observed.

Assessment Carcinogenicity:

This product contains substances that are considered to be probable or suspected human carcinogens as follows:

Component	Regulatory Agency Listing As Carcinogen			
	ACGIH	IARC	NTP	OSHA
Oxytetracycline calcium	No	No	No	No
Crystalline Silica (quartz)	A2	1	Known	No
Pyrophyllite	No	No	No	No
Mica	No	No	No	No
Kaolin	A4	No	No	No
Other Ingredients	No	No	No	No

12. ECOLOGICAL INFORMATION

Ecotoxicity:

Data on Oxytetracycline Calcium:

96-hour LC₅₀ Bluegill: >56 ppm

96-hour LC₅₀ Rainbow Trout: >58.5 ppm

48-hour EC₅₀ Daphnia: >59.4 ppm

7-day aquatic plant (Lemna): 0.65 ppm

96-hour freshwater algae: 43 ppb

Bobwhite Quail Acute Oral LC₅₀: >2,000 mg/kg

Bobwhite Quail 8-day Dietary LC₅₀: >5,620 ppm

Mallard Duck 8-day Dietary LC₅₀: >5,620 ppm

48-hour Honey Bee LD₅₀: 100 µg/bee

Environmental Fate:

Do not apply directly to water, to areas where surface water is present, or to intertidal areas below the mean high water mark. Do not contaminate water when disposing of equipment washwater. Low bioaccumulation potential.

13. DISPOSAL CONSIDERATIONS

Waste Disposal Method:

Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility.

Container Handling and Disposal:

Plastic Containers:

Nonrefillable Containers 50 lb or Less: Nonrefillable container. Do not reuse or refill this container. Triple rinse container (or equivalent) promptly after emptying.

Triple rinse as follows: Empty the remaining contents into application equipment or a mix tank. Fill the container ¼ full with water and recap. Shake for 10 seconds. Pour rinsate into application equipment or a mix tank or store rinsate for later use or disposal. Drain for 10 seconds after the flow begins to drip. Repeat this

SAFETY DATA SHEET

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procedure two more times. Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or by other procedures approved by State and local authorities. Plastic containers are also disposable by incineration, or, if allowed by State and local authorities, by burning. If burned stay out of smoke.

Nonrefillable Containers larger than 50 lb: Nonrefillable container. Do not reuse or refill this container.

Triple rinse as follows: Empty the remaining contents into application equipment or a mix tank. Fill the container $\frac{1}{4}$ full with water. Replace and tighten closures. Tip container on its side and roll it back and forth, ensuring at least one complete revolution, for 30 seconds. Stand the container on its end and tip it back and forth several times. Turn the container over onto its other end and tip it back and forth several times. Empty the rinsate into application equipment or a mix tank or store rinsate for later use or disposal. Repeat this procedure two more times. Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or by other procedures approved by State and local authorities. Plastic containers are also disposable by incineration, or, if allowed by State and local authorities, by burning. If burned stay out of smoke.

Bags:

Nonrefillable container. Do not reuse or refill this container. Completely empty bag into application equipment. Then offer for recycling, if available, or dispose of empty bag in a sanitary landfill or by incineration, or, if allowed by State and local authorities, by burning. If burned, stay out of smoke.

Fiber Drums with Liners:

Nonrefillable container. Do not reuse or refill this container. Completely empty liner by shaking and tapping sides and bottom to loosen clinging particles. Empty residue into application equipment. Then offer for recycling, if available, or dispose of liner in a sanitary landfill or by incineration, or, if allowed by State and local authorities, by burning. If burned, stay out of smoke.

If drum is contaminated and cannot be reused, dispose of it in the manner required for its liner.

14. TRANSPORTATION INFORMATION

Follow the precautions indicated in Section 7: HANDLING AND STORAGE of this SDS.

DOT:

Non Regulated

IMDG:

Non Regulated

IATA:

Non Regulated

15. REGULATORY INFORMATION

EPA FIFRA INFORMATION

This chemical is a pesticide product registered by the United States Environmental Protection Agency and is subject to certain labeling requirements under federal pesticide law. These requirements differ from the classification criteria and hazard information required for safety data sheets (SDS), and for workplace labels of non-pesticide chemicals. The hazard information required on the pesticide label is reproduced below. The pesticide label also includes other important information, including directions for use.

WARNING. Causes substantial but temporary eye injury. Harmful if absorbed through skin. Do not get in eyes, on skin, or on clothing. Prolonged or frequently repeated skin contact may cause allergic reactions in some individuals. Do not breathe dust or spray mist.

U.S. FEDERAL REGULATIONS

TSCA Inventory: This product is exempted from TSCA because it is solely for FIFRA regulated use.

SARA Hazard Notification/Reporting:

Hazard Categories Under Criteria of SARA Title III Rules (40 CFR Part 370):

Acute Health, Chronic Health

Section 313 Toxic Chemical(s):

None

Reportable Quantity (RQ) under U.S. CERCLA:

None

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RCRA Waste Code:

Under RCRA, it is the responsibility of the product user to determine at the time of disposal, whether a material containing the product or derived from the product should be classified as a hazardous waste.

State Information:

Other state regulations may apply. Check individual state requirements.

California Proposition 65: Oxytetracycline and Tetracyclines are listed for developmental toxicity (internal use).

16. OTHER INFORMATION

National Fire Protection Association (NFPA) Hazard Rating:

Rating for this product: Health: 2 Flammability: 1 Reactivity: 0

Hazards Scale: 0 = Minimal 1 = Slight 2 = Moderate 3 = Serious 4 = Severe

This Safety Data Sheet (SDS) serves different purposes than and DOES NOT REPLACE OR MODIFY THE EPA-ACCEPTED PRODUCT LABELING (attached to and accompanying the product container). This SDS provides important health, safety and environmental information for employers, employees, emergency responders and others handling large quantities of the product in activities generally other than product use, while the labeling provides that information specifically for product use in the ordinary course.

Use, storage and disposal of pesticide products are regulated by the EPA under the authority of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) through the product labeling, and all necessary and appropriate precautionary, use, storage, and disposal information is set forth on that labeling. It is a violation of Federal law to use a pesticide product in any manner not prescribed on the EPA-accepted label.

Although the information and recommendations set forth herein (hereinafter "Information") are presented in good faith and believed to be correct as of the date hereof, Nufarm Americas Inc. makes no representations as to the completeness or accuracy thereof. Information is supplied upon the condition that the persons receiving same will make their own determination as to its suitability for their purposes prior to use. In no event will Nufarm Americas Inc. be responsible for damages of any nature whatsoever resulting from the use of or reliance upon Information. NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR OF ANY OTHER NATURE ARE MADE HEREUNDER WITH RESPECT TO INFORMATION OR THE PRODUCT TO WHICH INFORMATION REFERS AND ALL SUCH WARRANTIES ARE HEREBY SPECIFICALLY DISCLAIMED.

Date of Issue: May 10, 2015

Supersedes: August 20, 2012

----- MATERIAL SAFETY DATA SHEET -----
SPREAD-R
Diamond R

MANUFACTURER: DIAMOND-R FERTILIZER CO., INC.
P.O. BOX 1137
WINTER GARDEN, FL 32787
PRODUCT NAME: Spread-R
DATE PREPARED: Nov/89
CHEMICAL NAME: Principal functioning agents include:
Alkylaryl polyethoxy ethanol, free fatty acids,
isopropanol. Typical values for spray adjuvants = 90
Nonionic Spreader-Activator.

SECTION I - PHYSICAL DATA

BOILING POINT (deg F): N.D.
SPECIFIC GRAVITY (Water = 1): 0.99
VAPOR DENSITY (Air = 1): 2.1
EVAPORATION RATE (Water = 1): 1.7
APPEARANCE & ODOR: Blue liquid, mild alcohol odor
pH: 5.3
MELTING POINT: N/A
VAPOR PRESSURE: 33 mm at 20 deg C
% VOLATILES BY VOL: 37.7%
SOLUBILITY IN WATER: Complete

SECTION II - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Test Method): 76 deg F T.C.C.
FLAMMABLE LIMITS: 2.1 % by volume for isopropanol
EXTINGUISHING MEDIA: Water fog, CO2, dry chemical, foam
UNUSUAL FIRE & EXPLOSION HAZARDS: Vapors can travel to
source of ignition and flash back.
SPECIAL FIRE FIGHTING PROCEDURES: Wear respirator and full
protective gear MSHA/NIOSH approved.
DOT SHIPPING REGULATIONS:
HAZARDOUS CLASS: Flammable liquid
SHIPPING CONTAINER LABELS: Flammable Liquid, NOS
FLASHPOINT: 73 deg F or above
FREIGHT CLASS: 60
IDENTIFICATION NO.: UN1993

SECTION III - REACTIVITY DATA

STABILITY: Stable
INCOMPATIBILITY: Strong, oxidizing agents
HAZARDOUS DECOMPOSITION PRODUCTS: None
HAZARDOUS POLYMERIZATION: Will not occur.
CONDITIONS TO AVOID: Excessive heat.

SECTION IV - HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE (TLV): For isopropanol - 400 ppm
ACGIH

EFFECTS OF OVEREXPOSURE: Ingestion or inhalation of large quantities of vapor may cause flushing, headache, dizziness, mental depression, nausea, vomiting, narcosis, anesthesia, coma.

SECTION V - EMERGENCY AND FIRST-AID PROCEDURES

EYES: Flush with plenty of water for at least 15 minutes.

SKIN: Flush with plenty of water.

INGESTION: Get medical attention immediately.

INHALATION: Move person to fresh air or very well ventilated area. Give artificial respiration if breathing has stopped. Get medical attention immediately.

SECTION VI - TOXICITY

ACUTE TOXICITY: Not determined to the best of our knowledge. For isopropanol (one of the components) - LD50 oral (rat) - 5.8 mg/kg.

SECTION VII - SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED:

Ventilate the area. Contain the spill with inert material. Sweep this material into containers for disposal. Spills are slippery - use to prevent falling. ELIMINATE IGNITION SOURCES.

WASTE DISPOSAL METHOD: Bury in landfill capable of absorbing surfactants. Leachate can cause forming.

SECTION VIII - SPECIAL PROTECTION INFORMATION

EYE PROTECTION: Use chemical splash goggles.

SKIN PROTECTION: Avoid contact. Wear chemical resistant gloves.

RESPIRATORY PROTECTION: None

VENTILATION: Use in well ventilated area.

OTHER: Have eyewash and general washing facilities nearby.

SECTION IV - SPECIAL PROTECTION

PRECAUTIONS TO BE TAKEN IN HANDLING & STORAGE: Avoid storage at high temperatures. Empty containers are still hazardous. KEEP AWAY FROM SOURCES OF IGNITION.

OTHER PRECAUTIONS: Avoid prolonged and repeated skin contact and chances of splashing in eyes. Keep out of reach of children.

The information provided in this Material Safety Sheet has been compiled from our experience and data presented in various technical publications. It is the users responsibility to determine the suitability of this information for the adoption of safety precautions as may be necessary. We reserve the right to revise Material Safety Data Sheets from time to time as new technical information becomes available. The information contained herein is furnished without warranty of any kind.

DISCLAIMER OF EXPRESSED AND IMPLIED WARRANTIES: although preparer and owner have taken reasonable care in the preparation of this document, we extend no warranties and make no representation as to the accuracy or completeness of the information contained herein, and assume no responsibility regarding the suitability of this information for the user's intended purposes or for the consequences of its use. Each user should make a determination as to the suitability of the information for their particular purpose(s). A request has been made to the manufacturer to approve the contents of this material safety data sheet. Upon receipt of any changes a new MSDS will be made available.

COMPAS Code: 21920070



SAFETY DATA SHEET

DREXEL CAPTAN 80 WDG FUNGICIDE

Section 1: Material Identification

Product Name: Drexel Captan 80 WDG Fungicide

EPA Reg No.: 19713-652

CAS NO: 133-06-2

Formula: C₉H₈Cl₃NO₂S

Company: Drexel Chemical Company
1700 Channel Avenue
Memphis, TN 38106

Identifiers:

EINECS: 205-087-0

RTECS: GW5075000

DOT label: UN-3077, Environmentally hazardous substances, solid, n.o.s., (Captan), 9, PG-III, RQ 10 lbs.

Emergency Telephone Number:

CHEMTREC	Drexel Chemical Co.
Tel: 1-800-424-9300	901-774-4370

This product is an EPA FIFRA registered pesticide. Some of the classifications on this SDS are not the same as the FIFRA label. Certain sections of this SDS are superseded by federal law governed by EPA for a registered pesticide. Please see **Section 15: REGULATORY INFORMATION** for explanation.

Section 2: Hazard Identification

(As defined by the OSHA Hazard Communication Standard, 29)

GHS classification:

Health Hazards:	Acute inhalation	Category 4
	Eye damage/irritation	Category 2A
	Aquatic acute toxicity	Category 1

GHS label elements:

Signal Word: Warning

**Hazard Statements:**

Harmful if inhaled.
Causes serious eye irritation.
Very toxic to aquatic life.

Precautionary Statements:**Prevention:**

Avoid breathing dust or vapors. Use only outdoors or in well-ventilated area.
Wash exposed skin thoroughly after handling.
Wear eye protection/face protection.
Avoid release to the environment.

Response:

If inhaled: Remove person to fresh air and keep comfortable for breathing. Call a poison center/doctor if you feel unwell. If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth-to-mouth, if possible. Call a poison control center or doctor for further treatment advice.
If in eyes: Hold eye open and rinse slowly and gently with water for 15 to 20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eyes for at least 15 minutes. **If eye irritation persists:** Get medical advice/attention.
Collect spillage.

Storage:

Store in a cool, dry, well ventilated and secure area designated specifically for pesticides and away from heat sources. Do not store in excessive heat. Do not store near children, food, foodstuffs, drugs or potable water supplies.
Keep in original containers and keep containers closed when not in use.

Disposal:

If wastes and/or containers cannot be disposed of according to the product label directions, disposal of this material must be in accordance with your local or area regulatory authorities.

Section 3: Composition Information

<u>Components</u>	<u>CAS No.</u>	<u>% By Wt.</u>	<u>OSHA PEL</u>	<u>ACGIH TLV</u>
Active Ingredient:				
Captan	133-06-2	80.0%	N/Av	5 mg/m ³
Inert Ingredients:	N/A	20.0%	N/A	N/A

Section 4: First-Aid Measures

Eye Contact: Hold eye open and rinse slowly and gently with water for 15 to 20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eyes for at least 15 minutes. Obtain medical attention without delay, preferably from an ophthalmologist.

If Swallowed: Call a poison control center or doctor immediately for treatment advice. Rinse out mouth. Have person sip a glass of water if able to swallow. Do not induce vomiting unless told to do so by the poison control center or doctor.

Do not give anything by mouth to an unconscious person. Have product label with you when calling a poison control center or doctor.

Skin Contact: Immediately flush skin with water while removing contaminated clothing and shoes. Get medical attention if symptoms occur. Wash clothing before reuse. Destroy contaminated leather items such as shoes, belts, and watchbands.

If Inhaled: Move person to fresh air. If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth-to-mouth, if possible. Call a poison control center or doctor for further treatment advice.

Note to Physician: There is no specific antidote. Treat symptomatically. Probable mucosal damage may contradict the use of gastric lavage.

Section 5: Fire Fighting Measures

Fire Hazards: Thermal decomposition during a fire can produce toxic fumes and irritating gases.

Flammability classification (OSHA 29 CFR 1910.1200): N/A

Flash point: N/A

Lower flammable limit (% by volume): N/Av

Upper flammable limit (% by volume): N/Av

Fire Fighting Procedures: Keep people away. Isolate fire and deny unnecessary entry. Evacuate the area and fight the fire from upwind at a safe distance to avoid hazardous vapors or decomposition products. Dike and collect fire-extinguishing water to prevent environmental damage and excessive waste runoff.

Firefighting media: Use foam, dry chemical, carbon dioxide, or water fog when fighting fires involving this product. Do not use water jet, as this may spread burning material. Minimize the use of water to avoid environmental contamination. Contain all runoff.

Special Protective Equipment for Firefighters: Wear positive-pressure self-contained breathing apparatus (SCBA) and protective firefighting clothing (includes firefighting helmet, coat, trousers, boots, and gloves). Use full face shield and operate in positive pressure mode. Avoid contact with this material during firefighting operations. If contact is likely, change to full chemical resistant firefighting clothing with self-contained breathing apparatus. If this is not available, wear full chemical resistant clothing with self-contained breathing apparatus and fight fire from a remote location. For protective equipment in post-fire or non-fire clean-up situations, refer to the relevant sections.

Hazardous Combustion Products: Carbon oxides, Sulfur oxides, nitrogen oxides, halogenated compounds, irritating fumes and smoke.

NFPA: **Health:** **Flammability:** **Reactivity:**

3

0

0

(Rating: 4-Extreme, 3-High, 2-Moderate, 1-Slight, 0-Insignificant)

Section 6: Accidental Release Measures

Steps to be taken if Material is Released or Spilled:

- Sweep as much material as possible, keeping dust to a minimum, and place in an approved chemical waste container. Wash the spill area with water containing a strong detergent, absorb with earth, sand or absorbent

material and sweep up and place in approved chemical waste container. For large spills contact Drexel Chemical Co. See Section 13, Disposal Considerations, for additional information.

Personal Precautions:

- Isolate area. Keep unnecessary and unprotected personnel from entering the area. Refer to Section 7, Handling, for additional precautionary measures. Ventilate area of leak or spill. Use appropriate safety equipment. For additional information, refer to Section 8, Exposure Controls and Personal Protection.

Environmental Precautions: Prevent from entering into soil, ditches, sewers, waterways and/or groundwater. See Section 12, Ecological Information.

Section 7: Handling and Storage

KEEP OUT OF REACH OF CHILDREN

Handling: General Handling: Avoid contact with eyes, skin, and clothing. Wash thoroughly with soap and water after handling. Do not swallow. Avoid breathing dust. Use with adequate ventilation. Wear long-sleeved shirt, long pants, shoes plus socks and chemical resistant apron when handling. Keep away from heat, sparks and flame. See Section 8, Exposure Controls and Personal Protection.

Storage: Store in a cool, dry, ventilated and secure area designated specifically for pesticides and away from heat sources. Keep in original containers and keep containers closed when not in use. Do not store in excessive heat. Do not store near children, food, foodstuffs, drugs or potable water supplies.

Section 8: Exposure Controls / Personal Protection

Exposure Limits: TLV: Captan 5 mg/m³

Personal Protection:

Eye/Face Protection: Wear dust proof and chemical splash goggles to prevent dust or mists from entering the eyes. If using a full face shield, always use safety glasses or goggles along with the face shield to ensure adequate protection of the eyes.

Skin Protection: Use protective clothing chemically resistant to this material. Selection of specific items such as face shield, boots, apron, or full body suit will depend on the task. Safety shower should be located in immediate work area. Remove contaminated clothing immediately, wash skin area with soap and water, and launder clothing before reuse or dispose of properly. Items which cannot be decontaminated, such as shoes, belts and watchbands, should be removed and disposed of properly.

Hand protection: Use gloves chemically resistant to this material. Examples of preferred glove barrier materials include: Neoprene, Nitrile/butadiene rubber ("nitrile" or "NBR") or Polyvinyl chloride ("PVC" or "vinyl").

Respiratory Protection: Respiratory protection should be worn when there is a potential to exceed the exposure limit requirements or guidelines. When handling in enclosed areas, when large quantities of dust or mists are generated or prolonged exposure is possible in excess of the TLV, use a respirator with either an organic vapor-removing cartridge with a pre-filter approved for pesticides (MSHA/NIOSH approval number prefix TC-23C) or a canister approved for pesticides (MSHA/NIOSH approval number prefix TC-14G).

Ingestion: Avoid ingestion of even very small amounts; do not consume or store food or tobacco in the work area; wash hands and face thoroughly with soap and water before smoking or eating. Avoid getting wash water in eyes.

Engineering Controls:

Ventilation: When handling this product proper ventilation is required to maintain exposure below the TLV. Ventilates all transport vehicles prior to unloading. Facilities storing or utilizing this material should be equipped with an eyewash facility and safety shower.

Section 9: Physical and Chemical Properties

Physical State:	Solid
Color:	Light brown
Odor:	Mild
Flash Point:	None
Vapor Pressure (mmHg):	N/A
Boiling Point:	N/A
Vapor Density (air = 1):	N/A
Bulk Density (H₂O = 1):	39.37 lbs. /ft ³
Freezing Point:	N/A
Solubility in water (wt. %):	Disperses
pH:	5-7 (5% emulsion)
Viscosity:	N/A

Section 10: Stability and Reactivity

Stability/Instability: Thermally stable at typical use temperatures and in closed containers.

Conditions to Avoid: Avoid heat of open flame. Avoid high temperatures above 130°F (54.4°C).

Incompatible Materials: Avoid contact with: Strong acids. Strong bases. Strong oxidizers.

Hazardous Polymerization: Will not occur

Thermal Decomposition: Decomposition products can include and are not limited to: Carbon oxides, sulfur oxides, nitrogen oxides, and halogenated compounds.

Section 11: Toxicological Information

Acute Toxicity:

Ingestion:

- LD₅₀, (rat): >5,050 mg/kg

Dermal:

- LD₅₀, (rabbit): >5,050 mg/kg

Inhalation

- LC₅₀, (4h), (rat): >2.23 mg/l

Eye Irritation (rabbit):

- Category II, "Positive" conjunctival irritation clearing in 8 – 21 days.

Skin Irritation (rabbit):

- Non-irritating

Sensitization Skin:

- Non-sensitizer (guinea pig)

Chronic Toxicity and Carcinogenicity:

- EPA lists as likely carcinogenic at high-level exposures but not likely at dose levels that do not cause cytotoxicity and regenerative cell hyperplasia. Not listed as carcinogenic by IARC, NTP or OSHA.

Teratogenicity, mutagenicity, and other reproductive effects: Not likely to cause reproductive effects in humans.

Section 12: Ecological Information

The information provided here is for Captan:

ENVIRONMENTAL FATE:

- This product is acutely toxic to freshwater fish, practically non-toxic to birds and non-toxic to bees when used as directed.

Persistence and Degradability:

- Dissipates rapidly in the environment, is slightly-to-relatively immobile in soils.

Aquatic Toxicity:

- Rainbow Trout: LC50: (73.2 µg/L)
- Bluegill Sunfish: LC50: (72 µg/L)
- Daphnia magna: 48 hour LC50: (7-10 mg/L)

Bees:

- Acute LD50: 46.26 µg/bee

Bird Toxicity:

- Mallard Duck: LD50: 2000 mg/kg
- Bobwhite Quail: LD50: >2150 mg/kg

Section 13: Disposal Considerations

If wastes and/or containers cannot be disposed of according to the product label directions, disposal of this material must be in accordance with your local or area regulatory authorities. This information presented below only applies to the material as supplied. The identification based on characteristic(s) or listing may not apply if the material has been used or otherwise contaminated. It is the responsibility of the waste generator to determine the toxicity and physical properties of the material generated to determine the proper waste identification and disposal methods in compliance with applicable regulations. If the material as supplied becomes a waste, follow all applicable regional, national and local laws.

Section 14: Transport Information

DOT: UN-3077, Environmentally hazardous substances, solid, n.o.s., (Captan), 9, PG-III, RQ 10 lbs.

IMDG: UN-3077, Environmentally hazardous substances, solid, n.o.s., (Captan), 9, PG-III, RQ 10 lbs., Marine pollutant

ICAO/IATA: UN-3077, Environmentally hazardous substances, solid, n.o.s., (Captan), 9, PG-III, RQ 10 lbs.

Freight Description: Agricultural Fungicide, Solid, n.o.s.

ERG Guide No.: 171

This information is not intended to convey all specific regulatory or operational requirements/information relating to this product. Additional transportation system information can be obtained through an authorized sales or customer service representative. It is the responsibility of the transporting organization to follow all applicable laws, regulations and rules relating to the transportation of the material.

Section 15: Regulatory Information

OSHA Hazard Communication Standard:

- This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.
- **EPA FIFRA INFORMATION:**
This chemical is a pesticide product registered by the United States Environmental Protection Agency and is subject to certain labeling requirements under federal pesticide law. These requirements differ from the classification criteria and hazard information required for safety data sheets (SDS), and for workplace labels of non-pesticide chemical. The hazard information required on the pesticide label is listed out below. The pesticide label also includes other important information, including directions for use.
- **EPA/CERCLA Reportable Quantity:** 10 Lbs.

SARA/TITLE III:

- **Sec. 302. Extremely Hazardous Substance Notification:** This material is not known to contain any Extremely Hazardous Substances.
- **Sec. 311/312. Hazard Categories:** Immediate health hazard
- **Sec. 313. Toxic Chemical(s):** Captan (CAS 133-06-2)
- **RCRA Waste Code:** Not applicable

California Proposition 65 (Safe Drinking Water and Toxic Enforcement Act of 1986):

- This product is listed.

Toxic Substances Control Act (TSCA):

- All components of this product are on the TSCA Inventory or are exempt from TSCA Inventory requirements under 40 CFR 720.30

Section 16: Other Information

Drexel Chemical Company recommends that each customer or recipient of this SDS to study it carefully and consult appropriate expertise, as necessary or appropriate, to become aware of and understand the data contained in this SDS and any hazards associated with the product. The information herein is provided in good

faith and believed to be accurate as of the effective date shown below. However, no warranty, express or implied, is given. Regulatory requirements are subject to change and may differ between various locations. It is the buyer's/user's responsibility to ensure that his activities comply with all federal, state, provincial or local laws. The information presented here pertains only to the product as shipped. Since conditions for use of the product are not under the control of the manufacturer, it is the buyer's/user's duty to determine the conditions necessary for the safe use of this product. Due to the proliferation of sources for information such as manufacturer-specific SDSs, we are not and cannot be responsible for SDSs obtained from any source other than ourselves. If you have obtained an SDS from another source or if you are not sure that the SDS you have is current, please contact us for the most current version.

Date Revised: April 28, 2016

Supersedes: May 4, 2015



MATERIAL SAFETY DATA SHEET

CAPTEVATE™ 68 WDG

Page 1 of 8

Please read the entire document. This Material Safety Data Sheet contains important environmental, health and toxicology information for your employees, and anyone who will use, transport, store, dispose of or handle this product. Please make sure this information is given to them. It also contains information to help you meet community right-to-know/emergency response reporting requirements under SARA Title III and many other laws. If you resell this product, this MSDS must be given to the buyer or the information contained herein must be incorporated in your MSDS.

SECTION 1: PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: CaptEstate™ 68 WDG
EPA REGISTRATION NUMBER(S): 66330-48
SYNONYM(S): TM-450, TM-45001, TM-45002

COMPANY

Arvesta Corporation
100 First Street, Suite 1700
San Francisco, CA 94105

EMERGENCY TELEPHONE NUMBERS

HEALTH EMERGENCY:

1-800-228-5635 ext. 174, or
1-651-632-8946 (International)

SPILL EMERGENCY:

1-800-424-9300

SECTION 2: COMPOSITION/INFORMATION ON INGREDIENTS

Active Ingredient(s)/ Hazardous Inert Ingredient(s)	CAS #	Exposure Limits*	% Weight	% Volume
Captan: N- [(trichloromethyl)thio]-4- cyclohexene-1, 2-dicarboximide	133-06-2	<u>TWA</u> ^a OSHA PEL ^b : None ACGIH TLV ^c : 5mg/m ³ NIOSH REL ^d : 5mg/m ³	53.6	NA
Fenhexamid: N-(2,3-dichloro-4- hydroxyphenyl) -1-methyl- cyclohexanecarboxamide	126833-17-8	<u>TWA</u> OSHA PEL: None ACGIH TLV: None NIOSH REL: None	14.3	NA

Only the identities of the active ingredient(s) and any hazardous inert ingredients are listed. Specific information on all of this product's ingredients can be obtained by the treating medical professional or spill emergency responder for the management of exposures, spills, or safety assessments.

*Source: *Guide to Occupational Exposure Values 2000*, published by ACGIH

^a**TWA**: Time-weighted average exposure concentration for a conventional 8-hour (TLV, PEL) or up to a 10-hour (REL) workday and a 40-hour workweek.

^b**OSHA PEL**: Occupational Safety and Health Administration Permissible Exposure Limits.

^c**ACGIH TLV**: American Conference of Governmental Industrial Hygienists, Inc., Threshold Limit Values.

^d**NIOSH REL**: National Institute for Occupational Safety and Health Recommended Exposure Limits.

EMERGENCY TELEPHONE #: 1-800-228-5635 Ext. 174 or 1-651-632-8946

MSDS Number: CP-015

Issue Date: 07/15/03

NDA = No Data Available

NA = Not Applicable

SECTION 3: HAZARDS IDENTIFICATION**EMERGENCY OVERVIEW**

DANGER:

- CAUSES IRREVERSIBLE EYE DAMAGE
- HARMFUL IF SWALLOWED OR INHALED
- MAY CAUSE SENSITIZATION BY SKIN CONTACT
- DO NOT GET IN EYES, ON SKIN, OR ON CLOTHING
- VERY TOXIC TO FISH
- KEEP OUT OF REACH OF CHILDREN

Acute Health Hazards

Eye: Corrosive to eyes. Severe eye irritation can be expected. The degree of injury will depend on the amount and duration of the contact and the speed and thoroughness of the first aid treatment.

Skin: Short contact periods may irritate skin slightly; prolonged contact could increase the severity of irritation. Repeated exposure may cause dermal sensitization. Captan is poorly absorbed through the skin and is minimally toxic via dermal exposure.

Ingestion: This product is expected to be minimally toxic if ingested. The degree of injury will depend on the amount of material absorbed and the speed and thoroughness of first aid treatment.

Inhalation: This product is not expected to pose an inhalation hazard due to its physical form as water-soluble granules. Inhalation of Captan may cause respiratory irritation. Short-term inhalation is expected to be only minimally toxic. The degree of any injury will depend upon the amount of material inhaled, duration of exposure, and the speed and thoroughness of first aid treatment.

Chronic Health Hazards (Including Cancer): Captan Technical was not oncogenic in the rat in a lifetime dietary study. In a lifetime mouse dietary study Captan Technical did produce a significant increase in tumors of the small intestine (especially the duodenum) after repeated exposure at high doses. The threshold oncogenic response results from a chemical irritation to the intestinal mucosa and not a genotoxic effect. Fenhexamid is not a carcinogen.

Teratology (Birth Defects) Information: Captan Technical was fetotoxic (not teratogenic) in animal studies at maternally toxic doses. Fenhexamid is not a reproductive or developmental toxicant.

SECTION 4: FIRST AID MEASURES

Eyes: Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. Call a poison control center or doctor for treatment advice.

Skin: Take off contaminated clothing. Rinse skin immediately with plenty of water for 15-20 minutes. Call a poison control center or doctor for treatment advice.

Ingestion: Call poison control center or doctor immediately for treatment advice. Have person sip a glass of water if able to swallow. Do not induce vomiting unless told to do so by the poison control center or doctor. Do not give anything by mouth to an unconscious person.

Inhalation: Move person to fresh air. If person is not breathing, call 9-1-1 or an ambulance, then give artificial respiration, preferably by mouth-to-mouth, if possible. Call a poison control center or doctor for further treatment advice.

Notes to Physicians/First Aid Providers: Probable mucosal damage may contraindicate the use of gastric lavage. Treatment is symptomatic.

SECTION 5: FIRE FIGHTING MEASURES

Flammable Limits in Air (% by volume):		
	Upper:	NA
	Lower:	NA
Flash Point:		NA
	Method Used:	NA
Autoignition Temperature:		Captan Technical does not self-ignite. Fenhexamid spontaneous ignition temperature = 295°C.
LEL/UEL:		NDA
NFPA Hazard Classification:		
	Health:	4
	Flammability:	2
	Reactivity:	2
	Other:	None
Extinguishing Media:		Foam, carbon dioxide, dry powder or halon extinguishant, water-fog
Special Fire Fighting Procedures:		Keep fire-exposed containers cool by spraying with water. Contain run-off water with temporary earthen barriers. A self-contained breathing apparatus and suitable protective clothing should be worn in fire conditions.
Hazardous Combustion Products:		Captan Technical can form flammable dust clouds at elevated temperatures. In small-scale thermal stability tests, exothermic decomposition was detected at a temperature of 155°C.

SECTION 6: ACCIDENTAL RELEASE MEASURES

EMERGENCY PHONE NUMBERS

Exposure Calls (PROSAR): 1-800-228-5635 Ext. 174 or 1-651-632-8946 (International)

Spill Calls (CHEMTREC): 1-800-424-9300

Wear suitable personal protection during cleanup of any spill. Wear a respirator, eye protection, chemically resistant gloves, boots and coveralls. Avoid runoff into storm sewers or other bodies of water. Clean up spill immediately. Cover spillage with moist sand, soil or sawdust. Transfer to a container for disposal. Wash the spillage area with water. Washings must be prevented from entering surface water drains. This material is very toxic to fish. Spillage or uncontrolled discharges into watercourses must be alerted to the appropriate regulatory body. Remove contaminated water for removal or treatment.

SECTION 7: HANDLING AND STORAGE

It is a violation of federal law to use this product in a manner inconsistent with its labeling. Read entire label. Use strictly in accordance with label precautionary statements and directions. Avoid contact with skin. Do not get in eyes. When not being used, keep container tightly closed and in a cool, dry, well ventilated place away from flammable materials and sources of heat or flames. Do not store or transport near feed or food.

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

Eye Protection: Do not get this material in your eyes. The use of chemical safety eyewear is recommended when handling this material.

Respiratory/Ventilation Requirements: Wear suitable MSA/NIOSH approved respiratory protective equipment if exposure to levels above the occupational exposure limit is likely.

Skin Protection: Avoid skin contact by wearing suitable protective clothing, gloves and eye/face protection. Remove contaminated clothing and wash before re-wearing.

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	Brown colored fine granule
Odor:	NDA
Physical State:	Solid
pH:	7.9 (1% w/v suspension at 26.8°C)
Boiling Point:	NA
Melting Point:	NDA
Freezing Point	NA
Vapor Pressure:	NDA
Vapor Density:	NDA
Bulk Density:	0.75-0.82 g/ml
Specific Gravity:	NA
Evaporation Rate:	NA
Solubility in Water:	NDA
Percent Solids by Weight:	NDA
Percent Volatile:	NA
Volatile Organic Compounds:	NA
Molecular Weight:	NDA
Viscosity:	NA

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability:	Stable at ambient temperature and atmospheric pressure. Decomposes at or near its melting point.
Hazardous Polymerization:	NDA
Flash Point:	NA
Flammable Point:	NDA
Auto Ignition:	NDA
Incompatibility With Other Materials:	Relatively non-reactive, but is decomposed by caustic chemicals.
Hazardous Decomposition Products:	Combustion or thermal decomposition will evolve toxic and irritant vapors such as hydrogen chloride, carbonyl sulfide, carbon disulfide, thiophosgene

SECTION 11: TOXICOLOGICAL INFORMATION**Acute:**

Eye Irritation: CaptEstate™ 68 WDG is expected to be highly irritating to the eyes. Captan Technical is classified as a severe to very severe irritant in the rabbit eye irritation study. Fenhexamid Technical is not irritating in laboratory tests.

Skin Irritation: CaptEstate™ 68 WDG is a slight skin irritant.

Skin Sensitization: CaptEstate™ 68 WDG is expected to be a skin sensitizer. Captan Technical is a moderate skin sensitizer. Fenhexamid Technical is negative in the Magnusson/Kligman and modified Buehler Guinea Pig Sensitization tests.

Dermal Toxicity: The dermal LD₅₀ of CaptEstate™ 68 WDG is > 5,000 mg/kg (Category IV).

Oral Toxicity: The oral LD₅₀ of CaptEstate™ 68 WDG is > 2,000 mg/kg (Category III).

Inhalation Toxicity: CaptEstate™ 68 WDG is not expected to pose an inhalation hazard due to its physical form as water-soluble granules. The 4-hour LC₅₀ of Captan Technical in male and female rats is 0.72 mg/L and 0.87 mg/L respectively. The 4-hour inhalation LC₅₀ (dust) of Fenhexamid Technical in rats is > 5,057 mg/m³.

Subchronic Toxicity: For Captan Technical the dermal 21-day LD₅₀ (rabbits) = 110 mg/kg/day and the inhalation 90-day LC₅₀ (rat) is > 13 mg/L. For Fenhexamid Technical the NOEL in mice is 267mg/kg/d (male) or 454 mg/kg/d (female) in a 14-week feeding study based upon kidney effects; the NOEL in dogs is 25 mg/kg/d in a 52-week study based upon liver effects; and no changes in clinical signs, mortality, clinical pathology, food consumption, pathology or organ weights.

Chronic/Carcinogenicity: Captan Technical is not carcinogenic to rats or dogs following chronic dietary exposure. In mice, chronic dietary exposure to Captan Technical produced increased tumors of the small intestine, but only at high doses. The tumors are a result of chemical irritation of the intestine, and not a mutagenic effect. The NOEL for tumor formation was 400 ppm Captan Technical in diet. Fenhexamid Technical is not carcinogenic in laboratory animals.

Teratology/Developmental Toxicity: Captan Technical is not teratogenic when tested in rabbits or hamsters and embryotoxicity and fetotoxicity were observed in animal studies only at maternally toxic doses. For Fenhexamid Technical the NOEL in rats is 1,000 mg/kg/d for maternal and developmental effects; and the NOEL in rabbits is 100 mg/kg/d for maternal (decreased body weight and food consumption) and developmental (resorptions, abortions, placental weight) effects.

Reproduction: In a 3-generation rat study, Captan Technical had no effects on fertility, gestation length or litter size; pup survival was reduced at doses ≥ 250 mg/kg/day; and a 1-generation study showed decreased pup (rat) weights at 12.5 mg/kg/day. For Fenhexamid Technical no reproduction toxicity was observed in a study with rats exposed to this product for two generations.

Mutagenicity: *In vivo*, Captan Technical has been examined in many systems and the overall conclusion is of no significant genotoxic activity; and genotoxicity has been shown *in vitro* primarily for prokaryotic and non-mammalian eukaryotic cells when cellular protective mechanisms (GSH, etc.) are absent. Fenhexamid Technical was negative in the following genotoxicity assays: Salmonella/microsome test (Ames test), mouse micronucleus test, V79-HGPRT assay *in vitro*, rat primary hepatocyte UDS assay. Fenhexamid Technical does not present a genetic hazard to intact animal systems.

Neurotoxicity: Captan Technical is not a neurotoxin.

SECTION 12: ECOLOGICAL INFORMATION

Environmental Fate and Distribution (based on Captan Technical):

Solid with moderate volatility
The substance is sparingly soluble in water
The substance has low potential for bioaccumulation
DT₅₀ of < 1 day in aerobic and anaerobic soil
Rapidly hydrolyzed in natural waters (DT₅₀ < 24 hrs)
Does not volatilize from soil
Does not readily leach into groundwater

(based on Fenhexamid Technical):

Does not leach into ground water.
Low soil mobility.
Rapid degradation in soil (DT₅₀ of < 1 day)
Rapid depuration in fish and mammals.

Avian Toxicity:Captan Technical:

Bobwhite quail oral LD₅₀ > 2,000 mg/kg
Bobwhite quail dietary LC₅₀ (5-day feeding) > 5,200 ppm
Mallard duck oral LD₅₀ > 2,000 mg/kg
Mallard duck dietary LC₅₀ (5-day feeding) > 5,200 ppm

Fenhexamid Technical:

Bobwhite quail oral LD₅₀ = > 2,000 mg/kg bw
Bobwhite quail dietary LC₅₀ = > 5,000 mg/kg diet
Mallard duck dietary LC₅₀ = > 5,000 mg/kg diet

Aquatic Organism Toxicity:Captan Technical:

Toxic to fish. Due to short persistence in water this product is unlikely to be hazardous to aquatic life.

Rainbow Trout 96-hour LC₅₀ = 50 µg/L
Mirror Carp 96-hour LC₅₀ = 240 µg/L
Daphnia magna 48-hour EC₅₀ = 4.7 mg/L

Fenhexamid Technical:

Sheephead minnow 96-hour LC₅₀ = 11 mg/L
Rainbow trout 96-hour LC₅₀ = 2.66 mg/L
Daphnia magna 48-hour EC₅₀ > 18.8 mg/L

Other Non-Target Organism Toxicity:Captan Technical:

Green algae (biomass) 96-hour EC₅₀ = 1.6 mg/L
Green algae (growth rate) 96-hour EC₅₀ = 11 mg/L
Pseudomonas putida EC₅₀ = 0.22 mg/L
24-hour contact LD₅₀ > 200 µg a.i./bee
24-hour oral LD₅₀ > 100 µg a.i./bee

Fenhexamid Technical:

Honeybees LD₅₀ (oral) = >100 µg/bee
Honeybees LD₅₀ (contact) = >200 µg/bee
Earthworm LC₅₀ = >1,000 mg/kg dry soil
Green algae (growth rate) 120-hour EC₅₀ = 8.81 mg/L

SECTION 13: DISPOSAL CONSIDERATIONS

End users must dispose of any unused product as per the label recommendations and in accordance with all applicable laws and regulations. Check governmental regulations and local authorities for approved disposal of this material.

SECTION 14: TRANSPORT INFORMATION

D.O.T. Shipping Name:	Environmentally Hazardous Substance, Solid, N.O.S., RQ
Technical Shipping Name:	Captan 53%
Packing Group:	III
D.O.T. Hazard Class:	9
U.N/N.A. Number:	UN3077
Product RQ (lbs):	18.8 lbs (based on % weight of RQ ingredient(s))
D.O.T. Label:	9
D.O.T. Placard:	9
Marine Pollutant:	Yes
IMO :	
IMO Label:	9
IMO Placard:	9
European Road/Rail:	
Class:	9

SECTION 15: REGULATORY INFORMATION

U.S Federal Regulations

FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act): All pesticides are governed under FIFRA. Therefore, the regulations presented below are pertinent only when handled outside of the normal use and applications of pesticides. This includes waste streams resulting from manufacturing/formulation facilities, spills or misuse of products, and storage of large quantities of products containing hazardous or extremely hazardous substances.

CERCLA (Comprehensive Response Compensation, and Liability Act): Captan Reportable Quantity = 10 lbs.

EPCRA (Emergency Planning and Community Right-to-Know Act) Section 313: Yes

OSHA (Occupational Safety and Health Administration): This product is hazardous under the criteria of the Federal OSHA Hazard Communication Standard 29 CFR 1910.1200.

RCRA (Resource Conservation and Recovery Act): NA

SARA Title III (SUPERFUND Amendments and Reauthorization Act):

Section 302 (EHS) TPQ: NONE

Section 304 (EHS) RQ: NONE

Section 311/312 CATEGORIES

1. Immediate (Acute) Health Effects; **YES**
2. Delayed (Chronic) Health Effect; **YES**
3. Fire Hazard; **NO**
4. Sudden Release of Pressure Hazard; **NO**
5. Reactivity Hazard; **NDA**

TSCA (Toxic Substance Control Act): This product is exempt from TSCA Regulation under FIFRA Section 3 (2)(B)(ii) when used as a pesticide.

State Regulations: Each state may promulgate standards more stringent than the federal government. This section cannot encompass an inclusive list of all state regulations. Therefore, the user should consult state or local authorities.

California Proposition 65: "WARNING. This product contains a chemical known to the State of California to cause cancer." Captan is on the June 13, 2003 list titled "CHEMICALS KNOWN TO THE STATE TO CAUSE CANCER OR REPRODUCTIVE TOXICITY" under the section titled "CHEMICALS KNOWN TO THE STATE TO CAUSE CANCER."

International Regulations:**EEC Classification:** IRRITANT

Risk Phrases:

R43: May cause sensitization by skin contact
R36: Irritating to eyes
R40: Possible risk of irreversible effects

Safety Phrases: S36/37: Wear suitable protective clothing and gloves

SECTION 16: OTHER INFORMATION

Reason for issue:	Revised Name from CaptEvate to CaptEvate™ 68 WDG
Prepared by:	James J. Reilly, Jr.
Approval date:	07/15/03
Supersedes date:	07/10/03
MSDS number:	CP-015

The information in this MSDS is based on data available to us as of the revision data given herein, and believed to be correct. Contact Arvesta Corporation's Compliance Officer - Safety, Health & Environmental Affairs at (415) 536-3491, Fax (415) 546-7699 to determine if additional data and information have become available since the revision date.

Judgments as to the suitability of information herein for the individual's own uses or purposes are necessarily the individual's own responsibility. Although reasonable care has been taken in the preparation of such information, Arvesta Corporation extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the individual's purposes or the consequences of its use.

**Material Safety Data Sheet****FLINT® 50WG FUNGICIDE**

MSDS Number: 102000011560

MSDS Version 1.4

Revision Date: 01/24/2012

Print Date: 01/24/2012

SECTION 1. CHEMICAL PRODUCT AND COMPANY INFORMATION

Product name	FLINT® 50WG FUNGICIDE
MSDS Number	102000011560
Product code (UVP)	06351867
PCP Registration No.	27529
Product Use	Fungicide

Bayer CropScience Inc
#200, 160 Quarry Park Blvd, SE
Calgary, Alberta T2C 3G3
Canada

For MEDICAL, TRANSPORTATION or other EMERGENCY call: 1-800-334-7577 (24 hours/day)
For Product Information call: 1-888-283-6847

SECTION 2. HAZARDS IDENTIFICATION

NOTE: Please refer to Section 11 for detailed toxicological information.

Emergency Overview Caution! May cause eye irritation. Avoid contact with eyes. Harmful if absorbed through skin. May cause sensitization by skin contact. Avoid contact with skin and clothing. Wash thoroughly with soap and water after handling.

Physical State water-dispersible granules

Appearance brown

Exposure routes Eye contact, Skin contact, Skin Absorption, Inhalation

Immediate Effects

Eye May cause mild irritation to eyes. Do not get in eyes.

skin May cause slight irritation. May cause sensitization by skin contact. Harmful if absorbed through skin. Avoid contact with skin and clothing.

Ingestion Do not take internally.

Inhalation Do not breathe dust or spray mist.

**Material Safety Data Sheet**

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FLINT® 50WG FUNGICIDE**Chronic or Delayed
Long-Term**

This product is not listed as a carcinogen by ACGIH, NTP, IARC or OSHA. However, it may contain crystalline silica (quartz), a substance which has been listed as a carcinogen by ACGIH, NTP and IARC. Crystalline silica is a naturally-occurring mineral component of many sands and clays. Although the carcinogenic potential of crystalline silica in humans is controversial, it must be considered if it is inhaled under excessive exposure conditions. The respirable portion of the silica that may be contained in this product, however, is small, such that inhalation exposure during anticipated conditions of use is minimal. This product or its components may have long term (chronic) health effects.

**Medical Conditions
Aggravated by Exposure**

As with all materials which can cause upper respiratory tract irritation, persons with a history of asthma, emphysema, or hyperreactive airways disease may be more susceptible to overexposure.

Target Organs

liver

**Potential Environmental
Effect**

Toxic to fish and aquatic organisms.

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

<u>Hazardous Component Name</u>	<u>CAS-No.</u>	<u>Average % by Weight</u>
Trifloxystrobin	141517-21-7	50.00
Diatomaceous earth	61790-53-2	10.00

SECTION 4. FIRST AID MEASURES**General**

When possible, have the product container or label with you when calling a poison control center or doctor or going for treatment.

Eye

Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. Call a physician or poison control center immediately.

skin

Take off contaminated clothing and shoes immediately. Wash off immediately with plenty of water for at least 15 minutes. Call a physician or poison control center immediately.

Ingestion

Call a physician or poison control center immediately. Rinse out mouth and give water in small sips to drink. DO NOT induce vomiting unless directed to do so by a physician or poison control center. Never give anything by mouth to an unconscious person. Do not leave victim unattended.

Inhalation

Move to fresh air. If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth-to-mouth if possible. Call a physician or poison control center immediately.

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**Notes to physician
Treatment**

Appropriate supportive and symptomatic treatment as indicated by the patient's condition is recommended. There is no specific antidote.

SECTION 5. FIRE FIGHTING MEASURES

Flash point	not applicable
Autoignition temperature	320 °C / 608 °F
Lower Flammability Limit	not applicable
Upper Flammability Limit	not applicable
Explosiveness	no data available
Fire and Explosion Hazards	In the event of fire the following may be released: Hydrogen cyanide (hydrocyanic acid) Hydrogen fluoride Carbon monoxide (CO) Nitrogen oxides (NOx)
Suitable extinguishing media	Dry chemical, Foam, Carbon dioxide (CO ₂), Water
Fire Fighting Instructions	Evacuate personnel to safe areas. Avoid contact with spilled product or contaminated surfaces. Contain the spread of the fire-fighting media. Keep out of smoke. Do not allow run-off from fire fighting to enter drains or water courses. After fire is extinguished, do not turn on any ignition source until the area is determined to be free from explosion or fire hazard. Firefighters should wear NIOSH approved self-contained breathing apparatus and full protective clothing.
Dust explosion class	no data available

SECTION 6. ACCIDENTAL RELEASE MEASURES

Personal precautions	Keep unauthorized people away. Isolate hazard area. Avoid contact with spilled product or contaminated surfaces. Use personal protective equipment.
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Methods for cleaning up Sweep up or vacuum up spillage and collect in suitable container for disposal. Collect and transfer the product into a properly labelled and tightly closed container. Avoid dust formation. Decontaminate tools and equipment following cleanup. Clean contaminated floors and objects thoroughly, observing environmental regulations. Contaminated soil may have to be removed and disposed.

Additional advice Do not allow to enter soil, waterways or waste water canal. Information regarding waste disposal, see section 13.

SECTION 7. HANDLING AND STORAGE

Handling procedures Handle and open container in a manner as to prevent spillage. Avoid contact with skin, eyes and clothing. Maintain exposure levels below the exposure limit through the use of general and local exhaust ventilation.

Keep away from heat and sources of ignition.

Storing Procedures Store in a cool, dry place and in such a manner as to prevent cross contamination with other crop protection products, fertilizers, food, and feed. Store in original container. Store in a place accessible by authorized persons only.

Work/Hygienic Procedures Handle in accordance with good industrial hygiene and safety practice. Wash hands thoroughly with soap and water after handling and before eating, drinking, chewing gum, using tobacco, using the toilet or applying cosmetics.

Remove Personal Protective Equipment (PPE) immediately after handling this product. Remove soiled clothing immediately and clean thoroughly before using again. Wash thoroughly and put on clean clothing.

SECTION 8. EXPOSURE CONTROLS / PERSONAL PROTECTION

General Protection Keep and wash PPE separately from other laundry. Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables, use detergent and warm/tepid water.

Eye/Face Protection Safety glasses with side-shields

Hand protection Chemical resistant nitrile rubber gloves

Body Protection Wear long-sleeved shirt and long pants and shoes plus socks. Coveralls

Respiratory protection When respirators are required, select NIOSH approved equipment based on actual or potential airborne concentrations and in accordance with the appropriate regulatory standards and/or industry recommendations.



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Exposure Limits

Trifloxystrobin	141517-21-7	OES BCS*	TWA	2.7 mg/m ³
Diatomaceous earth	61790-53-2	OEL (QUE)	TWA	6 mg/m ³
		CAD AB OEL	TWA	3 mg/m ³
		CAD AB OEL	TWA	10 mg/m ³
		CAD BC OEL	TWA	1.5 mg/m ³
		CAD BC OEL	TWA	4 mg/m ³
		CAD ON OEL	TWAEV	10 mg/m ³
		CAD ON OEL	TWAEV	3 mg/m ³
		OEL (QUE)	TWA	6 mg/m ³

*OES BCS: Internal Bayer CropScience "Occupational Exposure Standard"

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	brown
Physical State	water-dispersible granules
Vapor Pressure	no data available
Vapor Density (Air = 1)	no data available
Bulk density	27 - 32 lb/ft ³
Evaporation rate	no data available
Melting / Freezing Point	no data available
Water solubility	0.00061 g/l
Minimum Ignition Energy	no data available
Decomposition temperature	no data available
Partition coefficient: n-octanol/water	no data available

SECTION 10. STABILITY AND REACTIVITY

Conditions to avoid	no data available
Incompatibility	no data available

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**Hazardous
Decomposition Products** no data available

Hazardous reactions No hazardous reactions when stored and handled according to prescribed instructions.

SECTION 11. TOXICOLOGICAL INFORMATION

Only acute toxicity studies have been performed on the formulated product. The non-acute information pertains to the technical-grade active ingredient, trifloxystrobin.

Acute oral toxicity rat: LD50: > 5,050 mg/kg

Acute dermal toxicity rat: LD50: > 2,000 mg/kg

Acute inhalation toxicity rat: LC50: > 2.7 mg/l
Exposure time: 4 h
Determined in the form of dust.

rat: LC50: > 10.8 mg/l
Exposure time: 1 h
Determined in the form of dust.
Extrapolated from the 4 hr LC50.

Skin irritation rabbit: Slight irritation

Eye irritation rabbit: Mild eye irritation.

Sensitisation guinea pig: Sensitising

mouse: Sensitising
OECD Test Guideline 429, local lymph node assay (LLNA)

Chronic toxicity Trifloxystrobin caused liver effects in chronic studies in mice, rats and/or dogs.

Assessment Carcinogenicity

Trifloxystrobin was not carcinogenic in lifetime feeding studies in rats and mice.

ACGIH
None.

NTP
None.

IARC
OSHA
None.

Reproductive toxicity REPRODUCTION: Trifloxystrobin is not considered a primary reproductive toxicant in rats.

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DEVELOPMENTAL TOXICITY: Trifloxystrobin is not considered a primary developmental toxicant in laboratory animals. Developmental effects were observed only at doses that caused maternal toxicity.

**Assessment
neurotoxicity**

Trifloxystrobin is not a primary neurotoxicant based on an acute (oral gavage) neurotoxicity screening study in rats.

Mutagenicity

Trifloxystrobin was not considered mutagenic or genotoxic based on in vitro and in vivo tests.

SECTION 12. ECOLOGICAL INFORMATION**Environmental
precautions**

Do not apply directly to water, to areas where surface water is present or to intertidal areas below the mean high water mark. Do not contaminate surface or ground water by cleaning equipment or disposal of wastes, including equipment wash water. Do not apply when weather conditions favor runoff or drift.

SECTION 13. DISPOSAL CONSIDERATIONS**General Disposal
Guidance**

Dispose in accordance with all local, state/provincial and federal regulations. Follow container label instructions for disposal of wastes generated during use in compliance with the product label. It is best to use all of the product in accordance with label directions. If it is necessary to dispose of unused product, please follow container label instructions and applicable local guidelines.

Container Disposal

Do not re-use empty containers. Triple rinse containers. Puncture container to avoid re-use. Consult state and local regulations regarding the proper disposal of container. Follow advice on product label and/or leaflet.

SECTION 14. TRANSPORT INFORMATION

According to national and international transport regulations this material is not classified as dangerous goods / hazardous material.

Freight Classification: INSECTICIDES OR FUNGICIDES, N.O.I., OTHER THAN POISON

SECTION 15. REGULATORY INFORMATION

PCP Registration No. 27529

US Federal Regulations**TSCA list**

Diatomaceous earth

61790-53-2

US. Toxic Substances Control Act (TSCA) Section 12(b) Export Notification (40 CFR 707, Subpt D)

None.



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SARA Title III - Section 302 - Notification and Information

None.

SARA Title III - Section 313 - Toxic Chemical Release Reporting

None.

US States Regulatory Reporting

CA Prop65

This product does not contain any substances known to the State of California to cause cancer.

This product does not contain any substances known to the State of California to cause reproductive harm.

US State Right-To-Know Ingredients

Diatomaceous earth 61790-53-2 IL

Canadian Regulations

Canadian Domestic Substance List

None.

Environmental

CERCLA

None.

Clean Water Section 307 Priority Pollutants

None.

Safe Drinking Water Act Maximum Contaminant Levels

None.

SECTION 16. OTHER INFORMATION

NFPA 704 (National Fire Protection Association):

Health - 1 Flammability - 1 Instability - 0 Others - none

HMIS (Hazardous Materials Identification System, based on the Third Edition Ratings Guide)

Health - 1 Flammability - 1 Physical Hazard - PPE -

0 = minimal hazard, 1 = slight hazard, 2 = moderate hazard, 3 = severe hazard, 4 = extreme hazard

Reason for Revision: Reviewed and updated for general editorial purposes.

Prepared by the HSE Department of Bayer CropScience Inc. (306)-721-0310.

Revision Date: 01/24/2012

This information is provided in good faith but without express or implied warranty. The customer assumes all responsibility for safety and use not in accordance with label instructions. The product names are registered trademarks of Bayer.



Please read the entire document. This Material Safety Data Sheet contains important environmental, health and toxicology information for your employees, and anyone who will use, transport, store, dispose of or handle this product. Please make sure this information is given to them. It also contains information to help you meet community right-to-know/emergency response reporting requirements under WHMIS. If you resell this product, this MSDS must be given to the buyer or the information contained herein must be incorporated in your MSDS.

SECTION 1: PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: EVITO™ 480 SC Fungicide
PMRA REGISTRATION NUMBER(S): 30408
SYNONYM(S): None

COMPANY

Arysta LifeScience North America LLC
15401 Weston Parkway, Suite 150
Cary, NC 27513

EMERGENCY TELEPHONE NUMBERS

HEALTH EMERGENCY:	SPILL EMERGENCY:
1-866-303-6952, or 1-651-632-8946	1-800-424-9300, or 1-703-527-3887

SECTION 2: COMPOSITION/INFORMATION ON INGREDIENTS

Active Ingredient(s)/ Hazardous Inert Ingredient(s)	CAS #	Exposure Limits*	% Weight	% Volume
Fluoxastrobin: (E)-{2-[6-(2-chlorophenoxy)-5-fluoropyrimidin-4-yloxy]phenyl}(5,6-dihydro-1,4,2-dioxazin-3-yl)methanone O-methyloxime	361377-29-9	TWA^a OSHA PEL ^b : NA ACGIH TLV ^c : NA NIOSH REL ^d : NA	40.3	480 g/L

Only the identities of the active ingredient(s) and any hazardous inert ingredients are listed. Specific information on all of this product's ingredients can be obtained by the treating medical professional or spill emergency responder for the management of exposures, spills, or safety assessments.

*Source: *Guide to Occupational Exposure Values 2008*, published by ACGIH

^a**TWA**: Time-weighted average exposure concentration for a conventional 8-hour (TLV, PEL) or up to a 10-hour (REL) workday and a 40-hour workweek.

^b**OSHA PEL**: Occupational Safety and Health Administration Permissible Exposure Limits.

^c**ACGIH TLV**: American Conference of Governmental Industrial Hygienists, Inc., Threshold Limit Values.

^d**NIOSH REL**: National Institute for Occupational Safety and Health Recommended Exposure Limits.

SECTION 3: HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

CAUTION:	-	KEEP OUT OF REACH OF CHILDREN
	-	VERY TOXIC TO AQUATIC ORGANISMS
	-	MAY CAUSE LONG-TERM ADVERSE EFFECTS IN THE AQUATIC ENVIRONMENT

Acute Health Hazards

Eye: This product is considered practically non-irritant to the eyes.

Skin: This product is considered practically non-irritant to the skin.

Ingestion: This product is considered practically non-toxic if swallowed.

Inhalation: This product is considered practically non-toxic if inhaled.

Chronic Health Hazards (Including Cancer): EVITO™ 480 SC is not a carcinogen.

Reproductive and Developmental Toxicity: EVITO™ 480 SC is not a reproductive or development toxicant.

SECTION 4: FIRST AID MEASURES

Ingestion: Call a poison control centre or doctor immediately for treatment advice. Have person sip a glass of water if able to swallow. Do not induce vomiting unless told to do so by a poison control centre or doctor. Do not give anything by mouth to an unconscious person.

Skin: Take off contaminated clothing. Rinse skin immediately with plenty of water for 15-20 water. Call a poison control centre or doctor for treatment advice.

Inhalation: Move person to fresh air. If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably by mouth-to-mouth, if possible. Call a poison control centre or doctor for further treatment advice.

Eyes: Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. Call a poison control centre or doctor for treatment advice.

Take container, label or the product name and Pest Control Product Registration Number with you when seeking medical attention.

Toxicological Information: Treat Symptomatically.

SECTION 5: FIRE FIGHTING MEASURES

Flammable Limits in Air (% by volume):		
	Upper:	NA
	Lower:	NA
Flash Point:		Not flammable
	Method Used:	NA
Autoignition Temperature:		NDA
LEL/UEL:		NDA
NFPA Hazard Classification:		
	Health:	1
	Flammability:	0
	Reactivity:	0
	Other:	None
Extinguishing Media:		Sprayed water jet, foam, extinguishing powder, CO ₂ , sand.
Special Fire Fighting Procedures:		Fight fire in early stages if safe to do so. Wear respiratory protection. In well-ventilated areas, full-face mask with combination filter. In enclosed premises, wear respirator with independent air supply. Contain firefighting water.
Hazardous Combustion Products:		In the event of fire, the formation of hydrogen chloride, hydrogen cyanide, hydrogen fluoride, carbon monoxide, and nitrogen oxide must be anticipated.

SECTION 6: ACCIDENTAL RELEASE MEASURES

EMERGENCY PHONE NUMBERS

Exposure Calls (PROSAR): 1-866-303-6952 or 1-651-603-3432
(International) Spill Calls (CHEMTREC): 1-800-424-9300 or 1-703-527-3887

Use personal protective equipment. Do not empty into drains or waters. Take up spilled product with absorbent material and place into closable container. To clean the floor and all objects contaminated by this material, use damp cloth. Also place used cleaning materials into closable receptacles.

SECTION 7: HANDLING AND STORAGE

It is a violation of federal law to use this product in a manner inconsistent with its labeling. Read entire label. Use strictly in accordance with label precautionary statements and directions. Keep pesticide in original container. Store in a cool, dry place. Protect from excessive heat or direct sunlight. Do not contaminate food or foodstuffs. Do not store or transport near feed or food.

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

Eye Protection: Wear eye protection, goggles.

Skin Protection: Wear long-sleeved shirt, long pants, protective gloves for chemicals, shoes and socks. Keep the place of work clean. Avoid contact with product. Keep working clothes separate. Change badly soiled or soaked clothing. Wash hands before breaks and at end of work.

Respiratory/Ventilation Requirements: NDA

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	Viscous off-white liquid
Odor:	None
Physical State:	Liquid suspension
pH:	6.8 (10% solution)
Boiling Point:	NDA
Melting Point:	NA
Freezing Point:	NDA
Vapor Pressure:	NA
Vapor Density:	NDA
Bulk Density:	1.19 g/cc at 20°C
Specific Gravity:	NDA
Evaporation Rate:	NDA
Solubility in Water:	NA
Percent Solids by Weight:	NDA
Percent Volatile:	NDA
Volatile Organic Compounds:	NDA
Molecular Weight:	NDA
Viscosity:	822 cps @25°C

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability:	Stable at normal temperatures and storage conditions
Hazardous Polymerization:	Will not occur
Flash Point:	NDA
Flammable Point:	NDA
Auto Ignition:	NDA
Incompatibility With Other Materials:	Avoid contact with strong alkaline or acidic materials.
Hazardous Decomposition Products:	Carbon monoxide, Carbon dioxide, Nitrogen oxides, Sulfur oxides. Hazardous polymerization will not occur.

SECTION 11: TOXICOLOGICAL INFORMATION**Acute:**

Oral Toxicity: LD₅₀ (rat): >5000 mg/kg

Dermal Toxicity: LD₅₀ (rat): >5000 mg/kg

Inhalation Toxicity: LC₅₀ (rat): >2170 mg/m³

Eye Irritation: Non-irritant.

Skin Irritation: Slightly irritating.

Skin Sensitization: Skin sensitization (guinea pig) (via the Buehler Test).

Subchronic: In subchronic studies with Fluoxastrobin Technical, the NOEL for rat were 1000 ppm (M) and 2000 ppm (F), for mice was not assigned, and for dog 100 ppm. Reduced body weight gain and food intake, calculi in the urethra and kidney, urinary bladder, and urethra, vacuolation in the zona fasciculata in rats. There were no dose related toxicity effects in mice. Reduced net body weight gain and food efficiency in addition to toxicity findings in the liver in dogs.

Chronic Toxicity: In the dog chronic study with Fluoxastrobin Technical, the NOEL was 50 ppm. Reduced body weight and hepatocytomegaly and cytoplasmic changes associated with increased serum liver alkaline phosphatase indicative of cholestasis.

Carcinogenicity: No evidence of carcinogenicity.

Mutagenicity: Fluoxastrobin Technical is negative in the following genotoxicity assays: *In vitro* bacterial reverse gene mutation, *In vitro* mammalian chromosome aberration in Chinese hamster lung (V79) cells, mammalian cytogenetics-micronucleus assay (mouse).

Developmental Toxicity: In the developmental studies with Fluoxastrobin Technical the NOEL for rats were 1000 mg/kg/day (maternal) and 1000 mg/kg/day (developmental) (limit dose). The NOEL for rabbits were 100 mg/kg/day (maternal) based on cold years, transient body weight loss and decreased food consumption, and 400 mg/kg/day (developmental).

Reproduction: In the reproduction study with Fluoxastrobin Technical in rats were 1000 ppm (parental) based on decreased pre-mating body weight gain and decrease pre-mating absolute body weight; >10000 ppm (reproductive); 1000 ppm (offspring) based on decrease body weights, delayed preputial separation, and incomplete ossification.

Neurotoxicity: No evidence of neurotoxicity.

SECTION 12: ECOLOGICAL INFORMATION

This information is based upon the active ingredient.

Aquatic Organism Toxicity:

Trout (<i>Oncorhynchus mykiss</i>)	96 hr LC ₅₀ = 0.435 mg/L
Carp (<i>Cyprinus carpio</i>)	96 hr LC ₅₀ = 0.57 mg/L
Bluegill sunfish (<i>Lepomis macrochirus</i>)	96 hr LC ₅₀ = 0.97 mg/L
Water flea (<i>D. magna</i>)	48 hr EC ₅₀ = 0.48 mg/L
Mysid (<i>M. bahia</i>)	96 hr LC ₅₀ = 0.053 mg/L

Other Non-Target Organism Toxicity:

Green algae (<i>Selenastrum capricornutum</i>)(biomass):	72-hour EC ₅₀ = 0.45 mg/L
Green algae (<i>Selenastrum capricornutum</i>)(growth rate):	72-hour EC ₅₀ = 2.67 mg/L
Bacteria (activated sludge):	EC ₅₀ > 10000 mg/L

SECTION 13: DISPOSAL CONSIDERATIONS

End users must dispose of any unused product as per the label recommendations and in accordance with all applicable laws and regulations. Check governmental regulations and local authorities for approved disposal of this material.

SECTION 14: TRANSPORT INFORMATION

Only regulated when shipped by water or in bulk package. Describe as: UN3082, Environmentally hazardous substances, liquid, n.o.s. (Fluoxastrobin), 9, PG III, Marine Pollutant.

SECTION 15: REGULATORY INFORMATION

Canadian Information:

WHMIS information: This product is a Pest Control Product and is not regulated as a Controlled Product under the Hazardous Products Act (HPA).

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and this MSDS contains all the information required by the CPR.

US Federal Information:

EPA/CERCLA Reportable Quantity (RQ): None reported.

SARA TITLE III:

Section 302, Extremely Hazardous Substances, 40 CFR 355: No Extremely Hazardous Substances are present.

Section 313, Toxic Chemicals Notification, 40 CFR 372: None of the ingredients are listed at a concentration above the *de minimus* level.

US State Right to Know Laws:

California Proposition 65 Information: To the best of our knowledge, this product is not known to contain any chemicals known to the State of California to cause cancer and/or reproductive harm.

Pest Control Products (PCP) Act Registrations No.: 30408

SECTION 16: OTHER INFORMATION

Reason for issue:	Renewal
Prepared by:	Susan Parker
Issue date:	2/25/2015
Supersedes date:	5/23/2013
MSDS number:	00640

The information in this MSDS is based on data available to us as of the issue date given herein, and believed to be correct. Contact Arysta LifeScience North America LLC at (919) 678-4900 to determine if additional data and information have become available since the issue date.

Judgments as to the suitability of information herein for the individual's own use or purposes are necessarily the individual's own responsibility. Although reasonable care has been taken in the preparation of such information, Arysta LifeScience North America LLC extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the individual's purposes or the consequences of its use.

ABOUND® FLOWABLE

Date: 6/15/2015
Replaces: 12/16/2014

1. PRODUCT IDENTIFICATION

Product identifier on label: **ABOUND® FLOWABLE**
Product No.: A12705A
Use: Fungicide
Manufacturer: Syngenta Crop Protection, LLC
Post Office Box 18300
Greensboro NC 27419
Manufacturer Phone: 1-800-334-9481

Emergency Phone: 1-800-888-8372

2. HAZARDS IDENTIFICATION

Classifications: Not Applicable
Signal Word (OSHA): Not Applicable
Hazard Statements: Not Applicable

Hazard Symbols:

Precautionary Statements: Not Applicable

Other Hazard Statements: None

3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Name	Common Name	CAS Number	Concentration
1,2-Propanediol	Propylene Glycol	57-55-6	Trade Secret
Bentonite	Bentonite	1302-78-9	Trade Secret
Other ingredients	Other ingredients	Trade Secret	77.1%
Methyl (E)-2-{2-[6-(2-cyanophenoxy)pyrimidin-4-yloxy]phenyl}-3-methoxyacrylate	Azoxystrobin	131860-33-8	22.9%

Ingredients not precisely identified are proprietary or non-hazardous. Values are not product specifications.

ABOUND® FLOWABLE

Date: 6/15/2015

Replaces: 12/16/2014

4. FIRST AID MEASURES

Have the product container, label or Safety Data Sheet with you when calling Syngenta (800-888-8372), a poison control center or doctor, or going for treatment.

- Ingestion: If swallowed: Call Syngenta (800-888-8372), a poison control center or doctor immediately for treatment advice. Do not give any liquid to the person. Do not induce vomiting unless told to do so after calling 800-888-8372 or by a poison control center or doctor. Do not give anything by mouth to an unconscious person.
- Eye Contact: If in eyes: Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after 5 minutes, then continue rinsing eye. Call Syngenta (800-888-8372), a poison control center or doctor for treatment advice.
- Skin Contact: If on skin or clothing: Take off contaminated clothing. Rinse skin immediately with plenty of water for 15-20 minutes. Call Syngenta (800-888-8372), a poison control center or doctor for treatment advice.
- Inhalation: If inhaled: Move person to fresh air. If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth-to-mouth if possible. Call Syngenta (800-888-8372), a poison control center or doctor for further treatment advice.

Most important symptoms/effects:

Not Applicable

Indication of immediate medical attention and special treatment needed:

There is no specific antidote if this product is ingested.

Treat symptomatically.

5. FIRE FIGHTING MEASURES

Suitable (and unsuitable) extinguishing media:

Use dry chemical, foam or CO2 extinguishing media. If water is used to fight fire, dike and collect runoff.

Specific Hazards:

During a fire, irritating and possibly toxic gases may be generated by thermal decomposition or combustion.

Special protective equipment and precautions for firefighters:

Wear full protective clothing and self-contained breathing apparatus. Evacuate nonessential personnel from the area to prevent human exposure to fire, smoke, fumes or products of combustion.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment, and emergency procedures:

Follow exposure controls/personal protection outlined in Section 8.

Methods and materials for containment and cleaning up:

Control the spill at its source. Contain the spill to prevent from spreading or contaminating soil or from entering sewage and drainage systems or any body of water. Clean up spills immediately, observing precautions in Protective Equipment Section. Cover entire spill with absorbing material and place into compatible disposal container. Scrub area with hard water detergent (e.g. commercial products such as Tide, Joy, Spic and Span). Pick up wash liquid with additional absorbent and place into compatible disposal container. Once all material is cleaned up and placed in a disposal container, seal container and arrange for disposition.

ABOUND® FLOWABLE

Date: 6/15/2015

Replaces: 12/16/2014

7. HANDLING AND STORAGE

Precautions for safe handling:

Store the material in a well-ventilated, secure area out of reach of children and domestic animals. Do not store food, beverages or tobacco products in the storage area. Prevent eating, drinking, tobacco use, and cosmetic application in areas where there is a potential for exposure to the material. Wash thoroughly with soap and water after handling.

Conditions for safe storage, including any incompatibilities:

Not Applicable

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

THE FOLLOWING RECOMMENDATIONS FOR EXPOSURE CONTROLS/PERSONAL PROTECTION ARE INTENDED FOR THE MANUFACTURE, FORMULATION AND PACKAGING OF THIS PRODUCT.

FOR COMMERCIAL APPLICATIONS AND/OR ON-FARM APPLICATIONS CONSULT THE PRODUCT LABEL.

Occupational Exposure Limits:

Chemical Name	OSHA PEL	ACGIH TLV	Other	Source
Propylene Glycol	Not Established	Not Established	10 mg/m ³ TWA	AIHA
Bentonite	15 mg/m ³ TWA (total); 5 mg/m ³ TWA (respirable)	10 mg/m ³ TWA (inhalable); 3 mg/m ³ TWA (respirable)	Not Established	Not Applicable
Other ingredients	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Azoxystrobin	Not Established	Not Established	4 mg/m ³ TWA	Syngenta

Appropriate engineering controls:

Use effective engineering controls to comply with occupational exposure limits (if applicable).

Individual protection measures:

Ingestion:

Prevent eating, drinking, tobacco usage and cosmetic application in areas where there is a potential for exposure to the material. Wash thoroughly with soap and water after handling.

Eye Contact:

Where eye contact is likely, use chemical splash goggles.

Skin Contact:

Where contact is likely, wear chemical-resistant gloves (such as barrier laminate, butyl rubber, nitrile rubber, neoprene rubber, polyvinyl chloride [PVC] or Viton), coveralls, socks and chemical-resistant footwear.

Inhalation:

A respirator is not normally required when handling this substance. Use effective engineering controls to comply with occupational exposure limits.

In case of emergency spills, use a NIOSH approved respirator with any N, R, P or HE filter.

ABOUT® FLOWABLE

Date: 6/15/2015
Replaces: 12/16/2014

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance: Off-white to yellow-orange suspension
Odor: Not determined
Odor Threshold: Not Available
pH: 7
Melting point/freezing point: Not Applicable
Initial boiling point and boiling range: Not Available
Flash Point (Test Method): Does not flash
Flammable Limits (% in Air): Not Available
Flammability: Not Applicable
Vapor Pressure: Azoxystrobin 8.25 x 10⁻¹³ mmHg @ 68°F (20°C)
Vapor Density: Not Available
Relative Density: 1.096 g/ml
Solubility (ies): Azoxystrobin 6 mg/l in water @ 68°F (20°C)
Partition coefficient: n-octanol/water: Not Available
Autoignition Temperature: Not Available
Decomposition Temperature: Not Available
Viscosity: Not Available
Other: None

10. STABILITY AND REACTIVITY

Reactivity: Not reactive.
Chemical stability: Stable under normal use and storage conditions.
Possibility of hazardous reactions: Will not occur.
Conditions to Avoid: None known.
Incompatible materials: None known.
Hazardous Decomposition Products: None known.

11. TOXICOLOGICAL INFORMATION

Health effects information

Likely routes of exposure: Dermal, Inhalation

Symptoms of exposure: Not Applicable

Delayed, immediate and chronic effects of exposure: Not Applicable

Numerical measures of toxicity (acute toxicity/irritation studies (finished product))

Ingestion: Oral (LD50 Rat) : > 5000 mg/kg body weight

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Date: 6/15/2015
Replaces: 12/16/2014

Dermal:	Dermal (LD50 Rat) :	> 4000 mg/kg body weight
Inhalation:	Inhalation (LC50 Rat) :	> 6.32 mg/l air - 4 hours
Eye Contact:	Mildly Irritating (Rabbit)	
Skin Contact:	Non-Irritating (Rabbit)	
Skin Sensitization:	Not a Sensitizer (Guinea Pig)	

Reproductive/Developmental Effects

Azoxystrobin : Did not show reproductive toxicity effects in animal experiments.

Chronic/Subchronic Toxicity Studies

Azoxystrobin : No adverse effect has been observed in chronic toxicity tests.

Carcinogenicity

Azoxystrobin : Did not show carcinogenic effects in animal experiments.

Chemical Name	NTP/IARC/OSHA Carcinogen
---------------	--------------------------

1,2-Propanediol	No
Bentonite	No
Other ingredients	No
Methyl (E)-2-{2-[6-(2-cyanophenoxy)pyrimidin-4-yloxy]phenyl}-3-methoxyacrylate	No

Other Toxicity Information

None

Toxicity of Other Components

Bentonite

Prolonged inhalation of excessive concentrations of dust may lead to lung injury.

Other ingredients

Not Applicable

Propylene Glycol

Reported to cause central nervous system depression (anesthesia, dizziness, confusion), headache and nausea. Also, eye irritation may occur with lacrimation but no residual discomfort or injury. Prolonged contact to skin may cause mild to moderate irritation and possible allergic reactions. Chronic dietary exposure caused kidney and liver injury in experimental animals.

Target Organs

Active Ingredients

Azoxystrobin : Liver

Inert Ingredients

Bentonite:	Respiratory tract
Other ingredients:	Not Applicable
Propylene Glycol:	CNS, kidney, liver

ABOUT® FLOWABLE

Date: 6/15/2015
Replaces: 12/16/2014

12. ECOLOGICAL INFORMATION

Eco-Acute Toxicity

Azoxystrobin :

Fish (Rainbow Trout) 96-hour LC50 470 ppb
Green Algae 5-day EC50 106 ppb
Invertebrate (Water Flea) 48-hour EC50 259 ppb
Bird (Mallard Duck) 14-day LD50 > 250 mg/kg

Environmental Fate

Azoxystrobin :

The information presented here is for the active ingredient, azoxystrobin.
Low bioaccumulation potential. Not persistent in soil. Stable in water. Moderate mobility in soil. Sinks in water (after 24 h).

13. DISPOSAL CONSIDERATIONS

Disposal:

Do not reuse product containers. Dispose of product containers, waste containers, and residues according to local, state, and federal health and environmental regulations.

Characteristic Waste: Not Applicable

Listed Waste: Not listed

14. TRANSPORT INFORMATION

DOT Classification

Ground Transport - NAFTA
Not regulated

Comments

Water Transport - International
Proper Shipping Name: Environmentally Hazardous Substance, Liquid, N.O.S. (Azoxystrobin), Marine Pollutant
Hazard Class: Class 9
Identification Number: UN 3082
Packing Group: PG III

Air Transport

Proper Shipping Name: Environmentally Hazardous Substance, Liquid, N.O.S. (Azoxystrobin)
Hazard Class: Class 9
Identification Number: UN 3082
Packing Group: PG III

15. REGULATORY INFORMATION

Pesticide Registration:

This chemical is a pesticide product registered by the Environmental Protection Agency and is subject to certain labeling requirements under federal pesticide law. These requirements differ from the classification criteria and hazard information required for safety data sheets, and for workplace labels of non-pesticide chemicals. Following is the hazard information as required on the pesticide label:

ABOUND® FLOWABLE

Date: 6/15/2015
Replaces: 12/16/2014

Caution: Harmful if absorbed through skin. Avoid contact with skin, eyes or clothing. Wash thoroughly with soap and water after handling and before eating, drinking, chewing gum, using tobacco or using the toilet. Remove and wash contaminated clothing before reuse. Wear long-sleeved shirt and long pants, socks and shoes and chemical resistant gloves made of any waterproof material such as polyvinyl chloride, nitrile rubber or butyl rubber.

EPA Registration Number(s):
100-1098

EPCRA SARA Title III Classification:

Section 311/312 Hazard Classes: Acute Health Hazard

Section 313 Toxic Chemicals: None

CERCLA/SARA 304 Reportable Quantity (RQ):

None

RCRA Hazardous Waste Classification (40 CFR 261):

Not Applicable

TSCA Status:

Exempt from TSCA, subject to FIFRA

16. OTHER INFORMATION

NFPA Hazard Ratings

Health: 1
Flammability: 1
Instability: 0

HMIS Hazard Ratings

Health: 1
Flammability: 1
Reactivity: 0

0	Minimal
1	Slight
2	Moderate
3	Serious
4	Extreme
*	Chronic

Syngenta Hazard Category: A

For non-emergency questions about this product call:

1-800-334-9481

Original Issued Date: 6/20/2000

Revision Date: 6/15/2015

Replaces: 12/16/2014

Section(s) Revised: 2, 4, 11, 16

The information and recommendations contained herein are based upon data believed to be correct. However, no guarantee or warranty of any kind, expressed or implied, is made with respect to the information contained herein.



IMAZAPYR
MATERIAL SAFETY DATA SHEET

Revised 09/2011

1. SUBSTANCE IDENTITY

Product Name	Imazapyr
Brand	TOKU-E
Company	715 W Orchard Drive Suite 3 Bellingham, WA 98225
EMERGENCY PHONE (US only)	+1-800-535-5053
INF	+86-21-5206-9530

2. CHEMICAL COMPOSITION AND DATA ON COMPONENTS

CAS No.	81334-34-1
Formula	$C_{13}H_{15}N_3O_3$
Molecular Weight	261.28

3. HAZARD IDENTIFICATION

Label Precautionary Statements

P305, 251, 338: If in eyes, rinse cautiously with water for several minutes. Remove contacts (if present and easy to do). Continue rinsing

Label Hazard Statements

H313: May be harmful if in contact with skin

H319: Causes serious eye irritation

H402: Harmful to aquatic life

GHS Classification

Acute toxicity, Dermal (Category 5)

Eye irritation (Category 2A)

Acute aquatic toxicity (Category 3)

OSHA Hazards

Irritant

HMIS Classification

Health hazard: 2

Chronic Health Hazard: *

Flammability: 0

Physical Hazards: 0

NFPA Rating

Health Hazard: 2

Fire: 0

Reactivity Hazard: 0

In case of accident or if you feel unwell, seek medical advice immediately (show label when

possible). Wear suitable protective clothing, gloves, and eye/face protection.

4. FIRST-AID MEASURES

In case of eye and skin contact

Immediately flush eyes or skin with copious amounts of water for at least 15 minutes while removing contaminated clothing and shoes. Ensure proper flushing of eyes by separating eyelids with fingers.

If inhaled

Remove to fresh air. If breathing is difficult, call a physician.

If swallowed

Wash out mouth with water (provided person is conscious). Call a physician immediately.
Wash all contaminated clothing before reuse

5. FIRE-EXTINGUISHING MEASURES

Suitable extinguishing media

Carbon dioxide, dry chemical powder, water spray, or alcohol-resistant foam

Special protective equipment for fire-fighters

Wear self-contained breathing apparatus and protective clothing to prevent contact with eyes and skin

Unusual fire and explosion hazards

May form hazardous decomposition products under fire conditions, including carbon and nitrogen oxides.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions

Evacuate area. Avoid dust formation and breathing vapors, mist, or gas

Methods for cleaning up

Sweep up, avoid raising dust, place in a bag and hold for waste disposal. Ventilate area and wash spill site after material pickup is complete. Do not let product enter drains

7. HANDLING AND STORAGE

Handling

Wear government-approved respirator, chemical-resistant gloves, safety goggles, and all other protective clothing. Use only in a chemical fume hood. Avoid contact with eyes, skin, and clothing. Avoid breathing dust. Avoid prolonged or repeated exposure. Wash thoroughly after handling.

Storage

Keep tightly closed and in a dry, well-ventilated area

8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

Contains no substances with occupational exposure limit values

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate, use a full-face particle respirator type N99 (US) or type P2 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards, such as NIOSH (US) or CEN (EU).

Hand protection

Handle with gloves

Eye protection

Safety glasses

Skin and body protection

Impervious clothing. Choose body protection according to the amount and concentration of the dangerous substance at the work place.

Hygiene measures

Avoid contact with skin, eyes, and clothing. Wash hands before breaks and immediately after handling the product

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	Solid
pH	No data available
Melting point	172-173°C
Solubility	No data available
Other solvents	No data available

10. STABILITY AND REACTIVITY**Storage stability**

Stable under recommended storage conditions

Materials to avoid

No data available

Hazardous decomposition products

Carbon and nitrogen oxides, hydrogen chloride gas, and hydrogen fluoride gas may be formed under fire conditions. Otherwise, no data available

Hazardous polymerization products

Hazardous polymerization has not been shown to occur

11. TOXOLOGICAL INFORMATION**Potential health effects**

Inhalation May be harmful if inhaled. May cause respiratory tract irritation

Skin May be harmful if absorbed through the skin. Causes skin irritation

Eyes Causes eye irritation

Ingestion May be harmful if swallowed

Signs and symptoms of exposure

No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible, or confirmed human carcinogen by IARC, ACGIH, NTP, or OSHA

Toxicity Data

Oral Rat LD ₅₀	5,000 mg/kg
Skin Rat LD ₅₀	No data available
Skin Rabbit LD ₅₀	2,000 mg/kg
Skin Mouse LD ₅₀	No data available
Intraperitoneal Mouse LD ₅₀	No data available
Intravenous Mouse LD ₅₀	No data available

Only selected registry of toxic effects of chemical substances (RTECS # US5682500) data is

presented here. See actual entry in trees for complete information

12. ECOLOGICAL INFORMATION

Toxicity to fish:

LC₅₀ Oncorhynchus mykiss (rainbow trout)- 100 mg/L, 96h

EC₅₀ Daphnia magna (Water flea)- 100 mg/L, 48h

In the event of improper disposal or handling may cause an environmental hazard

13. DISPOSAL CONSIDERATIONS

Product

Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber. Observe all federal, state, and local environmental regulations.

14. TRANSPORT INFORMATION

Proper shipping name	NA. Not dangerous goods
UN No.	NA
Class	NA
Packing group	NA
Hazard label	NA
PIH	NA

15. REGULATORY INFORMATION

EU Information

No data available

US Information

OSHA Hazards: Irritant

No SARA 302 or 313 Components

Sara 311/312 Hazards: Acute Health Hazard

Massachusetts Right to Know Components: No components are subject to the Massachusetts Right to Know Act

Pennsylvania Right to Know Components

	CAS-No.	Revision Date
Imazapyr	81334-34-1	
New Jersey Right to Know Components		

	CAS-No.	Revision Date
Imazapyr	81334-34-1	

California Prop. 65 Components: This product does not contain any chemicals known to the State of California to cause cancer, birth defects, or any other reproductive harm

Canada Information

Not on the Canadian DSL nor NDSL lists

16. OTHER INFORMATION

Further Information

The above information is believed to be correct but does not purport to be all-inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It

does not represent any guarantee of the properties of the product. TOKU-E Co. shall not be held liable for any damage resulting from handling or from contact with the above product. Please see reverse side of invoice or packing slip for additional terms and conditions of sale.

1. Identification

Product identifier	Triclopyr		
Other means of identification			
Product code	N-13659		
Synonym(s)	3,5,6-trichloro-2-pyridoloxycetic acid		
Recommended use	For Laboratory Use Only		
Recommended restrictions	None known.		
Manufacturer/Importer/Supplier/Distributor information			
Manufacturer			
Company name	Chem Service, Inc.		
Address	660 Tower Lane West Chester, PA 19380 United States		
Telephone	Toll Free	800-452-9994	
	Direct	610-692-3026	
Website	www.chemservice.com		
E-mail	info@chemservice.com		
Emergency phone number	Chemtrec US	800-424-9300	
	Chemtrec outside US	+1 703-527-3887	

2. Hazard(s) identification

Physical hazards	Not classified.	
Health hazards	Acute toxicity, oral	Category 4
Environmental hazards	Hazardous to the aquatic environment, acute hazard	Category 1
	Hazardous to the aquatic environment, long-term hazard	Category 1
OSHA defined hazards	Not classified.	
Label elements		
Signal word	Warning	
Hazard statement	Harmful if swallowed. Very toxic to aquatic life. Very toxic to aquatic life with long lasting effects.	
Precautionary statement		
Prevention	Wash thoroughly after handling. Do not eat, drink or smoke when using this product. Avoid release to the environment.	
Response	If swallowed: Call a poison center/doctor if you feel unwell. Rinse mouth. Collect spillage.	
Storage	Store away from incompatible materials.	
Disposal	Dispose of contents/container in accordance with local/regional/national/international regulations.	
Hazard(s) not otherwise classified (HNOC)	None known.	
Supplemental information	Not applicable.	

3. Composition/information on ingredients

Substances			
Chemical name	Common name and synonyms	CAS number	%
Triclopyr	3,5,6-trichloro-2-pyridoloxycetic acid	55335-06-3	100

*Designates that a specific chemical identity and/or percentage of composition has been withheld as a trade secret.

4. First-aid measures

Inhalation	Move to fresh air. Call a physician if symptoms develop or persist.
-------------------	---

Skin contact	Wash off with soap and water. Get medical attention if irritation develops and persists.
Eye contact	Rinse with water. Get medical attention if irritation develops and persists.
Ingestion	Rinse mouth. IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell.
Most important symptoms/effects, acute and delayed	Direct contact with eyes may cause temporary irritation.
Indication of immediate medical attention and special treatment needed	Provide general supportive measures and treat symptomatically. In case of shortness of breath, give oxygen. Keep victim warm. Keep victim under observation. Symptoms may be delayed.
General information	In the case of accident or if you feel unwell, seek medical advice immediately (show the label where possible). Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

5. Fire-fighting measures

Suitable extinguishing media	Water fog. Foam. Dry chemical powder. Carbon dioxide (CO ₂).
Unsuitable extinguishing media	Do not use water jet as an extinguisher, as this will spread the fire.
Specific hazards arising from the chemical	During fire, gases hazardous to health may be formed.
Special protective equipment and precautions for firefighters	Self-contained breathing apparatus and full protective clothing must be worn in case of fire.
Fire-fighting equipment/instructions	Use water spray to cool unopened containers.
Specific methods	Use standard firefighting procedures and consider the hazards of other involved materials.
General fire hazards	No unusual fire or explosion hazards noted.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures	Keep unnecessary personnel away. Keep people away from and upwind of spill/leak. Keep out of low areas. Wear appropriate personal protective equipment. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Ensure adequate ventilation. Local authorities should be advised if significant spillages cannot be contained. For personal protection, see section 8 of the SDS.
Methods and materials for containment and cleaning up	This material is classified as a water pollutant under the Clean Water Act and should be prevented from contaminating soil or from entering sewage and drainage systems which lead to waterways. Stop the flow of material, if this is without risk. Collect spillage. Following product recovery, flush area with water. For waste disposal, see section 13 of the SDS.
Environmental precautions	Avoid release to the environment. Contact local authorities in case of spillage to drain/aquatic environment. Prevent further leakage or spillage if safe to do so. Do not contaminate water. Avoid discharge into drains, water courses or onto the ground.

7. Handling and storage

Precautions for safe handling	Do not taste or swallow. Provide adequate ventilation. Wear appropriate personal protective equipment. Observe good industrial hygiene practices. When using, do not eat, drink or smoke. Wash hands thoroughly after handling. Avoid release to the environment. Do not empty into drains.
Conditions for safe storage, including any incompatibilities	Store in original tightly closed container. Store away from incompatible materials (see Section 10 of the SDS).

8. Exposure controls/personal protection

Occupational exposure limits	No exposure limits noted for ingredient(s).
Biological limit values	No biological exposure limits noted for the ingredient(s).
Appropriate engineering controls	Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level.
Individual protection measures, such as personal protective equipment	
Eye/face protection	If contact is likely, safety glasses with side shields are recommended.
Skin protection	
Hand protection	For prolonged or repeated skin contact use suitable protective gloves.
Other	Wear suitable protective clothing.
Respiratory protection	In case of insufficient ventilation, wear suitable respiratory equipment.
Thermal hazards	Wear appropriate thermal protective clothing, when necessary.

General hygiene considerations

When using, do not eat, drink or smoke. Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants.

9. Physical and chemical properties

Appearance

Physical state	Solid.
Form	Crystalline Solid
Color	Colorless
Odor	Not available.
Odor threshold	Not available.
pH	Not available.
Melting point/freezing point	302.9 °F (150.5 °C)
Initial boiling point and boiling range	Not available.
Flash point	Not available.
Evaporation rate	Not available.
Flammability (solid, gas)	Not available.

Upper/lower flammability or explosive limits

Flammability limit - lower (%)	Not available.
Flammability limit - upper (%)	Not available.
Explosive limit - lower (%)	Not available.
Explosive limit - upper (%)	Not available.
Vapor pressure	0.2 mPa at 25 °C
Vapor density	Not available.
Relative density	Not available.
Solubility(ies)	
Solubility (water)	0.41 g/l at 20 °C
Partition coefficient (n-octanol/water)	Not available.
Auto-ignition temperature	Not available.
Decomposition temperature	406.4 °F (208 °C)
Viscosity	Not available.
Other information	
Density	1.85 g/cm ³ at 21 °C
Molecular formula	C ₇ H ₄ Cl ₃ NO ₃
Molecular weight	256.5 g/mol
Specific gravity	1.85

10. Stability and reactivity

Reactivity	The product is stable and non-reactive under normal conditions of use, storage and transport.
Chemical stability	Material is stable under normal conditions.
Possibility of hazardous reactions	Hazardous polymerization does not occur.
Conditions to avoid	Contact with incompatible materials.
Incompatible materials	Strong oxidizing agents.
Hazardous decomposition products	No hazardous decomposition products are known.

11. Toxicological information

Information on likely routes of exposure

Ingestion	Harmful if swallowed.
Inhalation	No adverse effects due to inhalation are expected.
Skin contact	No adverse effects due to skin contact are expected.
Eye contact	Direct contact with eyes may cause temporary irritation.

Symptoms related to the physical, chemical and toxicological characteristics Direct contact with eyes may cause temporary irritation.

Information on toxicological effects

Acute toxicity Harmful if swallowed.

Product	Species	Test Results
Triclopyr (CAS 55335-06-3)		
Acute		
<i>Dermal</i>		
LD50	Rabbit	> 2000 mg/kg
<i>Inhalation</i>		
LC50	Rat	> 256 mg/l, 4 Hours
<i>Oral</i>		
LD50	Rat	630 mg/kg

* Estimates for product may be based on additional component data not shown.

Skin corrosion/irritation Prolonged skin contact may cause temporary irritation.

Serious eye damage/eye irritation Direct contact with eyes may cause temporary irritation.

Respiratory or skin sensitization

Respiratory sensitization Not available.

Skin sensitization This product is not expected to cause skin sensitization.

Germ cell mutagenicity No data available to indicate product or any components present at greater than 0.1% are mutagenic or genotoxic.

Carcinogenicity This product is not considered to be a carcinogen by IARC, ACGIH, NTP, or OSHA.

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not listed.

Reproductive toxicity This product is not expected to cause reproductive or developmental effects.

Specific target organ toxicity - single exposure Not classified.

Specific target organ toxicity - repeated exposure Not classified.

Aspiration hazard Not available.

12. Ecological information

Ecotoxicity Very toxic to aquatic life with long lasting effects. Accumulation in aquatic organisms is expected.

Product	Species	Test Results
Triclopyr (CAS 55335-06-3)		
Aquatic		
Fish	LC50	Sockeye salmon (<i>Oncorhynchus nerka</i>) 0.4 mg/l, 96 hours

* Estimates for product may be based on additional component data not shown.

Persistence and degradability No data is available on the degradability of this product.

Bioaccumulative potential No data available.

Mobility in soil No data available.

Other adverse effects No other adverse environmental effects (e.g. ozone depletion, photochemical ozone creation potential, endocrine disruption, global warming potential) are expected from this component.

13. Disposal considerations

Disposal instructions Collect and reclaim or dispose in sealed containers at licensed waste disposal site. This material and its container must be disposed of as hazardous waste. Do not allow this material to drain into sewers/water supplies. Do not contaminate ponds, waterways or ditches with chemical or used container. Dispose of contents/container in accordance with local/regional/national/international regulations.

Local disposal regulations Dispose in accordance with all applicable regulations.

Hazardous waste code The waste code should be assigned in discussion between the user, the producer and the waste disposal company.

Waste from residues / unused products

Dispose of in accordance with local regulations. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe manner (see: Disposal instructions).

Contaminated packaging

Empty containers should be taken to an approved waste handling site for recycling or disposal. Since emptied containers may retain product residue, follow label warnings even after container is emptied.

14. Transport information**DOT**

UN number	UN3077
UN proper shipping name	Environmentally hazardous substances, solid, n.o.s. (Triclopyr), MARINE POLLUTANT
Transport hazard class(es)	
Class	9
Subsidiary risk	-
Label(s)	9
Packing group	III
Environmental hazards	
Marine pollutant	Yes
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.
Special provisions	8, 146, 335, A112, B54, IB8, IP3, N20, T1, TP33
Packaging exceptions	155
Packaging non bulk	213
Packaging bulk	240

IATA

UN number	UN3077
UN proper shipping name	Environmentally hazardous substance, solid, n.o.s. (Triclopyr)
Transport hazard class(es)	
Class	9
Subsidiary risk	-
Packing group	III
Environmental hazards	No.
ERG Code	9L
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.
Other information	
Passenger and cargo aircraft	Allowed.
Cargo aircraft only	Allowed.

IMDG

UN number	UN3077
UN proper shipping name	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (Triclopyr), MARINE POLLUTANT
Transport hazard class(es)	
Class	9
Subsidiary risk	-
Packing group	III
Environmental hazards	
Marine pollutant	Yes
EmS	F-A, S-F
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

DOT; IATA; IMDG





15. Regulatory information

US federal regulations

This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

All components are on the U.S. EPA TSCA Inventory List.

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

Not regulated.

CERCLA Hazardous Substance List (40 CFR 302.4)

Not listed.

SARA 304 Emergency release notification

Not regulated.

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not listed.

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories

Immediate Hazard - Yes

Delayed Hazard - No

Fire Hazard - No

Pressure Hazard - No

Reactivity Hazard - No

SARA 302 Extremely hazardous substance

Not listed.

SARA 311/312 Hazardous chemical

Yes

SARA 313 (TRI reporting)

Not regulated.

Other federal regulations

Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List

Not regulated.

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130)

Not regulated.

Safe Drinking Water Act (SDWA)

Not regulated.

US state regulations

US. Massachusetts RTK - Substance List

Not regulated.

US. New Jersey Worker and Community Right-to-Know Act

Not regulated.

US. Pennsylvania RTK - Hazardous Substances

Not regulated.

US. Rhode Island RTK

Not regulated.

US. California Proposition 65

California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65): This material is not known to contain any chemicals currently listed as carcinogens or reproductive toxins.

International Inventories

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	No
Canada	Non-Domestic Substances List (NDSL)	Yes
China	Inventory of Existing Chemical Substances in China (IECSC)	No

Country(s) or region	Inventory name	On inventory (yes/no)*
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	No
Korea	Existing Chemicals List (ECL)	Yes
New Zealand	New Zealand Inventory	Yes
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	No
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)

A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

16. Other information, including date of preparation or last revision

Issue date 11-05-2014

Version # 01

NFPA ratings Health: 2
Flammability: 0
Instability: 0

Disclaimer

The above information is believed to be correct on the date it was last revised and must not be considered all inclusive. The information has been obtained only by a search of available literature and is only a guide for handling the chemicals. OSHA regulations require that if other hazards become evident, an upgraded SDS must be made available to the employee within three months. RESPONSIBILITY for updates lies with the employer and not with CHEM SERVICE, Inc.

Persons not specifically and properly trained should not handle this chemical or its container. This product is furnished FOR LABORATORY USE ONLY! Our products may NOT BE USED as drugs, cosmetics, agricultural or pesticide products, food additives or as household chemicals.

This Safety Data Sheet (SDS) is intended only for use with Chem Service, Inc. products and should not be relied on for use with materials from any other supplier even if the chemical name(s) on the product are identical! Whenever using an SDS for a solution or mixture the user should refer to the SDS for every component of the solution or mixture. Chem Service warrants that this SDS is based upon the most current information available to Chem Service at the time it was last revised. THIS WARRANTY IS EXCLUSIVE, AND CHEM SERVICE, INC. MAKES NO OTHER WARRANTY, EXPRESSED OR IMPLIED, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. This SDS is provided gratis and CHEM SERVICE, INC. SHALL NOT BE LIABLE FOR ANY INCIDENTAL, CONSEQUENTIAL OR CONTINGENT DAMAGES.

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This product is furnished FOR LABORATORY USE ONLY.

MATERIAL SAFETY DATA SHEET

Emergency (800) 234-5979
Information (661) 257-8787

SPRAYTEX, Inc.
28430 West Witherspoon Parkway
Valencia, CA 91355

SPRAYTEX KNOCKDOWN DRYWALL SPRAY TEXTURE

Latest Revision Date 6/21/94

Print Date 1/1/01

SECTION 1

PRODUCT IDENTIFICATION

PRODUCT NAME OR NUMBER SPRC002 [2022]
TRADE NAME OR CHEMICAL NAME SPRAYTEX KNOCKDOWN DRYWALL SPRAY TEXTURE
SYNONYMS NA
FORMULA TSP0201 (L29004)
CHEMICAL FAMILY NA
MOLECULAR WEIGHT NA
NFPA NA
HMIS RATING HEALTH=1; FLAMMABILITY=0; REACTIVITY=0

SECTION 2

HAZARDOUS INGREDIENTS / HAZARD DATA

<u>CHEMICAL NAMES</u>	<u>CAS NUMBER</u>	<u>% WT</u>	<u>TLV-TWA</u>	<u>PEL</u>	<u>SEC.313</u>
CALCIUM CARBONATE	471-34-1	47	0.1mg/m3	NOT ESTABLISHED	NO
DIMETHYL ETHER	115-10-6	5	NONE ESTABLISHED	NONE ESTABLISHED	NO
LIQUIFIED NITROGEN	7727-37-9	2	SIMPLE ASPHYXIANT	SIMPLE ASPHYXIANT	NO

*Information for mixtures is based on constituent MSDS which are available upon request. (Minus Proprietary Trade Names)

SECTION 3

PHYSICAL DATA

BOILING/MELTING POINT @760 mm Hg NOT ESTABLISHED
pH @ 25° C = 9.8 - 10.8
VAPOR PRESSURE mm Hg @ 20° C 90 psig @ 70° F
VAPOR DENSITY (Air = 1) >1
PERCENT VOLATILE BY WEIGHT(%) NA
SPECIFIC GRAVITY OR BULK DENSITY 1.25
SOLUBILITY IN WATER MISCIBLE
EVAPORATION RATE (BuAc = 1) 1
APPEARANCE OFF WHITE THICK PASTE
ODOR CHARACTERISTIC FRAGRANCE
INTENSITY NA

SECTION 4

FIRE AND EXPLOSION HAZARD DATA

FLASH POINT °f (Test Method) NON-FLAMMABLE
AUTOIGNITION TEMPERATURE NOT ESTABLISHED
FLAMMABILITY LIMITS IN AIR (% V) NA
EXTINGUISHING MEDIA ANY MEDIA CAPABLE OF EXTINGUISHING THE SUPPORTING FIRE.
SPECIAL FIRE FIGHTING PROCEDURES KEEP TEMPERATURES OF CONTAINERS BELOW 120° f BY SPRAYING
WITH WATER UNTIL FIRE HAS BEEN EXTINGUISHED.
UNUSUAL FIRE & EXPLOSION HAZARDS CONTAINERS MAY RUPTURE AND RELEASE A SMALL AMOUNT OF
FLAMMABLE GAS IF EXPOSED TO HEAT OF FIRE.

SECTION 5

HEALTH HAZARDS DATA * EFFECTS OF OVEREXPOSURE

SKIN CONTACT WASH EXCESS MATERIAL FROM SKIN WITH SOAP & WATER.
EYE CONTACT FLUSH EYES WITH WARM WATER FOR 10 MINUTES.
CONSULT A PHYSICIAN IF IRRITATION OCCURS OR WORSENS.
INHALATION IF INHALED EXCESSIVELY, REMOVE TO FRESH AIR.
INGESTION PRODUCT IS NOT LIKELY TO BE INGESTED. IF THIS OCCURS TREAT SYMPTOMATICALLY.
CHRONIC EFFECTS OF OVEREXPOSURE NONE WHEN USED AS DIRECTED.
TOXICOLOGICAL TEST DATA NO RESULTS AVAILABLE.

note: ALL CHEMICALS ARE LISTED ON THE TSCA INVENTORY.

SPRAYTEX KNOCKDOWN DRYWALL SPRAY TEXTURE

SECTION 6 EMERGENCY AND FIRST AID PROCEDURES

SKIN Wash affected area with water while removing contaminated clothing.
GET IMMEDIATE MEDICAL ATTENTION. Launder contaminated clothing before reuse.

EYES..... Flush eyes with generous amounts of water for at least 15 minutes.
GET IMMEDIATE MEDICAL ATTENTION.

INGESTION..... If swallowed, **DO NOT INDUCE VOMITING**. Dilute with water or milk. CALL A PHYSICIAN IMMEDIATELY.
Never give fluids or induce vomiting if the victim is unconscious or having convulsions.

INHALATION..... Move to fresh air. Aid in breathing, if necessary and get immediate medical attention.

SECTION 7 REACTIVITY DATA

PRODUCT STABILITY STABLE

CONDITIONS TO AVOID NONE KNOWN. CONTENTS ARE STABLE BUT UNDER PRESSURE.
DO NOT PUNCTURE OR INCINERATE CONTAINERS, EVEN WHEN EMPTY.

CHEMICAL INCOMPATIBILITY..... KEEP AWAY FROM ACIDS.

HAZARDOUS DECOMPOSITION PRODUCTS. CALCIUM OXIDE MAY BE PRODUCED ON DECOMPOSITION.

HAZARDOUS POLYMERIZATION..... WILL NOT OCCUR.

CONDITIONS TO AVOID NONE KNOWN.

CORROSIVE TO METAL..... NO.

OXIDIZER NA

SECTION 8 SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION..... NIOSH/MSHA - Approved organic vapor respirator when vapors are generated above
the permissible limit

VENTILATION..... Local exhaust to control to recommended P.E.L.

PROTECTIVE CLOTHING..... Gloves, coveralls, aprons, boots, - as necessary to prevent skin contact.

EYE PROTECTION Chemical Goggles

OTHER PRECAUTIONS..... Avoid excessive inhalations. Read and follow all label directions and cautions.
Eyewash fountains should be easily accessible.

SECTION 9 ENVIRONMENTAL DATA

ENVIRONMENTAL TOXICITY DATA NA

SPILL OR LEAK PROCEDURES LEAKING CONTAINERS SHOULD BE PLACED IN AN OPENED CONTAINER,
OUTDOORS, AWAY FROM SOURCES OF IGNITION, UNTIL ALL PRESSURE IS RELEASED.

HAZARDOUS SUBSTANCE SUPERFUND NA

WASTE DISPOSAL METHOD..... BURY OR INCINERATE IN APPROVED DISPOSAL FACILITIES IN ACCORDANCE WITH
FEDERAL, STATE AND LOCAL REGULATION.

CONTAINER DISPOSAL EMPTY CONTAINERS & DRIED PRODUCT MAY BE DISPOSED OF AS NORMAL
REFUSE.

SECTION 10 SHIPPING DATA

D.O.T. PROPER SHIPPING NAME..... CONSUMER COMMODITY

HAZARDOUS SUBSTANCE 49CFR CERCLA..... NA

D.O.T. HAZARD CLASS ORM-D

D.O.T. LABELS REQUIRED NONE

D.O.T. PLACARDS REQUIRED NONE

POISON CONSTITUENT..... NONE

BILL OF LADING DESCRIPTION..... CONSUMER COMMODITY ORM-D

CC NO..... NA

UN/NA CODE..... NONE

SECTION 11 SUPPLIER INFORMATION

The information contained herein is, to the best of our knowledge and belief, accurate and reliable as of the date of issued. We do not however, warrant or guarantee the accuracy or reliability, nor shall we be liable for any loss or damage arising out of the use thereof. The information is offered for the user's consideration and examination, and it is the user's responsibility to satisfy himself that it is suitable and complete for his particular use.

PREPARED BY: J. STATEN, TECHNICAL SPECIALIST 6/21/94 / REFORMATTED: S. THOMAS 3/1/96

**IN THE REPUBLIC OF COLOMBIA SUPERINTENDENCE OF INDUSTRY AND
COMMERCE MINISTRY OF INDUSTRY, COMMERCE AND TOURISM**

Applicant	:	PARAMOUNT PRODUCTS 1 LLC	)
			)
Inventors	:	LEFILES and DAVIS	)
			)
Patent App. No.	:	NC2019/00045543	)
			)
Filed	:	May 2, 2019	)
			)
For	:	ADJUVANT COMPOSITIONS FOR PLANT TREATMENT CHEMICALS	)
			)

STATEMENT OF BRETT P. FORS, PH.D.

Superintendente Delegado para la Propiedad Industrial
Superintendence of Industry and Commerce
Ministry of Industry, Commerce and Tourism
Carrera 13 No. 27-00
Pisos Mezanine, 5 y 10
Bogotá
COLOMBIA

Dear Delegate Superintendent for Industrial Property:

I, **BRETT P. FORS, PH.D.**, hereby state:

1. I am an Associate Professor in the Department of Chemistry and Chemical Biology at Cornell University.
2. I received a B.Sc. in Chemistry from Montana State University in 2006 and a Ph.D. in Organic Chemistry from the Massachusetts Institute of Technology in 2011.
3. I have over 14 years of experience in synthetic strategies for polymer science. I have received numerous honors, including the Sloan Research Fellowship, the Journal of Polymer Science Innovation Award, the NSF Career Award, the Bruce Hartman Prize, the PMSE Young Investigator Award, 3M Non-Tenured Faculty Award, Arthur K. Doolittle Award, and Thieme Chemistry Journal Award. I have published more than 66 scientific papers in journals

including Angewandte Chemie International Edition English, ChemSusChem, Journal of the American Chemical Society, Macromolecules, Nature Reviews Materials, Organic Letters, and Polymer Chemistry. My credentials are fully set forth in my CV, which is attached hereto as **Exhibit A**.

4. My research focuses on the development of new synthetic methods and catalyst systems to control polymer architecture, composition, and function. My current research interests include the development of systems that enable precise regulation over catalyst reactivity *in situ* with light to allow control of a diverse array of polymerization processes (*i.e.*, radical, cationic, ring-opening, and insertion reactions) with an external stimulus. Another aim of my research is the investigation of the influence of polymer molar mass distribution on material properties. My research also focuses on the synthesis and characterization of polymers from renewable feedstocks, as well as the design and synthesis of polymers for applications in metal-ion batteries and fuel cells. I have also worked on the development of polymers that can self-assemble and be used for medical imaging or for delivery of therapeutics. Overall, my expertise lies in polymer synthesis, catalysis, polymer physics, and material science. Through this research I have expertise in polymer characterization, using techniques such as small angle X-ray scattering, nuclear magnetic resonance spectroscopy, size-exclusion chromatography, static light scattering, dynamic light scattering, tensile testing, and rheology. I am also an expert in polymer self-assembly, as well as understanding and exploiting polymer structure property relationships. This expertise allows me to understand the adjuvant of the present application at the molecular level and how it is performing, as well as evaluate the results of the conducted studies described below.

5. Based on my academic and research experience, I am regarded as an expert in the field of polymer science.

6. I have been retained by Applicant PARAMOUNT PRODUCTS 1 LLC to review Office Action No. 14781 (“Office Action”), dated November 25, 2020, from the Republic of Colombia Superintendence of Industry and Commerce (“SIC”), for the above patent application. I understand that in the Office Action the SIC has taken the position that there is no technical effect associated with including complex-forming agents within the presently claimed adjuvant formulation. *See* Office Action, p. 4.

7. It is my understanding that claims of the present application have been amended to recite “[a]n adjuvant premix composition comprising: an associative thickener; a water soluble divalent salt, wherein the water soluble divalent salt comprises a divalent cation selected from the group consisting of barium, calcium, cobalt (II), copper (II), iron (II), magnesium, manganese (II), strontium, zinc (II), and mixtures thereof; a foam control agent; a complexing agent; and a film forming agent” (claim 1). I am presenting this statement to show that a number of adjuvant premix compositions of the present application, as well as (i) the adjuvant compositions of claim 15 (comprising the adjuvant premix composition of claim 1 and water) and (ii) the plant treatment chemical formulations of claim 23 (comprising the adjuvant composition of claim 15 and a plant treatment chemical) provide a technical effect.

8. I am being compensated at my usual consulting rate of \$200 per hour for this work, with my compensation not being dependent on whether applicant is successful in obtaining a patent from this application. Further, I am a consultant to Applicant PARAMOUNT PRODUCTS 1 LLC on matters beyond the above patent application.

9. It is my understanding that PARAMOUNT PRODUCTS 1 LLC has conducted the isotope labeling study described below.

Study No. 1 (Isotope Labeling Trials): Rain-Fastness Study

10. The following paragraphs provide additional technical support for adjuvant premix compositions (claims 1-5 and 7-14), adjuvant compositions (claims 15-22), and plant treatment chemical formulations (claims 23-37) formulated according to Table 1 below.

Table 1. Study Providing Technical Support for the Presently Claimed Adjuvant Premix Compositions, Adjuvant Compositions, and Plant Treatment Chemical Formulations

Study Name (Trial ID No.)	Plant Treatment Chemical	Adjuvant Compositions for Use with Plant Treatment Chemicals	
Isotope Labeling Trials	BRIGADE® INSECTICIDE	2.00 wt%	Thickener (ACUSOL®823)
		0.10 wt%	Water Soluble Divalent Salt (Zinc Sulfate Monohydrate)
		0.10 wt%	Foam Control Agent (Antifoam®8810)
		2.00 wt%	Complexing Agent (Triethanolamine)
		0.10 wt%	Film Forming Agent (Polyvinyl Alcohol)
		95.70 wt%	Water

11. The Cornell University Stable Isotope Laboratory (COIL) was established in 1997 to support non-radioactive stable isotope measurements using Isotope Ratio Mass Spectrometry (IRMS) and Cavity Ring Down Spectrometry (CRDS) for scientific applications. COIL is located within the Dale R. Corson Building at Cornell University. The facility supports a broad community of scientists at Cornell as well as other academic institutions and organizations spanning the globe in the areas of biogeochemistry, agronomy, ecology, geology, atmospheric science, microbiology, nutrition and forensics. COIL personnel have optimized analysis methods for precision as well as sample linearity with capabilities comparable to other advanced isotope laboratories worldwide. In this specific case, COIL has used an added stable isotope as a tracer to determine if a substance of interest is present on the leaf surface over time. Stable isotopes are particularly useful in this context because the isotope can be incorporated into the compound of interest without changes its chemical composition or behavior making it the perfect tracer.

12. The aim of this project was to assess whether the presently claimed adjuvant composition increases pesticide retention when applied with the plant treatment chemical Bifenthrin on leaves of corn (*Zea mays*) before being subject to a series of artificial rainfall events. Isotopically-enriched (2H) Bifenthrin, the active ingredient in Brigade™, was applied with and without the claimed adjuvant composition to test the ability of the adjuvant premix composition at a dilution of 1:1000 to persist under a daily rainfall intensity of ½ in. precipitation equivalent.

13. Corn (*Zea mays*) plants were grown from seed and transplanted, 1 per pot, into Metromix soil media in quart pots. Plants were grown under plant growth chamber conditions for 28 days (16-hour day: 8-hour night cycle at 25 °C), and watered daily from above the soil, but below foliage. Seven leaves on each plant had 9 cm² sections marked and numbered. These sections were used in the treatments described below.

14. For adjuvant treatment studies, twenty plants were split into two groups, the first ten receiving a foliar treatment of isotopically-labeled Bifenthrin without the addition of adjuvant. The second ten plants received the same isotopically-labeled Bifenthrin with the addition of adjuvant premix (at a dilution of 1:1000). Technical Bifenthrin and technical isotopically-labeled (17 atom % ²H–deuterium) Bifenthrin, obtained from Sigma Aldrich, were combined then diluted in a 1:4200 solution in water consistent with estimated foliar application rates for corn borer on field grown corn. Leaves had designated 9 cm² sections marked partway

along the leaf, with two sections marked in some cases (see FIG. 2 below). Treatments were applied using a fine-mist sprayer, making sure to completely cover the marked section. Plastic shields were placed around the base of plants to prevent the label from contaminating the soil media.

15. For sample collection, leaves were harvested according to FIG. 1 below (leaf portion covered in ink represents treated leaf fraction). The first harvest occurred 24 hours after initial spray application (Day 0). Subsequent leaf collections were after 1, 7, 14, 21, and 28 days of $\frac{1}{2}$ " rainfall treatments. Samples were collected approximately 2 hours after water treatment (once the leaves are dry).

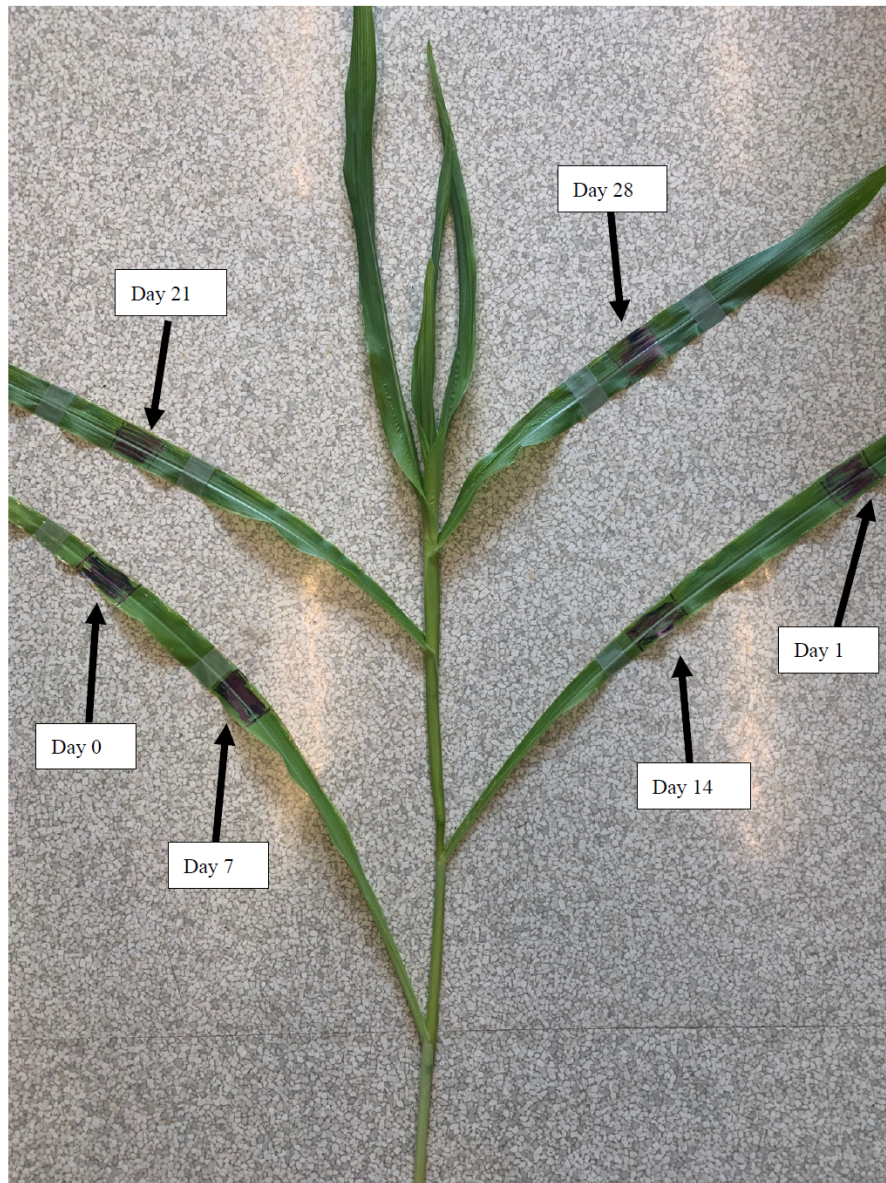


FIG. 1. Collection of Samples for Analysis.

16. For analysis, leaf materials were dried for 72 hours at 60 °C, ground to a fine powder and loaded into silver capsules and analyzed for hydrogen isotopic ratio at the Cornell Stable Isotope Laboratory. Treatments containing Bifenthrin mixed with adjuvant were compared directly to treatments receiving Bifenthrin alone using student T-tests with an alpha value of 0.05 (n=10), to determine the degree to which the adjuvant increases pesticide retention under repeated simulated rainfall. Strongly statistical differences showing 35-45% more adjuvant was observed after 21 days of treatment (see FIG. 2).

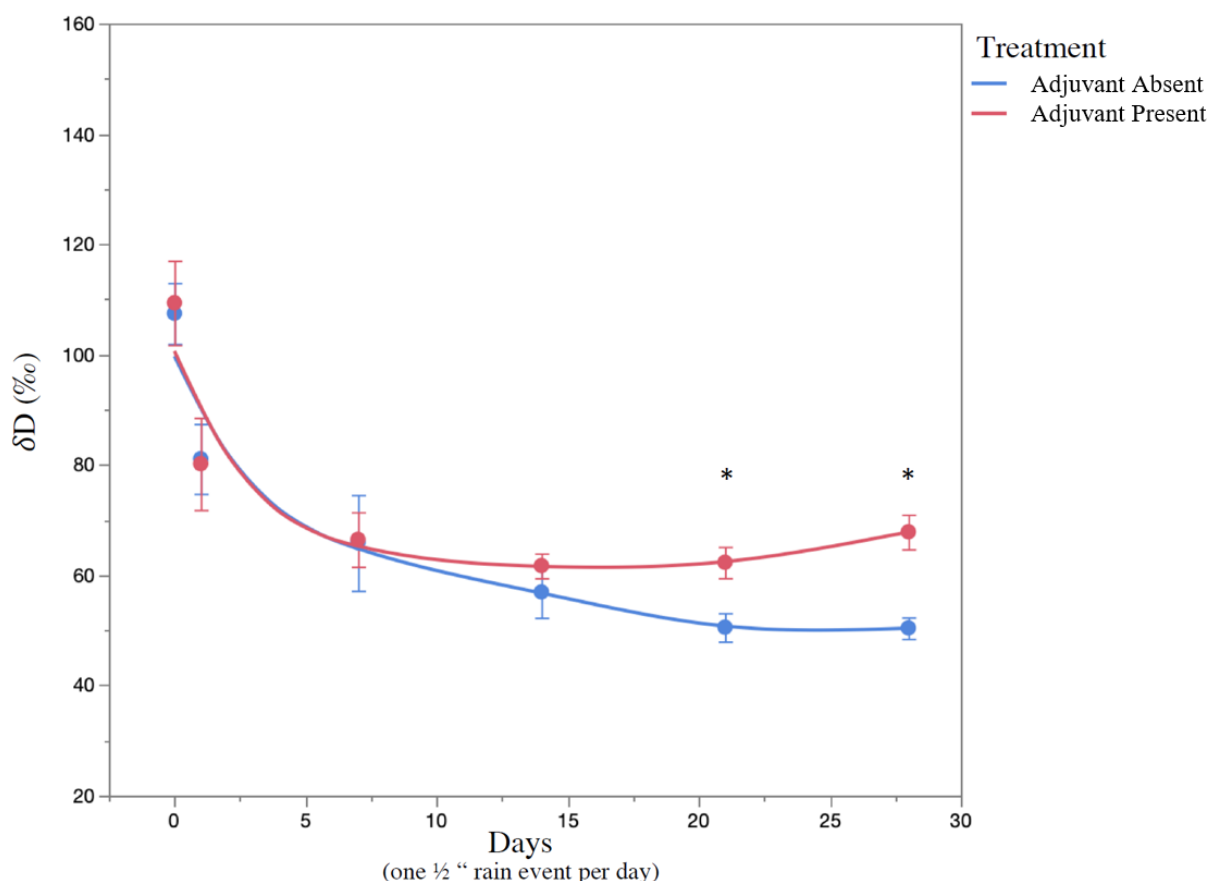


FIG. 2. Analysis of Collected Samples. *35-45% Significant difference between the Adjuvant composition present and absent ($\alpha=0.05$).

17. FIG. 1 and FIG. 2 suggest that plant treatment chemical formulations comprising the presently claimed adjuvant composition significantly improves the retention of the plant treatment chemical, *i.e.*, the presently claimed adjuvant composition improves the stickiness and

adherence of the applied plant treatment chemical formulation. Thus, the results presented in FIG. 1 and FIG. 2 provide technical support for compositions of the present application.

18. I hereby state that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true.

Date: April 3, 2021

A handwritten signature in blue ink, appearing to read "Brett P. Fors", is written above a horizontal line.

BRETT P. FORS, PH.D.

Exhibit A: *Curriculum Vitae of* **BRETT P. FORS, PH.D.**



E 164th ST, Findley Ave, Manhattan, 10035

NEW YORK, USA
www.langspire.com

April 6th, 2020

Documents Number:9

Certificate of Accuracy

We do hereby declare that we are fully competent in the language pair, **English & Spanish (Colombian Variant)**. And that the attached documents **“DRAFT Colombia Statement of Brett Fors_147505_000131 FINAL(signed)”** hereto is a true translation of the documents presented to you from **English into Spanish (Colombian variant)**, to the best of our knowledge and belief.

Thank you

PATENTE

No. de expediente: **147505 000131**

**EN LA SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO, MINISTERIO
DE INDUSTRIA, COMERCIO Y TURISMO DE LA REPÚBLICA DE
COLOMBIA**

Solicitante:	PARAMOUNT PRODUCTS 1 LLC	)
		)
Inventores:	LEFILES y DAVIS	)
		)
Solicitud de patente		)
No.:	NC2019/00045543	)
		)
Presentada:	2 de mayo de 2019	)
		)
Para:	COMPUESTOS ADYUVANTES PARA	)
	PRODUCTOS QUÍMICOS PARA EL	)
	TRATAMIENTO DE PLANTAS	)
		)

DECLARACIÓN DE BRETT P. FORS, PH.D.

Superintendente Delegado para la Propiedad Industrial
Superintendencia de Industria y Comercio
Ministerio de Industria, Comercio y Turismo
Carrera 13, No. 27-00
Pisos Mezanine, 5 y 10
Bogotá
COLOMBIA

Estimado Superintendente Delegado para la Propiedad Industrial

Por la presente yo, Dr. BRETT P. FORS., declaro:

1. Soy Profesor Adjunto del Departamento de Química y de Biología Química de la Universidad Cornell.
2. En el 2006, obtuve mi título universitario en ciencias especializado en Química en la universidad *Montana State University*, y en el 2011 obtuve mi doctorado en Química Orgánica del *Massachusetts Institute of Technology*.
3. Cuento con más de 14 años de experiencia en estrategias sintéticas para ciencia de polímeros. Recibí múltiples distinciones, tales como la beca de investigación *Sloan Research Fellowship*, el premio *Journal of Polymer Science Innovation Award*, el premio *NSF Career Award*, el premio *Bruce Hartman Prize*, el premio *PMSE Young Investigator Award*, el premio

3M Non-Tenured Faculty Award, el premio *Arthur K. Doolittle Award*, y el premio *Thieme Chemistry Journal Award*. Llevo publicados más de 66 artículos científicos en publicaciones tales como *Angewandte Chemie International Edition English*, *ChemSusChem*, *Journal of the American Chemical Society*, *Macromolecules*, *Nature Reviews Materials*, *Organic Letters*, y *Polymer Chemistry*. Mis acreditaciones se indican con detalle en mi CV, que se adjunta a la presente solicitud bajo el **Apéndice A**.

4. Mi investigación se enfoca en desarrollar nuevos métodos sintéticos y sistemas catalizadores para controlar la arquitectura, composición y función de los polímeros. En la actualidad, mis intereses de investigación incluyen, entre otros, el desarrollo de sistemas que permitan regular de forma precisa la reactividad de los catalizadores in situ utilizando luz, para así poder controlar la amplia gama de procesos de polimerización (es decir, reacciones radicales, catiónicas, por apertura de anillo y de inserción) a través de estímulos externos. Otro objetivo que persigue mi investigación es el estudio de la influencia de la distribución de la masa molar de los polímeros en sus propiedades materiales. Mi investigación también se enfoca en la síntesis y caracterización de polímeros obtenidos de materias primas renovables, al igual que en el diseño y la síntesis de polímeros para su aplicación en baterías de iones de metal y celdas de combustible. Asimismo, trabajé en el desarrollo de polímeros que pueden ensamblarse solos y utilizarse en imagenología médica o a la hora de suministrar terapias. En suma, tengo experiencia en la síntesis y catálisis de polímeros, en la física de los polímeros, y en ciencia material. Gracias a mi investigación, cuento con experiencia en la caracterización de polímeros, utilizando técnicas tales como dispersión de rayos X a bajo ángulo, espectroscopía de resonancia magnética nuclear, cromatografía de exclusión por tamaño, dispersión estática de luz, dispersión dinámica de luz, ensayo de materiales y reología. Además, soy experto en auto ensamblado de polímeros, al igual que en la comprensión y explotación de las relaciones entre las propiedades de la estructura de los polímeros. Mi experiencia me permite comprender al adyuvante de la presente solicitud a nivel molecular y comprender su desempeño, al igual que evaluar los resultados de los estudios realizados que se describen más adelante.

5. En virtud de mi experiencia académica y de investigación, soy considerado un experto en el campo de la ciencia de polímeros.

6. El solicitante, PARAMOUNT PRODUCTS 1 LLC, me contrató para analizar la Acción Administrativa No. 14781 ("Acción Administrativa") con fecha 25 de noviembre de 2020 emitida por la Superintendencia de Industria y Comercio ("SIC") de la República de

Colombia para la antemencionada solicitud de patente. Comprendo que la Acción Administrativa de la SIC adopta la posición de que no existe un efecto técnico asociado a incluir agentes aglutinantes dentro de la formulación de adyuvante reivindicada en la solicitud. Ver Acción Administrativa, página 4.

7. Entiendo que las reivindicaciones de la presente solicitud fueron modificadas de modo que dicen “un compuesto de premezcla de adyuvante que contiene: un espesante asociativo; una sal divalente soluble en agua, donde la sal divalente soluble en agua está formada por un catión divalente seleccionado a partir de un grupo que consta de bario, calcio, cobalto (II), cobre (II), hierro (II), magnesio, manganeso (II), estroncio, zinc (II), y mezclas de estos; un agente de control de espuma, un agente aglutinante y un agente formador de película” (reivindicación 1). Presento esta declaración para demostrar que varios compuestos de premezcla de adyuvante de la presente aplicación brindan un efecto técnico, al igual que lo hacen (i) los compuestos adyuvantes de la reivindicación 15 (que contiene un compuesto de premezcla de adyuvante de la reivindicación 1 y agua) y (ii) las formulaciones químicas para el tratamiento de plantas de la reivindicación 23 (que contiene el compuesto adyuvante de la reivindicación 15 y un producto químico para el tratamiento de plantas).

8. Por este trabajo, recibo mi remuneración habitual de \$200 por hora, que es la remuneración habitual que recibo por consultoría y que no depende de si la solicitud tiene éxito a la hora de obtener una patente a raíz de la solicitud. Asimismo, trabajo como consultor para PARAMOUNT PRODUCTS 1 LLC, el Solicitante, brindando asesoría en temas que van más allá de la antemencionada solicitud de patente.

9. Entiendo que PARAMOUNT PRODUCTS 1 LLC realizó múltiples estudios, tal y como se describe más abajo.

Ensayo No. 1 (Ensayos de Mercado Isotópico): Ensayo de Resistencia a la Lluvia

10. Los párrafos que siguen a continuación brindan el sustento técnico para los compuestos de premezcla de adyuvante (reivindicaciones 1-5 y 7-14), compuestos adyuvantes (reivindicaciones 15-22) y formulaciones químicas para el tratamiento de plantas (reivindicaciones 23-37), formulados según el Cuadro 1 que obra a continuación.

Cuadro 1 Ensayos que brindan sustento técnico para los compuestos de premezcla de adyuvantes, compuestos adyuvantes y formulaciones químicas para el tratamiento de plantas reivindicados en el presente

Nombre del Ensayo (No. de ID del Ensayo)	Producto químico de tratamiento de plantas	Compuestos adyuvantes para uso con productos químicos para el tratamiento de plantas	
Ensayos de Marcado Isotópico	BRIGADE® INSECTICIDE	2,00 wt%	Espesante (ACUSOL®823)
		0,10 wt%	Sal divalente soluble en agua (sulfato de zinc monohidratado)
		0,10 wt%	Agente de control de espuma (Antifoam®8810)
		2,00 wt%	Agente aglutinante (Trietanolamina)
		0,10 wt%	Agente formador de película (Alcohol polivinílico)
		95,70 wt%	Agua

11. El laboratorio *Cornell University Stable Isotope Laboratory* (o COIL, por sus siglas en inglés) se fundó en 1997 para brindar apoyo a la medición de isótopos estables no radioactivos utilizando la Espectrometría de Masas de Relaciones Isotópicas (IRMS, por sus siglas en inglés) y la Espectroscopía de Cavidad en Anillo Desplegable (CRDS, por sus siglas en inglés) para aplicaciones científicas. El laboratorio COIL está ubicado dentro del edificio Dale R. Corson Building en la universidad Cornell University. Las instalaciones sirven a una amplia comunidad de científicos de Cornell, al igual que a otras instituciones académicas y organizaciones de áreas tan diversas como la biogeoquímica, agronomía, ecología, geología, ciencia atmosférica, microbiología, nutrición y ciencia forense. El personal del COIL cuenta con métodos de análisis optimizados para la precisión, al igual que con métodos de linealidad de muestras con capacidades similares a las de otros laboratorios avanzados de isótopos del mundo. En este caso específico, el COIL utilizó un isótopo estable agregado como traza para determinar si una sustancia de interés está presente sobre la superficie de la hoja a lo largo del tiempo. Los isótopos estables son particularmente útiles en este contexto, dado que es posible incorporar el isótopo al compuesto de interés sin realizar cambios a la composición química o al comportamiento químico, por lo que son trazadores perfectos.

12. El objetivo de este proyecto fue evaluar si el compuesto adyuvante reivindicado en la presente solicitud de patente incrementa la retención del pesticida cuando se aplica junto con el producto químico para el tratamiento de plantas Bifenthrin sobre hojas de maíz (*Zea mays*) antes de ser sometido a una serie de eventos artificiales de lluvia. Se aplicó Bifenthrin enriquecido con isótopos ($2H$), el principio activo del Brigade™, con y sin el compuesto adyuvante reivindicado para evaluar la capacidad del compuesto de premezcla de adyuvante con una tasa de dilución de 1:1000 de persistir bajo una intensidad de lluvia diaria equivalente a $\frac{1}{2}$ pulgada diaria de precipitaciones.

13. Se plantaron semillas de plantas de maíz (*Zea mays*) para que crecieran y se trasplantaron en macetas de un cuarto con medios de suelo Metromix, dejando 1 planta por maceta. Las plantas se cultivaron bajo condiciones de cámara de cultivo durante 28 días (día de 16 horas: ciclo de 8 horas de noche a 25 °C), y se regaron a diario por encima de la tierra, pero por debajo de las hojas. Se marcaron y numeraron secciones de 9 cm² en siete hojas de cada planta. Estas secciones se utilizaron en los tratamientos que se describen a continuación.

14. Para los ensayos de tratamiento de adyuvantes, se dividieron veinte plantas en dos grupos: las primeras diez recibieron un tratamiento foliar de Bifenthrin con marcado isotópico sin adyuvante añadido. Las otras diez plantas recibieron el mismo Bifenthrin con marcado isotópico con la premezcla de adyuvante añadida (a una dilución de 1:1000). El Bifenthrin técnico y el Bifenthrin técnico con marcado isotópico (17 átomo % $2H$ -deuterio) obtenidos de Sigma Aldrich se combinaron y luego diluyeron en agua en una solución de 1:4200 consistente con las tasas estimadas de aplicación foliar para taladros del maíz en maíz cosechado en campo. Las hojas presentaban secciones designadas de 9 cm² marcadas a lo largo de la mitad de cada hoja, aunque en algunos casos se marcaron dos secciones (ver FIG. 2 más adelante). Se aplicaron los tratamientos utilizando un pulverizador de rocío fino, asegurándose de cubrir completamente la sección marcada. Se colocaron protectores de plástico alrededor de la base de las plantas para evitar que el marcado contaminara el medio de suelo.

15. Para recolectar muestras se cosecharon hojas tal y como se indica en la FIG. 1 que sigue más adelante (la sección de la hoja cubierta en tinta representa la parte de la hoja tratada). La primera cosecha se realizó 24 horas después de que se aplicara la primera pulverización (Día 0). Las cosechas subsiguientes se realizaron luego de 1, 7, 14, 21, y 28 días de tratamientos con $\frac{1}{2}$ pulgada de lluvia. Las muestras se recolectaron aproximadamente 2 horas

después del tratamiento con agua (una vez que las hojas estaban secas).

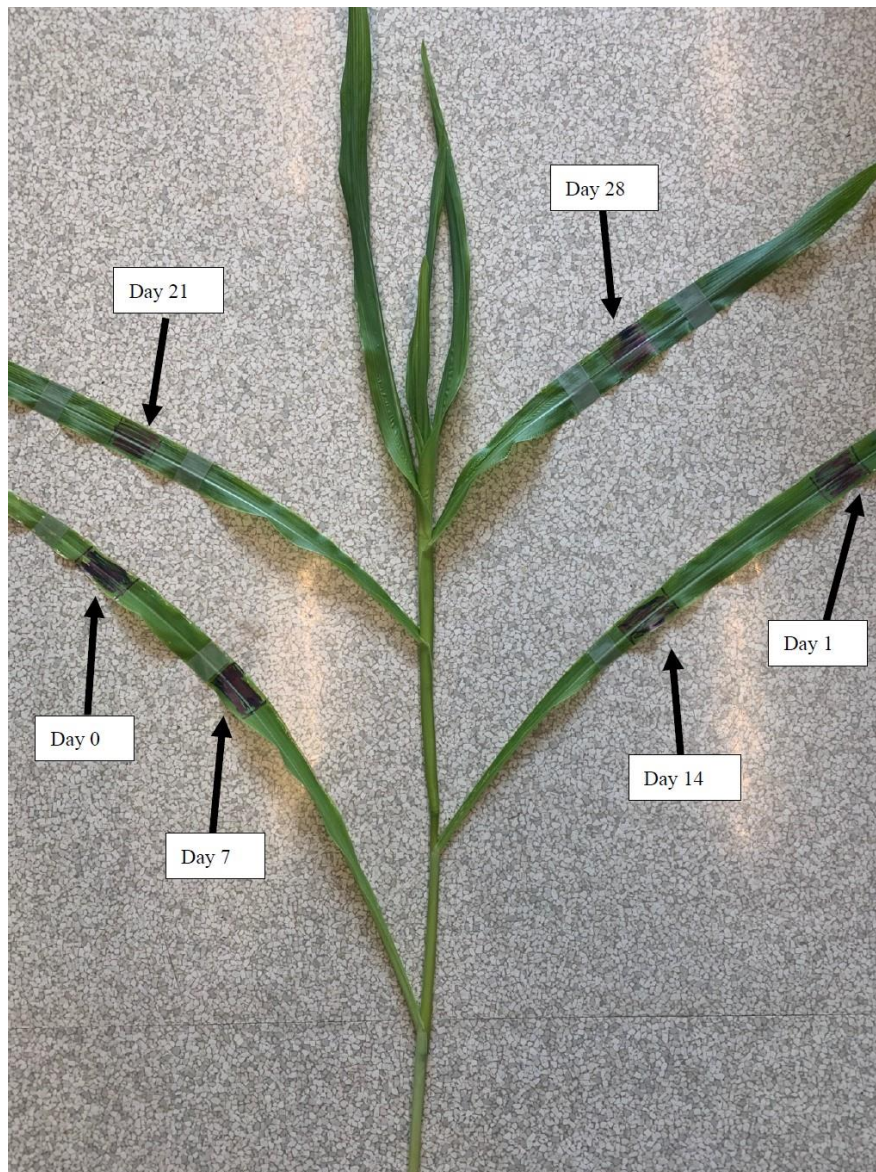


FIG. 1. Recolección de muestras para su análisis.

16. Para el análisis, se secó el material foliar durante 72 horas a 60° C, se lo trituro hasta obtener un polvo fino, se lo colocó en cápsulas de plata y se analizó su cociente de hidrógeno isotópico en el *Cornell Stable Isotope Laboratory*. Mediante pruebas t de Student con un valor alfa de 0,05 (n=10), se compararon directamente los tratamientos que contenían Bifenthrin mezclado con el adyuvante con los tratamientos que solo contenían Bifenthrin para determinar el grado en que el adyuvante incrementa la retención del pesticida bajo lluvia estimulada repetida. Luego de 21 y 28 días de tratamiento, se observaron diferencias estadísticas significativas de 35-45% más de Bifenthrin (ver FIG. 2).

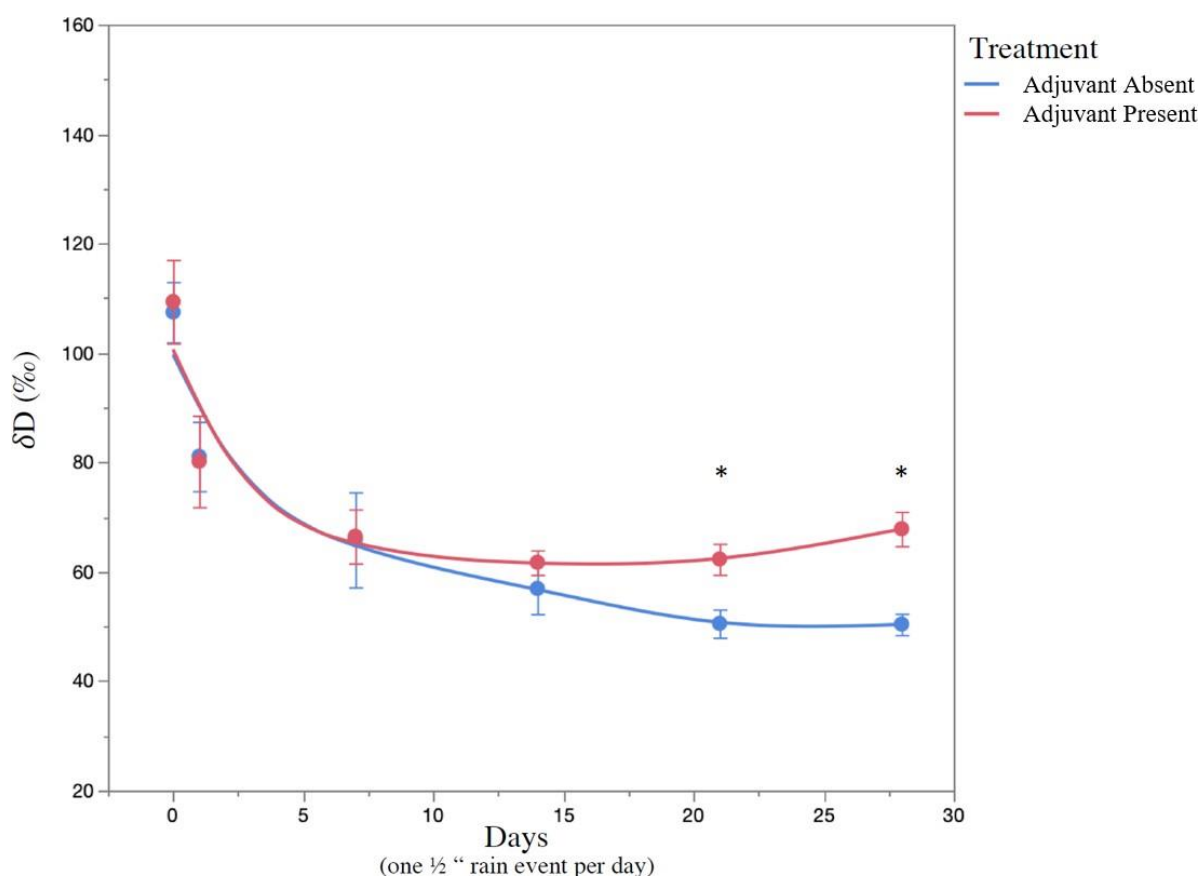


FIG. 2. Análisis de muestras recolectadas. *Diferencias significativas de 35-45% con compuesto Adyuvante presente y ausente ($\alpha=0.05$).

17. Las FIG. 1 y FIG. 2 sugieren que las formulaciones químicas para el tratamiento de plantas que comprenden el compuesto adyuvante reivindicado en la presente solicitud mejoran significativamente la retención del producto químico para el tratamiento de plantas, es

decir, el compuesto adyuvante reivindicado en la presente solicitud mejora la adhesividad y adherencia de la formulación química para el tratamiento de plantas aplicada. Por tanto, los resultados presentados en las FIG. 1 y FIG. 2 brindan sustento técnico para los compuestos de la presente solicitud.

18. Por la presente, declaro que todas las afirmaciones volcadas en el presente documento son verdaderas según mi leal saber y que creo que todas las afirmaciones sobre datos y creencias con verdaderas.

Fecha: de abril de 2021



BRETT P. FORS, PH.D.

APÉNDICE A: *Curriculum Vitae* de BRETT P. FORS, PH.D.

**IN THE REPUBLIC OF COLOMBIA SUPERINTENDENCE OF INDUSTRY AND
COMMERCE MINISTRY OF INDUSTRY, COMMERCE AND TOURISM**

Applicant	:	PARAMOUNT PRODUCTS 1 LLC	)
			)
Inventors	:	LEFILES and DAVIS	)
			)
Patent App. No.	:	NC2019/00045543	)
			)
Filed	:	May 2, 2019	)
			)
For	:	ADJUVANT COMPOSITIONS FOR PLANT TREATMENT CHEMICALS	)
			)

STATEMENT OF BRETT P. FORS, PH.D.

Superintendente Delegado para la Propiedad Industrial
Superintendence of Industry and Commerce
Ministry of Industry, Commerce and Tourism
Carrera 13 No. 27-00
Pisos Mezanine, 5 y 10
Bogotá
COLOMBIA

Dear Delegate Superintendent for Industrial Property:

I, **BRETT P. FORS, PH.D.**, hereby state:

1. I am an Associate Professor in the Department of Chemistry and Chemical Biology at Cornell University.
2. I received a B.Sc. in Chemistry from Montana State University in 2006 and a Ph.D. in Organic Chemistry from the Massachusetts Institute of Technology in 2011.
3. I have over 14 years of experience in synthetic strategies for polymer science. I have received numerous honors, including the Sloan Research Fellowship, the Journal of Polymer Science Innovation Award, the NSF Career Award, the Bruce Hartman Prize, the PMSE Young Investigator Award, 3M Non-Tenured Faculty Award, Arthur K. Doolittle Award, and Thieme Chemistry Journal Award. I have published more than 66 scientific papers in journals

including Angewandte Chemie International Edition English, ChemSusChem, Journal of the American Chemical Society, Macromolecules, Nature Reviews Materials, Organic Letters, and Polymer Chemistry. My credentials are fully set forth in my CV, which is attached hereto as **Exhibit A**.

4. My research focuses on the development of new synthetic methods and catalyst systems to control polymer architecture, composition, and function. My current research interests include the development of systems that enable precise regulation over catalyst reactivity *in situ* with light to allow control of a diverse array of polymerization processes (*i.e.*, radical, cationic, ring-opening, and insertion reactions) with an external stimulus. Another aim of my research is the investigation of the influence of polymer molar mass distribution on material properties. My research also focuses on the synthesis and characterization of polymers from renewable feedstocks, as well as the design and synthesis of polymers for applications in metal-ion batteries and fuel cells. I have also worked on the development of polymers that can self-assemble and be used for medical imaging or for delivery of therapeutics. Overall, my expertise lies in polymer synthesis, catalysis, polymer physics, and material science. Through this research I have expertise in polymer characterization, using techniques such as small angle X-ray scattering, nuclear magnetic resonance spectroscopy, size-exclusion chromatography, static light scattering, dynamic light scattering, tensile testing, and rheology. I am also an expert in polymer self-assembly, as well as understanding and exploiting polymer structure property relationships. This expertise allows me to understand the adjuvant of the present application at the molecular level and how it is performing, as well as evaluate the results of the conducted studies described below.

5. Based on my academic and research experience, I am regarded as an expert in the field of polymer science.

6. I have been retained by Applicant PARAMOUNT PRODUCTS 1 LLC to review Office Action No. 14781 (“Office Action”), dated November 25, 2020, from the Republic of Colombia Superintendence of Industry and Commerce (“SIC”), for the above patent application. I understand that in the Office Action the SIC has taken the position that there is no technical effect associated with including complex-forming agents within the presently claimed adjuvant formulation. *See* Office Action, p. 4.

7. It is my understanding that claims of the present application have been amended to recite “[a]n adjuvant premix composition comprising: an associative thickener; a water soluble divalent salt, wherein the water soluble divalent salt comprises a divalent cation selected from the group consisting of barium, calcium, cobalt (II), copper (II), iron (II), magnesium, manganese (II), strontium, zinc (II), and mixtures thereof; a foam control agent; a complexing agent; and a film forming agent” (claim 1). I am presenting this statement to show that a number of adjuvant premix compositions of the present application, as well as (i) the adjuvant compositions of claim 15 (comprising the adjuvant premix composition of claim 1 and water) and (ii) the plant treatment chemical formulations of claim 23 (comprising the adjuvant composition of claim 15 and a plant treatment chemical) provide a technical effect.

8. I am being compensated at my usual consulting rate of \$200 per hour for this work, with my compensation not being dependent on whether applicant is successful in obtaining a patent from this application. Further, I am a consultant to Applicant PARAMOUNT PRODUCTS 1 LLC on matters beyond the above patent application.

9. It is my understanding that PARAMOUNT PRODUCTS 1 LLC has conducted the isotope labeling study described below.

Study No. 1 (Isotope Labeling Trials): Rain-Fastness Study

10. The following paragraphs provide additional technical support for adjuvant premix compositions (claims 1-5 and 7-14), adjuvant compositions (claims 15-22), and plant treatment chemical formulations (claims 23-37) formulated according to Table 1 below.

Table 1. Study Providing Technical Support for the Presently Claimed Adjuvant Premix Compositions, Adjuvant Compositions, and Plant Treatment Chemical Formulations

Study Name (Trial ID No.)	Plant Treatment Chemical	Adjuvant Compositions for Use with Plant Treatment Chemicals	
Isotope Labeling Trials	BRIGADE® INSECTICIDE	2.00 wt%	Thickener (ACUSOL®823)
		0.10 wt%	Water Soluble Divalent Salt (Zinc Sulfate Monohydrate)
		0.10 wt%	Foam Control Agent (Antifoam®8810)
		2.00 wt%	Complexing Agent (Triethanolamine)
		0.10 wt%	Film Forming Agent (Polyvinyl Alcohol)
		95.70 wt%	Water

11. The Cornell University Stable Isotope Laboratory (COIL) was established in 1997 to support non-radioactive stable isotope measurements using Isotope Ratio Mass Spectrometry (IRMS) and Cavity Ring Down Spectrometry (CRDS) for scientific applications. COIL is located within the Dale R. Corson Building at Cornell University. The facility supports a broad community of scientists at Cornell as well as other academic institutions and organizations spanning the globe in the areas of biogeochemistry, agronomy, ecology, geology, atmospheric science, microbiology, nutrition and forensics. COIL personnel have optimized analysis methods for precision as well as sample linearity with capabilities comparable to other advanced isotope laboratories worldwide. In this specific case, COIL has used an added stable isotope as a tracer to determine if a substance of interest is present on the leaf surface over time. Stable isotopes are particularly useful in this context because the isotope can be incorporated into the compound of interest without changes its chemical composition or behavior making it the perfect tracer.

12. The aim of this project was to assess whether the presently claimed adjuvant composition increases pesticide retention when applied with the plant treatment chemical Bifenthrin on leaves of corn (*Zea mays*) before being subject to a series of artificial rainfall events. Isotopically-enriched (2H) Bifenthrin, the active ingredient in Brigade™, was applied with and without the claimed adjuvant composition to test the ability of the adjuvant premix composition at a dilution of 1:1000 to persist under a daily rainfall intensity of ½ in. precipitation equivalent.

13. Corn (*Zea mays*) plants were grown from seed and transplanted, 1 per pot, into Metromix soil media in quart pots. Plants were grown under plant growth chamber conditions for 28 days (16-hour day: 8-hour night cycle at 25 °C), and watered daily from above the soil, but below foliage. Seven leaves on each plant had 9 cm² sections marked and numbered. These sections were used in the treatments described below.

14. For adjuvant treatment studies, twenty plants were split into two groups, the first ten receiving a foliar treatment of isotopically-labeled Bifenthrin without the addition of adjuvant. The second ten plants received the same isotopically-labeled Bifenthrin with the addition of adjuvant premix (at a dilution of 1:1000). Technical Bifenthrin and technical isotopically-labeled (17 atom % ²H–deuterium) Bifenthrin, obtained from Sigma Aldrich, were combined then diluted in a 1:4200 solution in water consistent with estimated foliar application rates for corn borer on field grown corn. Leaves had designated 9 cm² sections marked partway

along the leaf, with two sections marked in some cases (see FIG. 2 below). Treatments were applied using a fine-mist sprayer, making sure to completely cover the marked section. Plastic shields were placed around the base of plants to prevent the label from contaminating the soil media.

15. For sample collection, leaves were harvested according to FIG. 1 below (leaf portion covered in ink represents treated leaf fraction). The first harvest occurred 24 hours after initial spray application (Day 0). Subsequent leaf collections were after 1, 7, 14, 21, and 28 days of $\frac{1}{2}$ " rainfall treatments. Samples were collected approximately 2 hours after water treatment (once the leaves are dry).

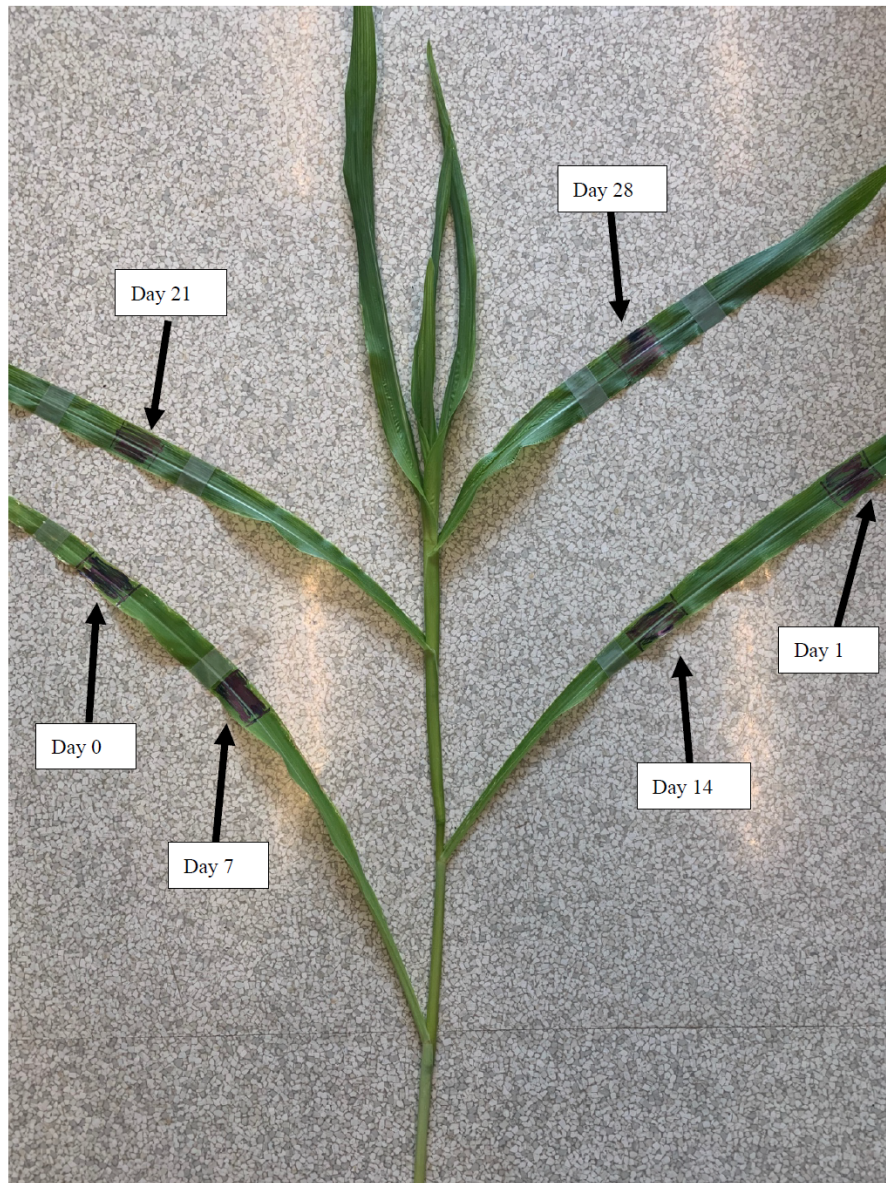


FIG. 1. Collection of Samples for Analysis.

16. For analysis, leaf materials were dried for 72 hours at 60 °C, ground to a fine powder and loaded into silver capsules and analyzed for hydrogen isotopic ratio at the Cornell Stable Isotope Laboratory. Treatments containing Bifenthrin mixed with adjuvant were compared directly to treatments receiving Bifenthrin alone using student T-tests with an alpha value of 0.05 (n=10), to determine the degree to which the adjuvant increases pesticide retention under repeated simulated rainfall. Strongly statistical differences showing 35-45% more adjuvant was observed after 21 days of treatment (see FIG. 2).

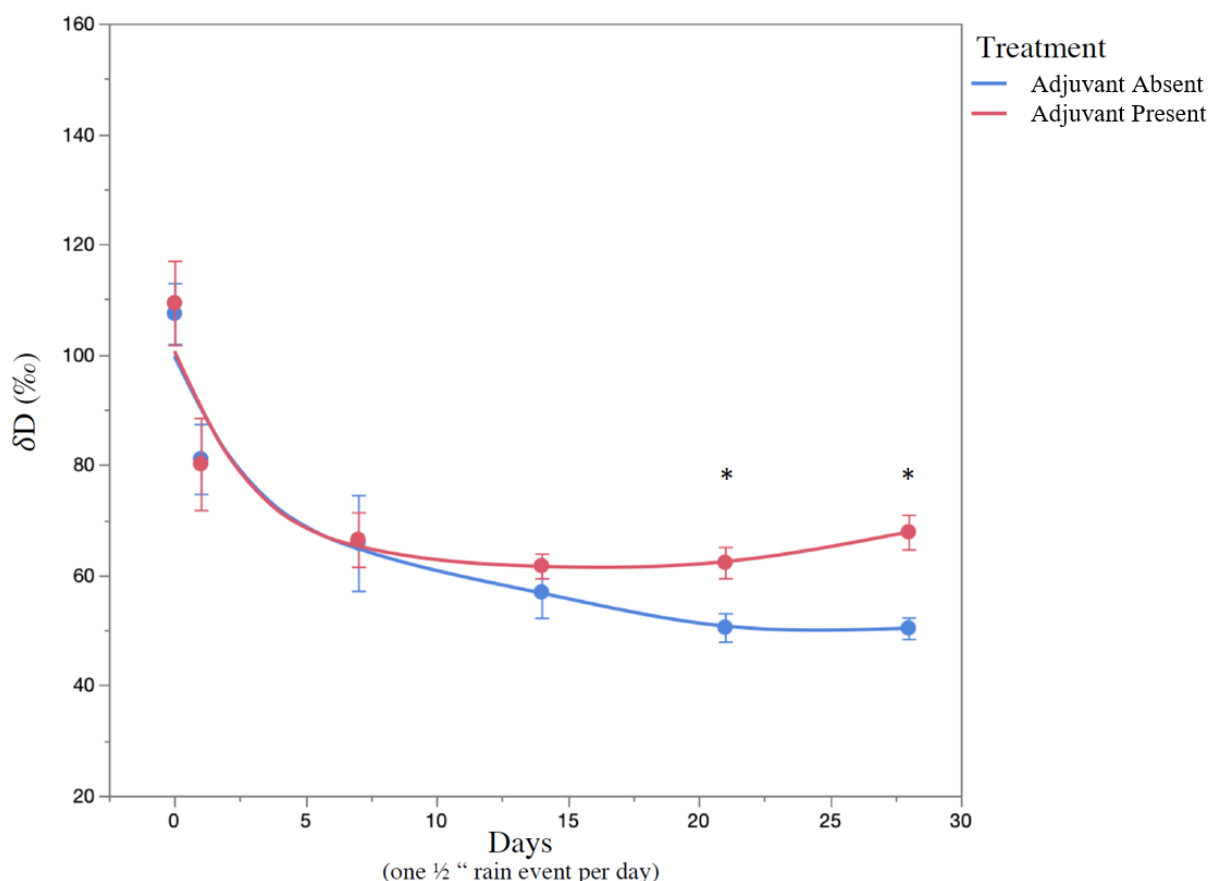


FIG. 2. Analysis of Collected Samples. *35-45% Significant difference between the Adjuvant composition present and absent ($\alpha=0.05$).

17. FIG. 1 and FIG. 2 suggest that plant treatment chemical formulations comprising the presently claimed adjuvant composition significantly improves the retention of the plant treatment chemical, *i.e.*, the presently claimed adjuvant composition improves the stickiness and

adherence of the applied plant treatment chemical formulation. Thus, the results presented in FIG. 1 and FIG. 2 provide technical support for compositions of the present application.

18. I hereby state that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true.

Date: April 3, 2021

A handwritten signature in blue ink, appearing to read "Brett P. Fors", is written above a horizontal line.

BRETT P. FORS, PH.D.

Exhibit A: *Curriculum Vitae of* **BRETT P. FORS, PH.D.**

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Brett P. Fors

Employment

- **2019 – Present**, Associate Professor, Department of Chemistry and Chemical Biology, Cornell University
- **2014 – 2019**, Assistant Professor, Department of Chemistry and Chemical Biology, Cornell University
- **2011 – 2014** Elings Postdoctoral Fellow with Professor Craig J. Hawker, California NanoSystems Institute and Materials Research Laboratory, University of California, Santa Barbara
- **2006 – 2011** Graduate Student with Professor Stephen L. Buchwald, Massachusetts Institute of Technology
- **2005, 2006** Medicinal Chemistry Intern, Merck and Company, Rahway, NJ

Education

- **2011** Ph.D. in Organic Chemistry, Massachusetts Institute of Technology, Cambridge, MA
- **2006** B.Sc. in Chemistry, Montana State University, Bozeman, MT

Honors and Awards

- Journal of Polymer Science Innovation Award – 2020
- ACS Organic Division Young Academic Investigator Symposium – 2018
- NSF CAREER Award – 2018
- Sloan Research Fellowship – 2018
- Arthur K. Doolittle Award – 2018
- JACS Young Investigator Virtual Issue – 2017, 2018
- Scialog Fellow – 2017
- ACS PMSE Young Investigator – 2017
- 3M Non-Tenured Faculty Award – 2016
- PolyChar Bruce Hartman Young Investigator Prize – 2015
- Thieme Chemistry Journal Award – 2014
- MRL/Dow Travel Fellowship – 2013
- Elings Fellowship in Experimental Science – 2011
- Bristol-Myers Squibb Graduate Fellowship – 2010
- Amgen Summer Fellowship – 2010
- MIT Wyeth Scholar – 2010
- ACS Organic Division Fellowship – 2010
- Sigma-Aldrich Graduate Student Innovation Award – 2009
- Merck Summer Fellowship – 2009
- Roche Symposium: Excellence in Chemistry Award – 2009
- William Asbornsen Albert Memorial Fellowship – 2009
- Synstar Chemistry Award – 2006
- Massachusetts Institute of Technology Presidential Fellowship – 2006

- EW Mares Chemistry Award – 2004, 2005

Publications

Cornell Affiliation

- 62) Veronika Kottisch, Janis Jermaks, Joe-Yee Mak, Ryan Woltornist, Tristan Lambert, Brett P. Fors “Hydrogen Bond Donor-Catalyzed Cationic Polymerization of Vinyl Ethers” *Angew. Chem. Int. Ed.* **2020**, DOI: 10.1002/anie.202012419.
- 61) Renee J. Sifri, Audrey J. Kennedy, Brett P. Fors “Photocontrolled Cationic Degenerate Chain Transfer Polymerizations via Thioacetal Initiators” *Polym. Chem.* **2020**, 11, 6499.
- 60) Stephanie I. Rosenbloom, Brett P. Fors “Shifting Boundaries: Controlling Molecular Weight Distribution Shape for Mechanically Enhanced Thermoplastic Elastomers” *Macromolecules* **2020**, 53, 7479.
- 59) Michael J. Supej, Brian M. Peterson, Brett P. Fors “Dual Stimuli Switching: Interconverting Cationic and Radical Mechanisms with Electricity and Light” *Chem* **2020**, 6, 1508.
- 58) Erin E. Stache, Veronika Kottisch, Brett P. Fors “Photocontrolled Radical Polymerization from Hydridic C-H Bonds” *J. Am. Chem. Soc.* **2020**, 142, 4581.
- 57) Cara N. Gannett, Brian M. Peterson, Luxi Shen, Jeessoo Seok, Brett P. Fors, Héctor Abruña “Cross-Linking Effects on Performance Metrics of Phanazine-Based Polymer Cathodes” *ChemSusChem* **2020**, 13, 2428.
- 56) Renee J. Sifri, Omar Padilla-Vélez, Geoffrey W. Coates, Brett P. Fors “Controlling the Shape of Molecular Weight Distributions in Coordination Polymerization and Its Impact on Physical Properties” *J. Am. Chem. Soc.* **2020**, 142, 1443.
- 55) Stephanie I. Rosenbloom, Dillon T. Gentekos, Brett P. Fors “Tailor-Made Elastomers: Customisable Materials via Modulation of Molecular Weight Distribution” *Chem. Sci.* **2020**, DOI: 10.1039/C9SC05278J.
- 54) Dillon T. Gentekos, Renee J. Sifri, Brett P. Fors “Controlling Polymer Properties Through the Shape of the Molecular-Weight Distribution” *Nat. Rev. Mater.* **2019**, 4, 761.
- 53) Angelika E. Neitzel, Leonel Barreda, Jacob T. Trotta, Grant W. Fahnhorst, Thomas J. Haversang, Thomas R. Hoyer, Brett P. Fors, Marc A. Hillmyer “Hydrolytically-Degradable Homo- and Copolymers of a Strained Exocyclic Hemiacetal Ester” *Polym. Chem.* **2019**, 10, 4573.
- 52) Veronika Kottisch, Jacob O’Leary, Quentin Michaudel, Erin E. Stache, Tristan H. Lambert, Brett P. Fors “Controlled Cationic Polymerization: Single-Component Initiation Under Ambient Conditions” *J. Am. Chem. Soc.* **2019**, 141, 10605.
- 51) Sergii Domanskyi, Dillon T. Gentekos, Vladimir Privman, Brett P. Fors “Predictive Design of Polymer Molecular Weight Distributions in Anionic Polymerization” *Polym. Chem.* **2020**, 11, 326.
- 50) Brian M. Peterson, Luxi Shen, Gerickson J. Lopez, Cara N. Gannett, Dong Ren, Héctor D. Abruña, Brett P. Fors “Elucidation of the Electrochemical Behavior of Phenothiazine-Based Polyaromatic Amines” *Tetrahedron* **2019**, 75, 4244.
- 49) Jacob T. Trotta, Annabelle Watts, Allison R. Wong, Anne M. LaPointe, Marc A. Hillmyer, Brett P. Fors “Renewable Thermosets and Thermoplastics from Itaconic Acid” *ACS Sustainable Chem. Eng.* **2019**, 7, 2691.
- 48) Neil D. Dolinski, Zachariah A. Page, Emre H. Discekici, David Meis, In-Hwan Lee, Glen R. Jones, Richard Whitfield, Xiangcheng Pan, Blaine G. McCarthy, Sivaprakash Shanmugam, Veronika Kottisch, Brett P. Fors, Cyrille Boyer, Garret M. Miyake, Krzysztof Matyjaszewski, David M. Haddleton, Javier Read de Alaniz, Athina Anastasaki, Craig J. Hawker “What Happens in the

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- 47) Brian M. Peterson, Veronika Kottisch, Michael J. Supej, Brett P. Fors “*On Demand Switching of Polymerization Mechanism and Monomer Selectivity with Orthogonal Stimuli*” *ACS Cent. Sci.* **2018**, 4, 1228.
- 46) Brian M. Peterson, Dong Ren, Luxi Shen, You-Chi Mason Wu, Burak Ulgut, Geoffrey W. Coates, Héctor D. Abruña, Brett P. Fors “*Phenothiazine-Based Polymer Cathode Materials with Ultrahigh Power Densities for Lithium Ion Batteries*” *ACS Appl. Energy Mat.* **2018**, 1, 3560.
- 45) Dillon T. Gentekos, Brett P. Fors “*Molecular Weight Distribution Shape as a Versatile Approach to Tailoring Block Copolymer Phase Behavior*” *ACS Macro Lett.* **2018**, 7, 677.
- 44) Veronika Kottisch, Michael J. Supej, Brett P. Fors “*Enhancing Temporal Control and Enabling Chain-End Modification in Photoregulated Cationic Polymerizations Using Ir-Based Catalysts*” *Angew. Chem. Int. Ed.* **2018**, 57, 8260.
- 43) Dillon T. Gentekos, Junteng Jia, Erika S. Tirado, Katherine P. Barteau, Detlef-M. Smilgies, Robert A. DiStasio Jr., Brett P. Fors “*Exploiting Molecular Weight Distribution Shape to Tune Domain Spacing in Block Copolymer Thin Films*” *J. Am. Chem. Soc.* **2018**, 140, 4639.
- 42) Brian M. Peterson, Song Lin, Brett P. Fors “*Electrochemically Controlled Cationic Polymerization of Vinyl Ethers*” *J. Am. Chem. Soc.* **2018**, 140, 2076.
- 41) Quentin Michaudel, Timothée Chauviré, Veronika Kottisch, Michael J. Supej, Katherine J. Stawiasz, Luxi Shen, Warren R. Zipfel, Héctor D. Abruña, Jack H. Freed, Brett P. Fors “*Mechanistic Insight into the Photocontrolled Cationic Polymerization of Vinyl Ethers*” *J. Am. Chem. Soc.* **2017**, 139, 15530.
- 40) Veronika Kottisch, Quentin Michaudel, Brett P. Fors “*Photocontrolled Interconversion of Cationic and Radical Polymerizations*” *J. Am. Chem. Soc.* **2017**, 139, 10665.
- 39) Milena Nadgorny, Dillon T. Gentekos, Zeyun Xiao, S. Parker Singleton, Brett P. Fors, Luke A. Connal “*Manipulation of Molecular Weight Distribution Shape as a New Strategy to Control Processing Parameters*” *Macromol. Rapid Commun.* **2017**, 1700352.
- 38) Jacob T. Trotta, Mengjuan Jin, Katherine J. Stawiasz, Quentin Michaudel, Wei-Liang Chen, Brett P. Fors “*Synthesis of Methylene Butyrolactone Polymers from Itaconic Acid*” *J. Polym. Sci. A Polym. Chem.* **2017**, 55, 2730.
- 37) Quentin Michaudel, Veronika Kottisch, Brett P. Fors “*Cationic Polymerization: From Photoinitiation to Photocontrol*” *Angew. Chem. Int. Ed.* **2017**, 56, 9670.
- 36) Veronika Kottisch, Quentin Michaudel, Brett P. Fors “*Cationic Polymerization of Vinyl Ethers Controlled by Visible Light*” *J. Am. Chem. Soc.* **2016**, 138, 15535.
- 35) Quentin Michaudel, Brett P. Fors “*Storing Information at the Molecular Level: Efficient Synthesis of ‘Barcode’ Polymers*” *Chem.* **2016**, 1, 23.
- 34) Veronika Kottisch, Dillon T. Gentekos, Brett P. Fors “*Shaping the Future of Molecular Weight Distributions in Anionic Polymerization*” *ACS Macro Lett.* **2016**, 5, 796.
- 33) Joe Collins, Zehun Xiao, Andrea Espinosa-Gomez, Brett P. Fors, Luke A. Connal “*Extremely Rapid and Versatile Synthesis of High Molecular Weight Step Growth Polymers via Oxime Click Chemistry*” *Polym. Chem.* **2016**, 7, 2581.
- 32) Dillon T. Gentekos, Lauren N. Dupuis, Brett P. Fors “*Beyond Dispersity: Deterministic Control of Polymer Molecular Weight Distributions*” *J. Am. Chem. Soc.* **2016**, 138, 1848.
- 31) Jacob T. Trotta, Brett P. Fors “*Organic Catalysts for Photocontrolled Polymerizations*” *Synlett* **2016**, 27, 702.

- 30) You-Chi Mason Wu, Michel F. Molaire, David S. Weiss, Felipe A. Angel, Catherine R. DeBlase, Brett P. Fors "Synthesis of Amorphous Monomeric Glass Mixtures for Organic Electronic Applications" *J. Org. Chem.*, **2015**, 80, 12740.
- 29) Nicolas J. Treat, Hazel Sprafke, John W. Kramer, Paul G. Clark, Bryan E. Barton, Javier Read de Alaniz, Brett P. Fors, Craig J. Hawker "Metal-Free Atom Transfer Radical Polymerization" *J. Am. Chem. Soc.* **2014**, 136, 16096.

Prior to Cornell

- 28) Hannah P. Luehmann, Lisa Detering, Brett P. Fors, Eric D. Pressly, Pamela K. Woodard, Gwendalyn J. Randolph, Robert J. Gropler, Craig J. Hawker, Yongjian Liu "PET/CT Imaging of Chemokine Receptors in Inflammatory Atherosclerosis Using Targeted Nanoparticles" *J. Nucl. Med.* **2016**, 57, 1124.
- 27) Anna Melker, Brett P. Fors, Craig J. Hawker, Justin E. Poelma "Continuous Flow Synthesis of Poly(methyl methacrylate) via a Light-Mediated Controlled Radical Polymerization" *J. Polym. Sci., Part A: Polym. Chem.* **2015**, 53, 2693.
- 26) Nicolas J. Treat, Brett P. Fors, John W. Kramer, Matthew Christianson, Chien-Yang Chiu, Javier Read de Alaniz, Craig J. Hawker "Controlled Radical Polymerization of Acrylates Regulated by Visible Light" *ACS Macro Lett.* **2014**, 3, 580.
- 25) Maxwell J. Robb, Brandon Newton, Brett P. Fors, Craig J. Hawker "One-Step Synthesis of Unsymmetrical N-Alkyl-N'-Aryl Perylene Diimides" *J. Org. Chem.* **2014**, 79, 6360.
- 24) Lauren M. Misch, Alexander Birkel, C. Adrian Figg, Brett P. Fors, Craig J. Hawker, Galen D. Stucky, Ram Seshadri "Rapid Microwave-Assisted Sol-Gel Preparation of Pd-Substituted LnFeO_3 ($\text{Ln} = \text{Y}, \text{La}$): Phase Formation and Catalytic Activity" *Dalton Trans.* **2014**, 43, 2079.
- 23) Brett P. Fors, Justin E. Poelma, Matthew S. Menyo, Maxwell J. Robb, Daniel M. Spokoyny, John W. Kramer, J. Herbert Waite, Craig J. Hawker "Fabrication of Unique Chemical Patterns and Surface Concentration Gradients with Visible Light" *J. Am. Chem. Soc.* **2013**, 135, 14106.
- 22) Justin E. Poelma, Brett P. Fors, Gregory F. Meyers, John W. Kramer, Craig J. Hawker "Fabrication of Complex 3-Dimensional Polymer Brush Nanostructures via Light-Mediated Living Radical Polymerization" *Angew. Chem. Int. Ed.* **2013**, 52, 6844.
- 21) Frank A. Leibfarth, Kaila M. Mattson, Brett P. Fors, Hazel A. Collins, Craig J. Hawker "External Regulation of Controlled Polymerizations" *Angew. Chem. Int. Ed.* **2013**, 52, 199.
- 20) Brett P. Fors, Craig J. Hawker "Control of a Living Radical Polymerization of Methacrylates by Light" *Angew. Chem. Int. Ed.* **2012**, 51, 8850.
- 19) Ekaterina V. Vinogradova, Nathaniel H. Park, Brett P. Fors, Stephen L. Buchwald "Palladium-Catalyzed Synthesis of N-Aryl Carbamates" *Org. Lett.* **2013**, 15, 1394.
- 18) Ekaterina V. Vinogradova, Brett P. Fors, Stephen L. Buchwald "Palladium-Catalyzed Cross-Coupling of Aryl Chlorides and Triflates with Sodium Cyanate: A Practical Synthesis of Unsymmetrical Ureas" *J. Am. Chem. Soc.* **2012**, 134, 11132.
- 17) Satoshi Ueda, Siraj Ali, Brett P. Fors, Stephen L. Buchwald " $\text{Me}_3(\text{OMe})\text{tBuXPhos}$: A Surrogate Ligand for $\text{Me}_4\text{tBuXPhos}$ in Palladium-Catalyzed C-N and C-O Bond-Forming Reactions" *J. Org. Chem.* **2012**, 77, 2543.
- 16) Simon Breitler, Nathan J. Oldenhuis, Brett P. Fors, Stephen L. Buchwald "Synthesis of Unsymmetrical Diarylureas via Pd-Catalyzed C-N Cross-Coupling Reactions" *Org. Lett.* **2011**, 13, 3262.
- 15) Brett P. Fors and Stephen L. Buchwald "Commentary on 'A New, Efficient and Recyclable Lanthanum(III) Oxide-Catalyzed C-N Cross-Coupling' by S. Narayana Murthy, B. Madhav, V.

Prakash Reddy, and Y. V. D. Nageswar, *Adv. Synth. Catal.* **2010**, 352, 3241–3245” *Adv. Synth. Catal.* **2010**, 352, 3119.

- 14) Brett P. Fors, Stephen L. Buchwald “A Multiligand Based Pd Catalyst for C–N Cross-Coupling Reactions” *J. Am. Chem. Soc.* **2010**, 132, 15914.
- 13) Xiaoxing Wu, Brett P. Fors, Stephen L. Buchwald “A Single Phosphine Ligand Allows Palladium-Catalyzed Intermolecular C–O Bond Formation with Secondary and Primary Alcohols” *Angew. Chem. Int. Ed.* **2011**, 50, 9943.
- 12) Debrata Maiti, Brett P. Fors, Jaclyn L. Henderson, Yoshinori Nakamura, Stephen L. Buchwald “Palladium-Catalyzed Coupling of Functionalized Primary and Secondary Amines with Aryl and Heteroaryl Halides: Two Ligands Suffice in Most Cases” *Chem. Sci.* **2011**, 2, 57.
- 11) Karin Dooleweerd, Brett P. Fors, Stephen L. Buchwald “Pd-Catalyzed Cross-Coupling of Amides and Aryl Mesylates” *Org. Lett.* **2010**, 12, 2350.
- 10) Brett P. Fors, Stephen L. Buchwald “Pd-Catalyzed Conversion of Aryl Chlorides, Triflates, and Nonaflates to Nitroaromatics” *J. Am. Chem. Soc.* **2009**, 131, 12898.
- 9) John R. Naber, Brett P. Fors, Xiaoxing Wu, Jonathon T. Gunn, Stephen L. Buchwald “Stille Cross-Coupling Reactions of Aryl Mesylates and Tosylates Using a Biarylphosphine Based Catalyst System” *Heterocycles* **2010**, 80, 1215.
- 8) Brijesh Bhayana, Brett P. Fors, Stephen L. Buchwald “A Versatile Catalyst System for Suzuki-Miyaura Cross-Coupling Reactions of C(sp²)-Tosylates and Mesylates” *Org. Lett.* **2009**, 11, 3954.
- 7) Brett P. Fors, Karin Dooleweerd, Qingle Zeng, Stephen L. Buchwald “An Efficient System for the Pd-Catalyzed Cross-Coupling of Amides and Aryl Chlorides” *Tetrahedron* **2009**, 65, 6576.
- 6) Brett P. Fors, Nicole R. Davis, Stephen L. Buchwald “An Efficient Process for Pd-Catalyzed C–N Cross-Coupling Reactions of Aryl Iodides: Insight Into Controlling Factors” *J. Am. Chem. Soc.* **2009**, 131, 5766.
- 5) Brett P. Fors, Donald A. Watson, Mark R. Biscoe, Stephen L. Buchwald “A Highly Active Catalyst for Pd-Catalyzed Amination Reactions: Cross-Coupling Reactions Using Aryl Mesylates and the Highly Selective Monoarylation of Primary Amines Using Aryl Chlorides” *J. Am. Chem. Soc.* **2008**, 130, 13552.
- 4) Brett P. Fors, Philip Krattiger, Eric Strieter, Stephen L. Buchwald “Water-Mediated Catalyst Preactivation: An Efficient Protocol for C–N Cross-Coupling Reactions” *Org. Lett.* **2008**, 10, 3505.
- 3) Mark R. Biscoe, Brett P. Fors, Stephen L. Buchwald “A New Class of Easily Activated Palladium Precatalysts for Facile C–N Cross-Coupling Reactions and the Low Temperature Oxidative Addition of Aryl Chlorides” *J. Am. Chem. Soc.* **2008**, 130, 6686.
- 2) Ryan A. Altman, Brett P. Fors, Stephen L. Buchwald “Pd-Catalyzed Amination Reactions of Aryl Halides Using Bulky Biarylmonophosphine Ligands” *Nature Protocols* **2007**, 2, 2881.
- 1) Harry R. Chobanian, Brett P. Fors, Linus S. Lin “A Facile Microwave-Assisted Palladium-Catalyzed Cyanation of Aryl Chlorides” *Tetrahedron Lett.* **2006**, 47, 3303.

Book Chapters

- 1) Nicolas J. Treat, Brett P. Fors, Craig J. Hawker “Photomediated Controlled Polymerizations” In *Visible Light Photocatalysis in Organic Chemistry*, 2018 Wiley-VCH.

Patents

- 6) Thanh-Tam Truong, Héctor D. Abruña, Geoffrey W. Coates, Brett P. Fors “Redox Active Poly(aryl amine)s and Uses Thereof” Application No. 62/202,040, August 6, 2016.

- 5) Craig J. Hawker, Brett P. Fors, Justin E. Poelma *"Using Organic Photoredox Catalysts to Achieve Metal Free Photoregulated Controlled Radical Polymerization"* Application No. 15/54196, October 6, 2015.
- 4) Craig J. Hawker, Brett P. Fors, Justin E. Poelma, Matthew S. Menyo *"Spatial Patterning of Surfaces with a Photomediated Atom Transfer Radical Addition Reaction"* Application No. 61/871816, August 29, 2013.
- 3) Craig J. Hawker, Brett P. Fors, Justin E. Poelma *"Spatial and Temporal Control over Brush Formation on Surfaces"* Application No. 14/050,098, October 9, 2013.
- 2) Craig J. Hawker, Brett P. Fors *"Control of Living Radical Polymerization by Light"* Application No. PCT/US2013/033933, March 26, 2012.
- 1) Stephen L. Buchwald, Brett P. Fors, David S. Surry *"Ligands for Transition-Metal-Catalyzed Cross-Couplings, and Methods of Use Thereof"* US 7858784, December 28, 2010.

Presentations

Cornell Affiliation (Since 2014)

- 61) Next Generation Smart Materials Symposium; Savannah, GA; December 17, 2019.
- 60) 37th Australasian Polymer Symposium; Gold Coast, Australia; November 12, 2019.
- 59) University of California, Berkeley; Berkeley, CA; September 17, 2019.
- 58) Stanford University; Palo Alto, CA; September 16, 2019.
- 57) ACS National Meeting, Tetrahedron Symposium in Honor of Stephen L. Buchwald; San Diego, CA; August 26, 2019.
- 56) GPC2019, The Polymer and Biomacromolecular Applications and Characterization Conference; New Orleans, LA; July 9, 2019.
- 55) Advanced Polymer Synthesis Summer School; Beijing, China; July 6 and 7, 2019.
- 54) Peking University; Beijing, China; July 4, 2019.
- 53) Pacific Conference on Radical Chemistry; Monterey, CA; June 19, 2019.
- 52) Texas A&M University; College Station, TX; April 26, 2019.
- 51) ACS National Meeting; Orlando, FL; April 3, 2019.
- 50) Bowling Green State University; Bowling Green, OH; March 13, 2019.
- 49) Massachusetts Institute of Technology; Cambridge, MA; February 28, 2019.
- 48) Boston College; Chestnut Hill, MA; February 27, 2019.
- 47) University of California, Santa Barbara; Santa Barbara, CA; February 14, 2019.
- 46) University of California, Los Angeles; Los Angeles, CA; February 13, 2019.
- 45) Arkema; King of Prussia, PA; February 7, 2019.
- 44) University of Florida; Gainesville, FL; January 24, 2019.
- 43) ACS Poly Webinar; November 2, 2018.
- 42) Caltech; Pasadena, CA; October 24, 2018.
- 41) Northwestern University; Evanston, IL; September 21, 2018.
- 40) University of Illinois; Urbana-Champaign, IL; September 13, 2018.
- 39) Columbia University; New York, NY; September 6, 2018.
- 38) ACS National Meeting, Block Polymer Synthesis & Nanoscale Self-Assembly Symposium; Boston, MA; August 22, 2018.

- 37) ACS National Meeting, Tosoh Lectures; Boston, MA; August 21, 2018.
- 36) ACS National Meeting, Young Academic Investigator Symposium; Boston, MA; August 21, 2018.
- 35) Stereochemistry GRC; Newport, RI; Poston and Short Talk; July 25, 2018.
- 34) EuChEMS Conference on Organic Free Radicals; Marseille, France; June 18, 2018.
- 33) ETH Zürich; Zürich, Switzerland; May 7, 2018.
- 32) Baker Symposium, Cornell University; Ithaca, NY; May 5, 2018.
- 31) Carnegie Mellon University; Pittsburgh, PA; May 3, 2018.
- 30) Center for Sustainable Polymers Annual Meeting; University of Minnesota; April 26, 2018.
- 29) Bowdoin College; Brunswick, ME; September 29, 2017.
- 28) 2017-2018 BMS Lecturer of Organic Chemistry; Princeton University; Princeton, NJ; September 5, 2017.
- 27) ACS National Meeting, Overberger Prize Symposium in Honor of Craig Hawker; Washington, DC; August, 2017.
- 26) ACS National Meeting, Journal of Polymer Science Innovation Award Symposium in Honor of Luis Campos; Washington, DC; August, 2017.
- 25) ACS National Meeting, 8th Symposium on Controlled Radical Polymerization; Washington, DC; August, 2017.
- 24) Polymer GRC; Mount Holyoke, MA; June 15, 2018 (Poster).
- 23) Emergent Macromolecular Systems Symposium; Hunter College; New York, NY; June 1, 2017.
- 22) University of Wisconsin, Madison; Student Invited McElvain Seminar; Madison, WI; April 10, 2017.
- 21) ACS National Meeting, Polymer Chemistry Lectureship Symposium; San Francisco, CA; April 4, 2017.
- 20) ACS National Meeting, Switchable Catalysis Symposium; San Francisco, CA; April 3, 2017.
- 19) ACS National Meeting, ACS PMSE Young Investigator Symposium; San Francisco, CA; April 2, 2017.
- 18) The City College of New York; New York, NY; March 27, 2017.
- 17) 36th Australasian Polymer Symposium; Lorne, Australia; November, 23, 2016.
- 16) Clarkson University; Potsdam, NY; September 9, 2016.
- 15) ACS National Meeting, Henkel Award Symposium in honor of Maxwell J. Robb; Philadelphia, PA; August 21, 2016.
- 14) Stereochemistry GRC; Newport, RI; July 24, 2016 (Poster).
- 13) Stereochemistry GRC; Short Talk; Newport, RI; July 24, 2016.
- 12) Japan-US Polymer Chemistry Symposium; Hokkaido, Japan; June 28, 2016.
- 11) Center for Sustainable Polymers Review; University of Minnesota; June 9, 2016.
- 10) 3M; St. Paul, Minnesota; June 2, 2016.
- 9) Center for Sustainable Polymers Meeting; University of Minnesota; April 21, 2016.
- 8) Polymer GRC; Mount Holyoke, MA; June 17, 2015 (Poster).
- 7) Cornell Center for Materials Research Symposium; Ithaca, NY; May 19, 2015.
- 6) PolyChar 23; Lincoln, NE; May 14, 2015.
- 5) PolyChar 23 Short Course; Lincoln, NE; May 11, 2015.

- 4) Cornell Science Sampler Series for Teachers, New York, NY; March 21, 2015.
- 3) SUNY Potsdam, Potsdam, NY; November 4, 2014.
- 2) St. Lawrence University, Canton, NY; November 4, 2014.
- 1) The Dow Chemical Company, Midland, MI; July 9, 2014.

Service

- Academic Integrity Hearing Board, Cornell College of Arts and Sciences; 2019 – present
- Executive Committee, Cornell Center for Materials Research; 2019
- Seminars Committee Chair; 2015 – present
- Curriculum Planning Member; 2016 – present
- Seminars Committee Member; 2014, 2015
- Safety Committee Member; 2014 – 2017
- Graduate Program Committee Member; 2014 – present
- Faculty Search Committee Member; 2014 – present
- Co-Organizer of Stephen L. Buchwald's 60th Birthday Symposium
- Co-Organizer of the Cornell Center for Materials Research Symposium – 2015
- Co-Organizer of the Symposium on Photochemistry and Polymers; 2018 ACS National Meeting
- Reviewer – National Science Foundation, Department of Energy, Petroleum Research Fund
- Reviewer – Journal of the American Chemical Society, Macromolecules, ACS Macro Letters, Polymer Chemistry, Journal of Organic Chemistry, Macromolecular Rapid Communications, Nature Chemistry, Journal of Polymer Science Part A: Polymer Chemistry, Advanced Synthesis and Catalysis, Chemical Reviews, Journal of the Australian Chemical Society

Fors Group Outreach Program

- Harlem Children Zone – 2015, 2018
- Keynote Speaker at the CCMR Cornell Science Sampler Series for Teachers – March 21, 2015
- 4H Science Samplers – 2016, 2017, 2018
- Expanding Your Horizons – 2015, 2018
- East Ithaca Preschool – 2016, 2017, 2018
- Research Experience for Teachers – 2016, 2017, 2018
- Science Saturdays for Elementary Students – 2016
- Cornell Science Sampler Series for Elementary Teachers – 2015, 2015
- Southern Cayuga Elementary School – 2017
- Lansing Library Family Science Event – 2016
- Vestal High School – 2018
- Lansing Middle School – 2018
- Polymer Demonstrations for Children with Disabilities, Franziska Racker's Center – 2015
- Minnesota State Fair Outreach with the Center for Sustainable Polymers – 2018

December 29, 2020

NO. OF DOCUMENTS: 1

Certificate of Accuracy

We do hereby declare that we are fully competent in the language pair, English & Spanish. And that the attached documents "ForsCurriculumVitae112020_SP" hereto is a true translation of the document presented to you from English into Spanish, to the best of our knowledge and belief.

Thank you

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Brett P. Fors

Experiencia laboral

- **2019 – Actualmente**, Profesor Adjunto en el Departamento de Química y de Biología Química de la Universidad Cornell.
- **2014 – 2019**, Profesor Asistente en el Departamento de Química y de Biología Química de la Universidad Cornell.
- **2011 – 2014** Becario de Investigación en el Postdoctorado *Elings* con el Profesor Craig J. Hawker, en el *NanoSystems Institute* de California y en el Laboratorio de Investigación en Ciencia de Materiales de la Universidad de California, Santa Barbara.
- **2006 – 2011** Estudiante de Postgrado con el Profesor Stephen L. Buchwald, en el *Massachusetts Institute of Technology*.
- **2005, 2006** Pasante de Química Medicinal, *Merck and Company*, Rahway, NJ.

Educación

- **2011** Doctorado en Química Orgánica del *Massachusetts Institute of Technology*, Cambridge, MA.
- **2006** Título universitario en Ciencias, especializado en Química, de la *Universidad Montana State University*.

Distinciones y Premios

- Premio *Journal of Polymer Science Innovation* – 2020
- *ACS Organic Division Young Academic Investigator Symposium* – 2018
- Premio *NSF CAREER* – 2018
- Beca de Investigación *Sloan Research* – 2018
- Premio *Arthur K. Doolittle* – 2018
- *JACS Young Investigator Virtual Issue* – 2017, 2018
- Becario de Investigación *Scialog* – 2017
- *ACS PMSE Young Investigator* – 2017
- Premio *3M Non-Tenured Faculty* – 2016
- Premio *PolyChar Bruce Hartman Young Investigator* – 2015
- Premio *Thieme Chemistry Journal* – 2014
- Becario de Investigación *MRL/Dow Travel* – 2013
- Becario de Investigación *Elings in Experimental Science* – 2011
- Becario de Investigación *Bristol-Myers Squibb Graduate* – 2010
- Becario de Investigación *Amgen Summer* – 2010
- *MIT Wyeth Scholar* – 2010
- Becario de Investigación *ACS Organic Division* – 2010
- Premio *Sigma-Aldrich Graduate Student Innovation* – 2009
- Becario de Investigación *Merck Summer* – 2009
- Premio *Roche Symposium: Excellence in Chemistry* – 2009
- Becario de Investigación *William Asbornsen Albert Memorial* – 2009

- Premio Synstar Chemistry – 2006
- Becario de Investigación *Massachusetts Institute of Technology Presidential*– 2006
- Premio EW Mares Chemistry – 2004, 2005

Publicaciones

En Cornell

- 62) Veronika Kottisch, Janis Jermaks, Joe-Yee Mak, Ryan Woltornist, Tristan Lambert, Brett P. Fors “Hydrogen Bond Donor-Catalyzed Cationic Polymerization of Vinyl Ethers” *Angew. Chem. Int. Ed.* **2020**, DOI: 10.1002/anie.202012419.
- 61) Renee J. Sifri, Audrey J. Kennedy, Brett P. Fors “Photocontrolled Cationic Degenerate Chain Transfer Polymerizations via Thioacetal Initiators” *Polym. Chem.* **2020**, 11, 6499.
- 60) Stephanie I. Rosenbloom, Brett P. Fors “Shifting Boundaries: Controlling Molecular Weight Distribution Shape for Mechanically Enhanced Thermoplastic Elastomers” *Macromolecules* **2020**, 53, 7479.
- 59) Michael J. Supej, Brian M. Peterson, Brett P. Fors “Dual Stimuli Switching: Interconverting Cationic and Radical Mechanisms with Electricity and Light” *Chem* **2020**, 6, 1508.
- 58) Erin E. Stache, Veronika Kottisch, Brett P. Fors “Photocontrolled Radical Polymerization from Hydridic C-H Bonds” *J. Am. Chem. Soc.* **2020**, 142, 4581.
- 57) Cara N. Gannett, Brian M. Peterson, Luxi Shen, Jeessoo Seok, Brett P. Fors, Héctor Abruña “Cross-Linking Effects on Performance Metrics of Phanazine-Based Polymer Cathodes” *ChemSusChem* **2020**, 13, 2428.
- 56) Renee J. Sifri, Omar Padilla-Vélez, Geoffrey W. Coates, Brett P. Fors “Controlling the Shape of Molecular Weight Distributions in Coordination Polymerization and Its Impact on Physical Properties” *J. Am. Chem. Soc.* **2020**, 142, 1443.
- 55) Stephanie I. Rosenbloom, Dillon T. Gentekos, Brett P. Fors “Tailor-Made Elastomers: Customisable Materials via Modulation of Molecular Weight Distribution” *Chem. Sci.* **2020**, DOI: 10.1039/C9SC05278J.
- 54) Dillon T. Gentekos, Renee J. Sifri, Brett P. Fors “Controlling Polymer Properties Through the Shape of the Molecular-Weight Distribution” *Nat. Rev. Mater.* **2019**, 4, 761.
- 53) Angelika E. Neitzel, Leonel Barreda, Jacob T. Trotta, Grant W. Fahnhorst, Thomas J. Haversang, Thomas R. Hoyer, Brett P. Fors, Marc A. Hillmyer “Hydrolytically-Degradable Homo- and Copolymers of a Strained Exocyclic Hemiacetal Ester” *Polym. Chem.* **2019**, 10, 4573.
- 52) Veronika Kottisch, Jacob O’Leary, Quentin Michaudel, Erin E. Stache, Tristan H. Lambert, Brett P. Fors “Controlled Cationic Polymerization: Single-Component Initiation Under Ambient Conditions” *J. Am. Chem. Soc.* **2019**, 141, 10605.
- 51) Sergii Domanskyi, Dillon T. Gentekos, Vladimir Privman, Brett P. Fors “Predictive Design of Polymer Molecular Weight Distributions in Anionic Polymerization” *Polym. Chem.* **2020**, 11, 326.
- 50) Brian M. Peterson, Luxi Shen, Gerickson J. Lopez, Cara N. Gannett, Dong Ren, Héctor D. Abruña, Brett P. Fors “Elucidation of the Electrochemical Behavior of Phenothiazine-Based Polyaromatic Amines” *Tetrahedron* **2019**, 75, 4244.
- 49) Jacob T. Trotta, Annabelle Watts, Allison R. Wong, Anne M. LaPointe, Marc A. Hillmyer, Brett P. Fors “Renewable Thermosets and Thermoplastics from Itaconic Acid” *ACS Sustainable Chem. Eng.* **2019**, 7, 2691.
- 48) Neil D. Dolinski, Zachariah A. Page, Emre H. Discekici, David Meis, In-Hwan Lee, Glen R. Jones, Richard Whitfield, Xiangcheng Pan, Blaine G. McCarthy, Sivaprakash Shanmugam, Veronika Kottisch, Brett P. Fors, Cyrille Boyer, Garret M. Miyake, Krzysztof Matyjaszewski, David

- M. Haddleton, Javier Read de Alaniz, Athina Anastasaki, Craig J. Hawker "What Happens in the Dark? Assessing the Temporal Control of Photo-Mediated Controlled Radical Polymerizations" *J. Polym. Sci. A Polym. Chem.* **2019**, 57, 268.
- 47) Brian M. Peterson, Veronika Kottisch, Michael J. Supej, Brett P. Fors "On Demand Switching of Polymerization Mechanism and Monomer Selectivity with Orthogonal Stimuli" *ACS Cent. Sci.* **2018**, 4, 1228.
- 46) Brian M. Peterson, Dong Ren, Luxi Shen, You-Chi Mason Wu, Burak Ulgut, Geoffrey W. Coates, Héctor D. Abruña, Brett P. Fors "Phenothiazine-Based Polymer Cathode Materials with Ultrahigh Power Densities for Lithium Ion Batteries" *ACS Appl. Energy Mat.* **2018**, 1, 3560.
- 45) Dillon T. Gentekos, Brett P. Fors "Molecular Weight Distribution Shape as a Versatile Approach to Tailoring Block Copolymer Phase Behavior" *ACS Macro Lett.* **2018**, 7, 677.
- 44) Veronika Kottisch, Michael J. Supej, Brett P. Fors "Enhancing Temporal Control and Enabling Chain-End Modification in Photoregulated Cationic Polymerizations Using Ir-Based Catalysts" *Angew. Chem. Int. Ed.* **2018**, 57, 8260.
- 43) Dillon T. Gentekos, Junteng Jia, Erika S. Tirado, Katherine P. Barteau, Detlef-M. Smilgies, Robert A. DiStasio Jr., Brett P. Fors "Exploiting Molecular Weight Distribution Shape to Tune Domain Spacing in Block Copolymer Thin Films" *J. Am. Chem. Soc.* **2018**, 140, 4639.
- 42) Brian M. Peterson, Song Lin, Brett P. Fors "Electrochemically Controlled Cationic Polymerization of Vinyl Ethers" *J. Am. Chem. Soc.* **2018**, 140, 2076.
- 41) Quentin Michaudel, Timothée Chauviré, Veronika Kottisch, Michael J. Supej, Katherine J. Stawiasz, Luxi Shen, Warren R. Zipfel, Héctor D. Abruña, Jack H. Freed, Brett P. Fors "Mechanistic Insight into the Photocontrolled Cationic Polymerization of Vinyl Ethers" *J. Am. Chem. Soc.* **2017**, 139, 15530.
- 40) Veronika Kottisch, Quentin Michaudel, Brett P. Fors "Photocontrolled Interconversion of Cationic and Radical Polymerizations" *J. Am. Chem. Soc.* **2017**, 139, 10665.
- 39) Milena Nadgorny, Dillon T. Gentekos, Zeyun Xiao, S. Parker Singleton, Brett P. Fors, Luke A. Connal "Manipulation of Molecular Weight Distribution Shape as a New Strategy to Control Processing Parameters" *Macromol. Rapid Commun.* **2017**, 1700352.
- 38) Jacob T. Trotta, Mengjuan Jin, Katherine J. Stawiasz, Quentin Michaudel, Wei-Liang Chen, Brett P. Fors "Synthesis of Methylene Butyrolactone Polymers from Itaconic Acid" *J. Polym. Sci. A Polym. Chem.* **2017**, 55, 2730.
- 37) Quentin Michaudel, Veronika Kottisch, Brett P. Fors "Cationic Polymerization: From Photoinitiation to Photocontrol" *Angew. Chem. Int. Ed.* **2017**, 56, 9670.
- 36) Veronika Kottisch, Quentin Michaudel, Brett P. Fors "Cationic Polymerization of Vinyl Ethers Controlled by Visible Light" *J. Am. Chem. Soc.* **2016**, 138, 15535.
- 35) Quentin Michaudel, Brett P. Fors "Storing Information at the Molecular Level: Efficient Synthesis of 'Barcode' Polymers" *Chem.* **2016**, 1, 23.
- 34) Veronika Kottisch, Dillon T. Gentekos, Brett P. Fors "Shaping the Future of Molecular Weight Distributions in Anionic Polymerization" *ACS Macro Lett.* **2016**, 5, 796.
- 33) Joe Collins, Zehun Xiao, Andrea Espinosa-Gomez, Brett P. Fors, Luke A. Connal "Extremely Rapid and Versatile Synthesis of High Molecular Weight Step Growth Polymers via Oxime Click Chemistry" *Polym. Chem.* **2016**, 7, 2581.
- 32) Dillon T. Gentekos, Lauren N. Dupuis, Brett P. Fors "Beyond Dispersity: Deterministic Control of Polymer Molecular Weight Distributions" *J. Am. Chem. Soc.* **2016**, 138, 1848.
- 31) Jacob T. Trotta, Brett P. Fors "Organic Catalysts for Photocontrolled Polymerizations" *Synlett* **2016**, 27, 702.

- 30) You-Chi Mason Wu, Michel F. Molaire, David S. Weiss, Felipe A. Angel, Catherine R. DeBlase, Brett P. Fors "Synthesis of Amorphous Monomeric Glass Mixtures for Organic Electronic Applications" *J. Org. Chem.*, **2015**, 80, 12740.
- 29) Nicolas J. Treat, Hazel Sprafke, John W. Kramer, Paul G. Clark, Bryan E. Barton, Javier Read de Alaniz, Brett P. Fors, Craig J. Hawker "Metal-Free Atom Transfer Radical Polymerization" *J. Am. Chem. Soc.* **2014**, 136, 16096.

Previo a Cornell

- 28) Hannah P. Luehmann, Lisa Detering, Brett P. Fors, Eric D. Pressly, Pamela K. Woodard, Gwendalyn J. Randolph, Robert J. Gropler, Craig J. Hawker, Yongjian Liu "PET/CT Imaging of Chemokine Receptors in Inflammatory Atherosclerosis Using Targeted Nanoparticles" *J. Nucl. Med.* **2016**, 57, 1124.
- 27) Anna Melker, Brett P. Fors, Craig J. Hawker, Justin E. Poelma "Continuous Flow Synthesis of Poly(methyl methacrylate) via a Light-Mediated Controlled Radical Polymerization" *J. Polym. Sci., Part A: Polym. Chem.* **2015**, 53, 2693.
- 26) Nicolas J. Treat, Brett P. Fors, John W. Kramer, Matthew Christianson, Chien-Yang Chiu, Javier Read de Alaniz, Craig J. Hawker "Controlled Radical Polymerization of Acrylates Regulated by Visible Light" *ACS Macro Lett.* **2014**, 3, 580.
- 25) Maxwell J. Robb, Brandon Newton, Brett P. Fors, Craig J. Hawker "One-Step Synthesis of Unsymmetrical N-Alkyl-N'-Aryl Perylene Diimides" *J. Org. Chem.* **2014**, 79, 6360.
- 24) Lauren M. Misch, Alexander Birkel, C. Adrian Figg, Brett P. Fors, Craig J. Hawker, Galen D. Stucky, Ram Seshadri "Rapid Microwave-Assisted Sol-Gel Preparation of Pd-Substituted LnFeO_3 ($\text{Ln} = \text{Y}, \text{La}$): Phase Formation and Catalytic Activity" *Dalton Trans.* **2014**, 43, 2079.
- 23) Brett P. Fors, Justin E. Poelma, Matthew S. Menyo, Maxwell J. Robb, Daniel M. Spokoyny, John W. Kramer, J. Herbert Waite, Craig J. Hawker "Fabrication of Unique Chemical Patterns and Surface Concentration Gradients with Visible Light" *J. Am. Chem. Soc.* **2013**, 135, 14106.
- 22) Justin E. Poelma, Brett P. Fors, Gregory F. Meyers, John W. Kramer, Craig J. Hawker "Fabrication of Complex 3-Dimensional Polymer Brush Nanostructures via Light-Mediated Living Radical Polymerization" *Angew. Chem. Int. Ed.* **2013**, 52, 6844.
- 21) Frank A. Leibfarth, Kaila M. Mattson, Brett P. Fors, Hazel A. Collins, Craig J. Hawker "External Regulation of Controlled Polymerizations" *Angew. Chem. Int. Ed.* **2013**, 52, 199.
- 20) Brett P. Fors, Craig J. Hawker "Control of a Living Radical Polymerization of Methacrylates by Light" *Angew. Chem. Int. Ed.* **2012**, 51, 8850.
- 19) Ekaterina V. Vinogradova, Nathaniel H. Park, Brett P. Fors, Stephen L. Buchwald "Palladium-Catalyzed Synthesis of N-Aryl Carbamates" *Org. Lett.* **2013**, 15, 1394.
- 18) Ekaterina V. Vinogradova, Brett P. Fors, Stephen L. Buchwald "Palladium-Catalyzed Cross-Coupling of Aryl Chlorides and Triflates with Sodium Cyanate: A Practical Synthesis of Unsymmetrical Ureas" *J. Am. Chem. Soc.* **2012**, 134, 11132.
- 17) Satoshi Ueda, Siraj Ali, Brett P. Fors, Stephen L. Buchwald " $\text{Me}_3(\text{OMe})\text{tBuXPhos}$: A Surrogate Ligand for $\text{Me}_4\text{tBuXPhos}$ in Palladium-Catalyzed C-N and C-O Bond-Forming Reactions" *J. Org. Chem.* **2012**, 77, 2543.
- 16) Simon Breitler, Nathan J. Oldenhuis, Brett P. Fors, Stephen L. Buchwald "Synthesis of Unsymmetrical Diarylureas via Pd-Catalyzed C-N Cross-Coupling Reactions" *Org. Lett.* **2011**, 13, 3262.
- 15) Brett P. Fors and Stephen L. Buchwald "Commentary on 'A New, Efficient and Recyclable Lanthanum(III) Oxide-Catalyzed C-N Cross-Coupling' by S. Narayana Murthy, B. Madhav, V.

- Prakash Reddy, and Y. V. D. Nageswar, *Adv. Synth. Catal.* **2010**, 352, 3241–3245” *Adv. Synth. Catal.* **2010**, 352, 3119.
- 14) Brett P. Fors, Stephen L. Buchwald “A Multiligand Based Pd Catalyst for C–N Cross-Coupling Reactions” *J. Am. Chem. Soc.* **2010**, 132, 15914.
 - 13) Xiaoxing Wu, Brett P. Fors, Stephen L. Buchwald “A Single Phosphine Ligand Allows Palladium-Catalyzed Intermolecular C–O Bond Formation with Secondary and Primary Alcohols” *Angew. Chem. Int. Ed.* **2011**, 50, 9943.
 - 12) Debrata Maiti, Brett P. Fors, Jaclyn L. Henderson, Yoshinori Nakamura, Stephen L. Buchwald “Palladium-Catalyzed Coupling of Functionalized Primary and Secondary Amines with Aryl and Heteroaryl Halides: Two Ligands Suffice in Most Cases” *Chem. Sci.* **2011**, 2, 57.
 - 11) Karin Dooleweerd, Brett P. Fors, Stephen L. Buchwald “Pd-Catalyzed Cross-Coupling of Amides and Aryl Mesylates” *Org. Lett.* **2010**, 12, 2350.
 - 10) Brett P. Fors, Stephen L. Buchwald “Pd-Catalyzed Conversion of Aryl Chlorides, Triflates, and Nonaflates to Nitroaromatics” *J. Am. Chem. Soc.* **2009**, 131, 12898.
 - 9) John R. Naber, Brett P. Fors, Xiaoxing Wu, Jonathon T. Gunn, Stephen L. Buchwald “Stille Cross-Coupling Reactions of Aryl Mesylates and Tosylates Using a Biarylphosphine Based Catalyst System” *Heterocycles* **2010**, 80, 1215.
 - 8) Brijesh Bhayana, Brett P. Fors, Stephen L. Buchwald “A Versatile Catalyst System for Suzuki-Miyaura Cross-Coupling Reactions of C(sp²)-Tosylates and Mesylates” *Org. Lett.* **2009**, 11, 3954.
 - 7) Brett P. Fors, Karin Dooleweerd, Qingle Zeng, Stephen L. Buchwald “An Efficient System for the Pd-Catalyzed Cross-Coupling of Amides and Aryl Chlorides” *Tetrahedron* **2009**, 65, 6576.
 - 6) Brett P. Fors, Nicole R. Davis, Stephen L. Buchwald “An Efficient Process for Pd-Catalyzed C–N Cross-Coupling Reactions of Aryl Iodides: Insight Into Controlling Factors” *J. Am. Chem. Soc.* **2009**, 131, 5766.
 - 5) Brett P. Fors, Donald A. Watson, Mark R. Biscoe, Stephen L. Buchwald “A Highly Active Catalyst for Pd-Catalyzed Amination Reactions: Cross-Coupling Reactions Using Aryl Mesylates and the Highly Selective Monoarylation of Primary Amines Using Aryl Chlorides” *J. Am. Chem. Soc.* **2008**, 130, 13552.
 - 4) Brett P. Fors, Philip Krattiger, Eric Strieter, Stephen L. Buchwald “Water-Mediated Catalyst Preactivation: An Efficient Protocol for C–N Cross-Coupling Reactions” *Org. Lett.* **2008**, 10, 3505.
 - 3) Mark R. Biscoe, Brett P. Fors, Stephen L. Buchwald “A New Class of Easily Activated Palladium Precatalysts for Facile C–N Cross-Coupling Reactions and the Low Temperature Oxidative Addition of Aryl Chlorides” *J. Am. Chem. Soc.* **2008**, 130, 6686.
 - 2) Ryan A. Altman, Brett P. Fors, Stephen L. Buchwald “Pd-Catalyzed Amination Reactions of Aryl Halides Using Bulky Biarylmonophosphine Ligands” *Nature Protocols* **2007**, 2, 2881.
 - 1) Harry R. Chobanian, Brett P. Fors, Linus S. Lin “A Facile Microwave-Assisted Palladium-Catalyzed Cyanation of Aryl Chlorides” *Tetrahedron Lett.* **2006**, 47, 3303.

Capítulos de Libro

- 1) Nicolas J. Treat, Brett P. Fors, Craig J. Hawker “Photomediated Controlled Polymerizations” en *Visible Light Photocatalysis in Organic Chemistry*, 2018 Wiley-VCH.

Patentes

- 6) Thanh-Tam Truong, Héctor D. Abruña, Geoffrey W. Coates, Brett P. Fors “*Redox Active Poly(aryl amine)s and Uses Thereof*” No. de solicitud 62/202,040, 6 de agosto de 2016.
- 5) Craig J. Hawker, Brett P. Fors, Justin E. Poelma “*Using Organic Photoredox Catalysts to Achieve Metal Free Photoregulated Controlled Radical Polymerization*” No. de solicitud 15/54196, 6 de octubre de 2015.
- 4) Craig J. Hawker, Brett P. Fors, Justin E. Poelma, Matthew S. Menyo “*Spatial Patterning of Surfaces with a Photomediated Atom Transfer Radical Addition Reaction*” No. de solicitud 61/871816, 29 de agosto de 2013.
- 3) Craig J. Hawker, Brett P. Fors, Justin E. Poelma “*Spatial and Temporal Control over Brush Formation on Surfaces*” No. de solicitud 14/050,098, 9 de octubre de 2013.
- 2) Craig J. Hawker, Brett P. Fors “*Control of Living Radical Polymerization by Light*” No. de solicitud PCT/US2013/033933, 26 de marzo de 2012.
- 1) Stephen L. Buchwald, Brett P. Fors, David S. Surry “*Ligands for Transition-Metal-Catalyzed Cross-Couplings, and Methods of Use Thereof*” US 7858784, 28 de diciembre de 2010.

Presentaciones*En Cornell (desde 2014)*

- 61) Simposio Próxima generación de materiales inteligentes (*Next Generation Smart Materials Symposium*); Savannah, GA; 17 de diciembre de 2019.
- 60) 37° simposio australasiano de polímeros (37th *Australasian Polymer Symposium*); Costa Dorada, Australia; 12 de noviembre de 2019.
- 59) Universidad de California, Berkeley; Berkeley, CA; 17 de setiembre de 2019.
- 58) Universidad de Stanford; Palo Alto, CA; 16 de setiembre de 2019.
- 57) *ACS National Meeting, Tetrahedron Symposium* en honor a Stephen L. Buchwald; San Diego, CA; 26 de agosto de 2019.
- 56) GPC2019, Conferencia de las aplicaciones y caracterización de plímeros y biomacromoleculares. (*The Polymer and Biomacromolecular Applications and Characterization Conference*); New Orleans, LA; 9 de julio de 2019.
- 55) Escuela de verano de síntesis avanzada de plímeros (*Advanced Polymer Synthesis Summer School*); Beijing, China; 6 y 7 de julio de 2019.
- 54) Universidad de Pekin; Beijing, China; 4 de julio de 2019.
- 53) Conferencia del Pacífico en Química Radical (*Pacific Conference on Radical Chemistry*); Monterey, CA; 19 de junio de 2019.
- 52) Universidad de Texas A&M; College Station, TX; 26 de abril de 2019.
- 51) *ACS National Meeting*; Orlando, FL; 3 de abril de 2019.
- 50) Universidad Estatal Bowling Green; Bowling Green, OH; 13 de marzo 2019.
- 49) *Massachusetts Institute of Technology*; Cambridge, MA; 28 de febrero de 2019.
- 48) *Boston College*; Chestnut Hill, MA; 27 de febrero de 2019.
- 47) Universidad de California, Santa Barbara; Santa Barbara, CA; 14 de febrero de 2019.

- 46) Universidad de California, Los Angeles; Los Angeles, CA; 13 de febrero de 2019.
- 45) *Arkema*; King of Prussia, PA; 7 de febrero de 2019.
- 44) Universidad de Florida; Gainesville, FL; 24 de enero de 2019.
- 43) Seminario web *ACS Poly*; 2 de noviembre de 2018.
- 42) *Caltech*; Pasadena, CA; 24 de octubre de 2018.
- 41) Universidad Northwestern; Evanston, IL; 21 de setiembre de 2018.
- 40) Universidad de Illinois; Urbana-Champaign, IL; 13 de setiembre de 2018.
- 39) Universidad Columbia; New York, NY; 6 de setiembre de 2018.
- 38) Simposio de síntesis de polímeros en bloque y autoensamblaje a nanoescala *ACS National Meeting, (Block Polymer Synthesis & Nanoscale Self-Assembly Symposium)*; Boston, MA; 22 de agosto de 2018.
- 37) *ACS National Meeting, Tosoh Lectures*; Boston, MA; 21 de agosto de 2018.
- 36) *ACS National Meeting, Young Academic Investigator Symposium*; Boston, MA; 21 de agosto de 2018.
- 35) *Stereochemistry GRC; Newport, RI; Poston and Short Talk*; 25 de julio de 2018.
- 34) Conferencia *EuCheMS* sobre Radicales libres orgánicos (*EuCheMS Conference on Organic Free Radicals*); Marsella, Francia, 18 de junio de 2018.
- 33) *ETH Zürich*; Zürich, Suiza; 7 de mayo de 2018.
- 32) *Baker Symposium*, Universidad Cornell; Ithaca, NY; 5 de mayo de 2018.
- 31) Universidad Carnegie Mellon; Pittsburgh, PA; 3 de mayo de 2018.
- 30) Reunión anual del Centro de polímeros sustentables (*Center for Sustainable Polymers Annual Meeting*); Universidad de Minnesota; 26 de abril de 2018.
- 29) *Bowdoin College*; Brunswick, ME; 29 de setiembre de 2017.
- 28) 2017-2018 Orador BMS de Química Orgánica (*BMS Lecturer of Organic Chemistry*); Universidad de Princeton; Princeton, NJ; 5 de setiembre de 2017.
- 27) *ACS National Meeting*, Premio *Overberger*, simposio en honor a Craig Hawker; Washington, DC; agosto de 2017.
- 26) *ACS National Meeting*, Premio *Journal of Polymer Science Innovation*, simposio en honor a Luis Campos; Washington, DC; agosto de 2017.
- 25) *ACS National Meeting*, 8° simposio de polimerización radical controlada (*8th Symposium on Controlled Radical Polymerization*); Washington, DC; agosto de 2017.
- 24) *Polymer GRC*; Mount Holyoke, MA; 15 de junio de 2018 (Póster).
- 23) Simposio de sistemas macromoleculares emergentes (*Emergent Macromolecular Systems Symposium*); *Hunter College*; New York, NY; 1 de junio de 2017.
- 22) Universidad de Wisconsin, Madison; Seminario con invitación a estudiantes *McElvain*; Madison, WI; 10 de abril de 2017.
- 21) *ACS National Meeting*, Simposio Química de plímeros (*Polymer Chemistry Lectureship Symposium*); San Francisco, CA; 4 de abril de 2017.
- 20) *ACS National Meeting*, Simposio de catálisis conmutable (*Switchable Catalysis Symposium*); San Francisco, CA; 3 de abril de 2017.
- 19) *ACS National Meeting, ACS PMSE Young Investigator Symposium*; San Francisco, CA; 2 de abril de 2017.
- 18) *The City College of New York*; New York, NY; 27 de marzo de 2017.

- 17) 36° simposio australasiano de polímeros (36th Australasian Polymer Symposium); Lorne, Australia; 23 de noviembre de 2016.
- 16) Universidad de Clarkson; Potsdam, NY; 9 de setiembre de 2016.
- 15) ACS National Meeting, Simposio premio Henkel en honor a Maxwell J. Robb; Philadelphia, PA; 21 de agosto de 2016.
- 14) Stereochemistry GRC; Newport, RI; 24 de julio de 2016 (Póster).
- 13) Stereochemistry GRC; Charla corta, Newport, RI; 24 de julio de 2016.
- 12) Simposio de química de polímeros, Japón - USA (Japan-US Polymer Chemistry Symposium); Hokkaido, Japón; 28 de junio de 2016.
- 11) Reseña de Centro de polímeros sustentables (Center for Sustainable Polymers Review); Universidad de Minnesota; 9 de junio de 2016.
- 10) 3M; St. Paul, Minnesota; 2 de junio de 2016.
- 9) Encuentro Centro de polímeros sustentables (Center for Sustainable Polymers Meeting); Universidad de Minnesota; 21 de abril de 2016.
- 8) Polymer GRC; Mount Holyoke, MA; 17 de junio de 2015 (Póster).
- 7) Simposio Centro Cornell de investigación de Ciencia de Materiales (Cornell Center for Materials Research Symposium); Ithaca, NY; 19 de mayo de 2015.
- 6) PolyChar 23; Lincoln, NE; 14 de mayo de 2015.
- 5) PolyChar 23 curso corto; Lincoln, NE; 11 de mayo de 2015.
- 4) Cornell Science Sampler Series for teachers, New York, NY; 21 de marzo de 2015.
- 3) SUNY Potsdam, Potsdam, NY; 4 de noviembre de 2014.
- 2) Universidad de St. Lawrence, Canton, NY; 4 de noviembre de 2014.
- 1) The Dow Chemical Company, Midland, MI; 9 de julio de 2014.

Servicios

- Junta de Integridad Académica, Cornell, Facultad de Artes y Ciencias; 2019 – actualmente.
- Comité ejecutivo, Centro Cornell de Investigación de Ciencia de Materiales; 2019
- Presidente del comité de seminarios; 2015 – actualmente.
- Miembro de planificación curricular; 2016 – actualmente.
- Miembro de comité de seminarios 2014, 2015
- Miembro de comité de seguridad; 2014 – 2017
- Miembro de comité del programa de posgrado; 2014 – actualmente.
- Miembro del comité de contratación de profesores 2014 – present
- Coorganizador del simposio Stephen L. Buchwald's 60th Birthday
- Coorganizador del simposio Centro Cornell para la investigación de Ciencia de Materiales– 2015
- Coorganizador del simposio de Fotoquímica y Polímeros; 2018 ACS National Meeting
- Crítico – Fundación de Ciencias Naturales, Departamento de Energía, Petroleum Research Fund
- Crítico – Journal of the American Chemical Society, Macromolecules, ACS Macro Letters, Polymer Chemistry, Journal of Organic Chemistry, Macromolecular Rapid Communications, Nature Chemistry,

Journal of Polymer Science Part A: Polymer Chemistry, Advanced Synthesis and Catalysis, Chemical Reviews, Journal of the Australian Chemical Society

Programa de Divulgación del Grupo Fors

- *Harlem Children Zone* – 2015, 2018
- Orador principal en el *CCMR Cornell Science Sampler Series for Teachers* – 21 de marzo de 2015
- *4H Science Samplers* – 2016, 2017, 2018
- *Expanding Your Horizons* – 2015, 2018
- *East Ithaca Preschool* – 2016, 2017, 2018
- *Research Experience for Teachers* – 2016, 2017, 2018
- *Science Saturdays for Elementary Students* – 2016
- *Cornell Science Sampler Series for Elementary Teachers* – 2015, 2015
- *Southern Cayuga Elementary School* – 2017
- *Lansing Library Family Science Event* – 2016
- *Vestal High School* – 2018
- *Lansing Middle School* – 2018
- Demostraciones con polímeros para niños con discapacidades, *Franziska Racker's Center* – 2015
- *Minnesota State Fair Outreach with the Center for Sustainable Polymers* – 2018

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Brett P. Fors

Employment

- **2019 – Present**, Associate Professor, Department of Chemistry and Chemical Biology, Cornell University
- **2014 – 2019**, Assistant Professor, Department of Chemistry and Chemical Biology, Cornell University
- **2011 – 2014** Elings Postdoctoral Fellow with Professor Craig J. Hawker, California NanoSystems Institute and Materials Research Laboratory, University of California, Santa Barbara
- **2006 – 2011** Graduate Student with Professor Stephen L. Buchwald, Massachusetts Institute of Technology
- **2005, 2006** Medicinal Chemistry Intern, Merck and Company, Rahway, NJ

Education

- **2011** Ph.D. in Organic Chemistry, Massachusetts Institute of Technology, Cambridge, MA
- **2006** B.Sc. in Chemistry, Montana State University, Bozeman, MT

Honors and Awards

- Journal of Polymer Science Innovation Award – 2020
- ACS Organic Division Young Academic Investigator Symposium – 2018
- NSF CAREER Award – 2018
- Sloan Research Fellowship – 2018
- Arthur K. Doolittle Award – 2018
- JACS Young Investigator Virtual Issue – 2017, 2018
- Scialog Fellow – 2017
- ACS PMSE Young Investigator – 2017
- 3M Non-Tenured Faculty Award – 2016
- PolyChar Bruce Hartman Young Investigator Prize – 2015
- Thieme Chemistry Journal Award – 2014
- MRL/Dow Travel Fellowship – 2013
- Elings Fellowship in Experimental Science – 2011
- Bristol-Myers Squibb Graduate Fellowship – 2010
- Amgen Summer Fellowship – 2010
- MIT Wyeth Scholar – 2010
- ACS Organic Division Fellowship – 2010
- Sigma-Aldrich Graduate Student Innovation Award – 2009
- Merck Summer Fellowship – 2009
- Roche Symposium: Excellence in Chemistry Award – 2009
- William Asbornsen Albert Memorial Fellowship – 2009
- Synstar Chemistry Award – 2006
- Massachusetts Institute of Technology Presidential Fellowship – 2006

- EW Mares Chemistry Award – 2004, 2005

Publications

Cornell Affiliation

- 62) Veronika Kottisch, Janis Jermaks, Joe-Yee Mak, Ryan Woltornist, Tristan Lambert, Brett P. Fors *"Hydrogen Bond Donor-Catalyzed Cationic Polymerization of Vinyl Ethers"* *Angew. Chem. Int. Ed.* **2020**, DOI: 10.1002/anie.202012419.
- 61) Renee J. Sifri, Audrey J. Kennedy, Brett P. Fors *"Photocontrolled Cationic Degenerate Chain Transfer Polymerizations via Thioacetal Initiators"* *Polym. Chem.* **2020**, 11, 6499.
- 60) Stephanie I. Rosenbloom, Brett P. Fors *"Shifting Boundaries: Controlling Molecular Weight Distribution Shape for Mechanically Enhanced Thermoplastic Elastomers"* *Macromolecules* **2020**, 53, 7479.
- 59) Michael J. Supej, Brian M. Peterson, Brett P. Fors *"Dual Stimuli Switching: Interconverting Cationic and Radical Mechanisms with Electricity and Light"* *Chem* **2020**, 6, 1508.
- 58) Erin E. Stache, Veronika Kottisch, Brett P. Fors *"Photocontrolled Radical Polymerization from Hydridic C-H Bonds"* *J. Am. Chem. Soc.* **2020**, 142, 4581.
- 57) Cara N. Gannett, Brian M. Peterson, Luxi Shen, Jeessoo Seok, Brett P. Fors, Héctor Abruña *"Cross-Linking Effects on Performance Metrics of Phanazine-Based Polymer Cathodes"* *ChemSusChem* **2020**, 13, 2428.
- 56) Renee J. Sifri, Omar Padilla-Vélez, Geoffrey W. Coates, Brett P. Fors *"Controlling the Shape of Molecular Weight Distributions in Coordination Polymerization and Its Impact on Physical Properties"* *J. Am. Chem. Soc.* **2020**, 142, 1443.
- 55) Stephanie I. Rosenbloom, Dillon T. Gentekos, Brett P. Fors *"Tailor-Made Elastomers: Customisable Materials via Modulation of Molecular Weight Distribution"* *Chem. Sci.* **2020**, DOI: 10.1039/C9SC05278J.
- 54) Dillon T. Gentekos, Renee J. Sifri, Brett P. Fors *"Controlling Polymer Properties Through the Shape of the Molecular-Weight Distribution"* *Nat. Rev. Mater.* **2019**, 4, 761.
- 53) Angelika E. Neitzel, Leonel Barreda, Jacob T. Trotta, Grant W. Fahnhorst, Thomas J. Haversang, Thomas R. Hoyer, Brett P. Fors, Marc A. Hillmyer *"Hydrolytically-Degradable Homo- and Copolymers of a Strained Exocyclic Hemiacetal Ester"* *Polym. Chem.* **2019**, 10, 4573.
- 52) Veronika Kottisch, Jacob O'Leary, Quentin Michaudel, Erin E. Stache, Tristan H. Lambert, Brett P. Fors *"Controlled Cationic Polymerization: Single-Component Initiation Under Ambient Conditions"* *J. Am. Chem. Soc.* **2019**, 141, 10605.
- 51) Sergii Domanskyi, Dillon T. Gentekos, Vladimir Privman, Brett P. Fors *"Predictive Design of Polymer Molecular Weight Distributions in Anionic Polymerization"* *Polym. Chem.* **2020**, 11, 326.
- 50) Brian M. Peterson, Luxi Shen, Gerickson J. Lopez, Cara N. Gannett, Dong Ren, Héctor D. Abruña, Brett P. Fors *"Elucidation of the Electrochemical Behavior of Phenothiazine-Based Polyaromatic Amines"* *Tetrahedron* **2019**, 75, 4244.
- 49) Jacob T. Trotta, Annabelle Watts, Allison R. Wong, Anne M. LaPointe, Marc A. Hillmyer, Brett P. Fors *"Renewable Thermosets and Thermoplastics from Itaconic Acid"* *ACS Sustainable Chem. Eng.* **2019**, 7, 2691.
- 48) Neil D. Dolinski, Zachariah A. Page, Emre H. Discekici, David Meis, In-Hwan Lee, Glen R. Jones, Richard Whitfield, Xiangcheng Pan, Blaine G. McCarthy, Sivaprakash Shanmugam, Veronika Kottisch, Brett P. Fors, Cyrille Boyer, Garret M. Miyake, Krzysztof Matyjaszewski, David M. Haddleton, Javier Read de Alaniz, Athina Anastasaki, Craig J. Hawker *"What Happens in the*

- Dark? Assessing the Temporal Control of Photo-Mediated Controlled Radical Polymerizations* *J. Polym. Sci. A Polym. Chem.* **2019**, 57, 268.
- 47) Brian M. Peterson, Veronika Kottisch, Michael J. Supej, Brett P. Fors “*On Demand Switching of Polymerization Mechanism and Monomer Selectivity with Orthogonal Stimuli*” *ACS Cent. Sci.* **2018**, 4, 1228.
- 46) Brian M. Peterson, Dong Ren, Luxi Shen, You-Chi Mason Wu, Burak Ulgut, Geoffrey W. Coates, Héctor D. Abruña, Brett P. Fors “*Phenothiazine-Based Polymer Cathode Materials with Ultrahigh Power Densities for Lithium Ion Batteries*” *ACS Appl. Energy Mat.* **2018**, 1, 3560.
- 45) Dillon T. Gentekos, Brett P. Fors “*Molecular Weight Distribution Shape as a Versatile Approach to Tailoring Block Copolymer Phase Behavior*” *ACS Macro Lett.* **2018**, 7, 677.
- 44) Veronika Kottisch, Michael J. Supej, Brett P. Fors “*Enhancing Temporal Control and Enabling Chain-End Modification in Photoregulated Cationic Polymerizations Using Ir-Based Catalysts*” *Angew. Chem. Int. Ed.* **2018**, 57, 8260.
- 43) Dillon T. Gentekos, Junteng Jia, Erika S. Tirado, Katherine P. Barteau, Detlef-M. Smilgies, Robert A. DiStasio Jr., Brett P. Fors “*Exploiting Molecular Weight Distribution Shape to Tune Domain Spacing in Block Copolymer Thin Films*” *J. Am. Chem. Soc.* **2018**, 140, 4639.
- 42) Brian M. Peterson, Song Lin, Brett P. Fors “*Electrochemically Controlled Cationic Polymerization of Vinyl Ethers*” *J. Am. Chem. Soc.* **2018**, 140, 2076.
- 41) Quentin Michaudel, Timothée Chauviré, Veronika Kottisch, Michael J. Supej, Katherine J. Stawiasz, Luxi Shen, Warren R. Zipfel, Héctor D. Abruña, Jack H. Freed, Brett P. Fors “*Mechanistic Insight into the Photocontrolled Cationic Polymerization of Vinyl Ethers*” *J. Am. Chem. Soc.* **2017**, 139, 15530.
- 40) Veronika Kottisch, Quentin Michaudel, Brett P. Fors “*Photocontrolled Interconversion of Cationic and Radical Polymerizations*” *J. Am. Chem. Soc.* **2017**, 139, 10665.
- 39) Milena Nadgorny, Dillon T. Gentekos, Zeyun Xiao, S. Parker Singleton, Brett P. Fors, Luke A. Connal “*Manipulation of Molecular Weight Distribution Shape as a New Strategy to Control Processing Parameters*” *Macromol. Rapid Commun.* **2017**, 1700352.
- 38) Jacob T. Trotta, Mengjuan Jin, Katherine J. Stawiasz, Quentin Michaudel, Wei-Liang Chen, Brett P. Fors “*Synthesis of Methylene Butyrolactone Polymers from Itaconic Acid*” *J. Polym. Sci. A Polym. Chem.* **2017**, 55, 2730.
- 37) Quentin Michaudel, Veronika Kottisch, Brett P. Fors “*Cationic Polymerization: From Photoinitiation to Photocontrol*” *Angew. Chem. Int. Ed.* **2017**, 56, 9670.
- 36) Veronika Kottisch, Quentin Michaudel, Brett P. Fors “*Cationic Polymerization of Vinyl Ethers Controlled by Visible Light*” *J. Am. Chem. Soc.* **2016**, 138, 15535.
- 35) Quentin Michaudel, Brett P. Fors “*Storing Information at the Molecular Level: Efficient Synthesis of ‘Barcode’ Polymers*” *Chem.* **2016**, 1, 23.
- 34) Veronika Kottisch, Dillon T. Gentekos, Brett P. Fors “*Shaping the Future of Molecular Weight Distributions in Anionic Polymerization*” *ACS Macro Lett.* **2016**, 5, 796.
- 33) Joe Collins, Zehun Xiao, Andrea Espinosa-Gomez, Brett P. Fors, Luke A. Connal “*Extremely Rapid and Versatile Synthesis of High Molecular Weight Step Growth Polymers via Oxime Click Chemistry*” *Polym. Chem.* **2016**, 7, 2581.
- 32) Dillon T. Gentekos, Lauren N. Dupuis, Brett P. Fors “*Beyond Dispersity: Deterministic Control of Polymer Molecular Weight Distributions*” *J. Am. Chem. Soc.* **2016**, 138, 1848.
- 31) Jacob T. Trotta, Brett P. Fors “*Organic Catalysts for Photocontrolled Polymerizations*” *Synlett* **2016**, 27, 702.

- 30) You-Chi Mason Wu, Michel F. Molaire, David S. Weiss, Felipe A. Angel, Catherine R. DeBlase, Brett P. Fors "Synthesis of Amorphous Monomeric Glass Mixtures for Organic Electronic Applications" *J. Org. Chem.*, **2015**, 80, 12740.
- 29) Nicolas J. Treat, Hazel Sprafke, John W. Kramer, Paul G. Clark, Bryan E. Barton, Javier Read de Alaniz, Brett P. Fors, Craig J. Hawker "Metal-Free Atom Transfer Radical Polymerization" *J. Am. Chem. Soc.* **2014**, 136, 16096.

Prior to Cornell

- 28) Hannah P. Luehmann, Lisa Detering, Brett P. Fors, Eric D. Pressly, Pamela K. Woodard, Gwendalyn J. Randolph, Robert J. Gropler, Craig J. Hawker, Yongjian Liu "PET/CT Imaging of Chemokine Receptors in Inflammatory Atherosclerosis Using Targeted Nanoparticles" *J. Nucl. Med.* **2016**, 57, 1124.
- 27) Anna Melker, Brett P. Fors, Craig J. Hawker, Justin E. Poelma "Continuous Flow Synthesis of Poly(methyl methacrylate) via a Light-Mediated Controlled Radical Polymerization" *J. Polym. Sci., Part A: Polym. Chem.* **2015**, 53, 2693.
- 26) Nicolas J. Treat, Brett P. Fors, John W. Kramer, Matthew Christianson, Chien-Yang Chiu, Javier Read de Alaniz, Craig J. Hawker "Controlled Radical Polymerization of Acrylates Regulated by Visible Light" *ACS Macro Lett.* **2014**, 3, 580.
- 25) Maxwell J. Robb, Brandon Newton, Brett P. Fors, Craig J. Hawker "One-Step Synthesis of Unsymmetrical N-Alkyl-N'-Aryl Perylene Diimides" *J. Org. Chem.* **2014**, 79, 6360.
- 24) Lauren M. Misch, Alexander Birkel, C. Adrian Figg, Brett P. Fors, Craig J. Hawker, Galen D. Stucky, Ram Seshadri "Rapid Microwave-Assisted Sol-Gel Preparation of Pd-Substituted LnFeO_3 ($\text{Ln} = \text{Y}, \text{La}$): Phase Formation and Catalytic Activity" *Dalton Trans.* **2014**, 43, 2079.
- 23) Brett P. Fors, Justin E. Poelma, Matthew S. Menyo, Maxwell J. Robb, Daniel M. Spokoyny, John W. Kramer, J. Herbert Waite, Craig J. Hawker "Fabrication of Unique Chemical Patterns and Surface Concentration Gradients with Visible Light" *J. Am. Chem. Soc.* **2013**, 135, 14106.
- 22) Justin E. Poelma, Brett P. Fors, Gregory F. Meyers, John W. Kramer, Craig J. Hawker "Fabrication of Complex 3-Dimensional Polymer Brush Nanostructures via Light-Mediated Living Radical Polymerization" *Angew. Chem. Int. Ed.* **2013**, 52, 6844.
- 21) Frank A. Leibfarth, Kaila M. Mattson, Brett P. Fors, Hazel A. Collins, Craig J. Hawker "External Regulation of Controlled Polymerizations" *Angew. Chem. Int. Ed.* **2013**, 52, 199.
- 20) Brett P. Fors, Craig J. Hawker "Control of a Living Radical Polymerization of Methacrylates by Light" *Angew. Chem. Int. Ed.* **2012**, 51, 8850.
- 19) Ekaterina V. Vinogradova, Nathaniel H. Park, Brett P. Fors, Stephen L. Buchwald "Palladium-Catalyzed Synthesis of N-Aryl Carbamates" *Org. Lett.* **2013**, 15, 1394.
- 18) Ekaterina V. Vinogradova, Brett P. Fors, Stephen L. Buchwald "Palladium-Catalyzed Cross-Coupling of Aryl Chlorides and Triflates with Sodium Cyanate: A Practical Synthesis of Unsymmetrical Ureas" *J. Am. Chem. Soc.* **2012**, 134, 11132.
- 17) Satoshi Ueda, Siraj Ali, Brett P. Fors, Stephen L. Buchwald " $\text{Me}_3(\text{OMe})\text{tBuXPhos}$: A Surrogate Ligand for $\text{Me}_4\text{tBuXPhos}$ in Palladium-Catalyzed C-N and C-O Bond-Forming Reactions" *J. Org. Chem.* **2012**, 77, 2543.
- 16) Simon Breitler, Nathan J. Oldenhuis, Brett P. Fors, Stephen L. Buchwald "Synthesis of Unsymmetrical Diarylureas via Pd-Catalyzed C-N Cross-Coupling Reactions" *Org. Lett.* **2011**, 13, 3262.
- 15) Brett P. Fors and Stephen L. Buchwald "Commentary on 'A New, Efficient and Recyclable Lanthanum(III) Oxide-Catalyzed C-N Cross-Coupling' by S. Narayana Murthy, B. Madhav, V.

Prakash Reddy, and Y. V. D. Nageswar, *Adv. Synth. Catal.* **2010**, 352, 3241–3245” *Adv. Synth. Catal.* **2010**, 352, 3119.

- 14) Brett P. Fors, Stephen L. Buchwald “A Multiligand Based Pd Catalyst for C–N Cross-Coupling Reactions” *J. Am. Chem. Soc.* **2010**, 132, 15914.
- 13) Xiaoxing Wu, Brett P. Fors, Stephen L. Buchwald “A Single Phosphine Ligand Allows Palladium-Catalyzed Intermolecular C–O Bond Formation with Secondary and Primary Alcohols” *Angew. Chem. Int. Ed.* **2011**, 50, 9943.
- 12) Debrata Maiti, Brett P. Fors, Jaclyn L. Henderson, Yoshinori Nakamura, Stephen L. Buchwald “Palladium-Catalyzed Coupling of Functionalized Primary and Secondary Amines with Aryl and Heteroaryl Halides: Two Ligands Suffice in Most Cases” *Chem. Sci.* **2011**, 2, 57.
- 11) Karin Dooleweerd, Brett P. Fors, Stephen L. Buchwald “Pd-Catalyzed Cross-Coupling of Amides and Aryl Mesylates” *Org. Lett.* **2010**, 12, 2350.
- 10) Brett P. Fors, Stephen L. Buchwald “Pd-Catalyzed Conversion of Aryl Chlorides, Triflates, and Nonaflates to Nitroaromatics” *J. Am. Chem. Soc.* **2009**, 131, 12898.
- 9) John R. Naber, Brett P. Fors, Xiaoxing Wu, Jonathon T. Gunn, Stephen L. Buchwald “Stille Cross-Coupling Reactions of Aryl Mesylates and Tosylates Using a Biarylphosphine Based Catalyst System” *Heterocycles* **2010**, 80, 1215.
- 8) Brijesh Bhayana, Brett P. Fors, Stephen L. Buchwald “A Versatile Catalyst System for Suzuki-Miyaura Cross-Coupling Reactions of C(sp²)-Tosylates and Mesylates” *Org. Lett.* **2009**, 11, 3954.
- 7) Brett P. Fors, Karin Dooleweerd, Qingle Zeng, Stephen L. Buchwald “An Efficient System for the Pd-Catalyzed Cross-Coupling of Amides and Aryl Chlorides” *Tetrahedron* **2009**, 65, 6576.
- 6) Brett P. Fors, Nicole R. Davis, Stephen L. Buchwald “An Efficient Process for Pd-Catalyzed C–N Cross-Coupling Reactions of Aryl Iodides: Insight Into Controlling Factors” *J. Am. Chem. Soc.* **2009**, 131, 5766.
- 5) Brett P. Fors, Donald A. Watson, Mark R. Biscoe, Stephen L. Buchwald “A Highly Active Catalyst for Pd-Catalyzed Amination Reactions: Cross-Coupling Reactions Using Aryl Mesylates and the Highly Selective Monoarylation of Primary Amines Using Aryl Chlorides” *J. Am. Chem. Soc.* **2008**, 130, 13552.
- 4) Brett P. Fors, Philip Krattiger, Eric Strieter, Stephen L. Buchwald “Water-Mediated Catalyst Preactivation: An Efficient Protocol for C–N Cross-Coupling Reactions” *Org. Lett.* **2008**, 10, 3505.
- 3) Mark R. Biscoe, Brett P. Fors, Stephen L. Buchwald “A New Class of Easily Activated Palladium Precatalysts for Facile C–N Cross-Coupling Reactions and the Low Temperature Oxidative Addition of Aryl Chlorides” *J. Am. Chem. Soc.* **2008**, 130, 6686.
- 2) Ryan A. Altman, Brett P. Fors, Stephen L. Buchwald “Pd-Catalyzed Amination Reactions of Aryl Halides Using Bulky Biarylmonophosphine Ligands” *Nature Protocols* **2007**, 2, 2881.
- 1) Harry R. Chobanian, Brett P. Fors, Linus S. Lin “A Facile Microwave-Assisted Palladium-Catalyzed Cyanation of Aryl Chlorides” *Tetrahedron Lett.* **2006**, 47, 3303.

Book Chapters

- 1) Nicolas J. Treat, Brett P. Fors, Craig J. Hawker “Photomediated Controlled Polymerizations” In *Visible Light Photocatalysis in Organic Chemistry*, 2018 Wiley-VCH.

Patents

- 6) Thanh-Tam Truong, Héctor D. Abruña, Geoffrey W. Coates, Brett P. Fors “Redox Active Poly(aryl amine)s and Uses Thereof” Application No. 62/202,040, August 6, 2016.

- 5) Craig J. Hawker, Brett P. Fors, Justin E. Poelma *"Using Organic Photoredox Catalysts to Achieve Metal Free Photoregulated Controlled Radical Polymerization"* Application No. 15/54196, October 6, 2015.
- 4) Craig J. Hawker, Brett P. Fors, Justin E. Poelma, Matthew S. Menyo *"Spatial Patterning of Surfaces with a Photomediated Atom Transfer Radical Addition Reaction"* Application No. 61/871816, August 29, 2013.
- 3) Craig J. Hawker, Brett P. Fors, Justin E. Poelma *"Spatial and Temporal Control over Brush Formation on Surfaces"* Application No. 14/050,098, October 9, 2013.
- 2) Craig J. Hawker, Brett P. Fors *"Control of Living Radical Polymerization by Light"* Application No. PCT/US2013/033933, March 26, 2012.
- 1) Stephen L. Buchwald, Brett P. Fors, David S. Surry *"Ligands for Transition-Metal-Catalyzed Cross-Couplings, and Methods of Use Thereof"* US 7858784, December 28, 2010.

Presentations

Cornell Affiliation (Since 2014)

- 61) Next Generation Smart Materials Symposium; Savannah, GA; December 17, 2019.
- 60) 37th Australasian Polymer Symposium; Gold Coast, Australia; November 12, 2019.
- 59) University of California, Berkeley; Berkeley, CA; September 17, 2019.
- 58) Stanford University; Palo Alto, CA; September 16, 2019.
- 57) ACS National Meeting, Tetrahedron Symposium in Honor of Stephen L. Buchwald; San Diego, CA; August 26, 2019.
- 56) GPC2019, The Polymer and Biomacromolecular Applications and Characterization Conference; New Orleans, LA; July 9, 2019.
- 55) Advanced Polymer Synthesis Summer School; Beijing, China; July 6 and 7, 2019.
- 54) Peking University; Beijing, China; July 4, 2019.
- 53) Pacific Conference on Radical Chemistry; Monterey, CA; June 19, 2019.
- 52) Texas A&M University; College Station, TX; April 26, 2019.
- 51) ACS National Meeting; Orlando, FL; April 3, 2019.
- 50) Bowling Green State University; Bowling Green, OH; March 13, 2019.
- 49) Massachusetts Institute of Technology; Cambridge, MA; February 28, 2019.
- 48) Boston College; Chestnut Hill, MA; February 27, 2019.
- 47) University of California, Santa Barbara; Santa Barbara, CA; February 14, 2019.
- 46) University of California, Los Angeles; Los Angeles, CA; February 13, 2019.
- 45) Arkema; King of Prussia, PA; February 7, 2019.
- 44) University of Florida; Gainesville, FL; January 24, 2019.
- 43) ACS Poly Webinar; November 2, 2018.
- 42) Caltech; Pasadena, CA; October 24, 2018.
- 41) Northwestern University; Evanston, IL; September 21, 2018.
- 40) University of Illinois; Urbana-Champaign, IL; September 13, 2018.
- 39) Columbia University; New York, NY; September 6, 2018.
- 38) ACS National Meeting, Block Polymer Synthesis & Nanoscale Self-Assembly Symposium; Boston, MA; August 22, 2018.

- 37) ACS National Meeting, Tosoh Lectures; Boston, MA; August 21, 2018.
- 36) ACS National Meeting, Young Academic Investigator Symposium; Boston, MA; August 21, 2018.
- 35) Stereochemistry GRC; Newport, RI; Poston and Short Talk; July 25, 2018.
- 34) EuCHEMS Conference on Organic Free Radicals; Marseille, France; June 18, 2018.
- 33) ETH Zürich; Zürich, Switzerland; May 7, 2018.
- 32) Baker Symposium, Cornell University; Ithaca, NY; May 5, 2018.
- 31) Carnegie Mellon University; Pittsburgh, PA; May 3, 2018.
- 30) Center for Sustainable Polymers Annual Meeting; University of Minnesota; April 26, 2018.
- 29) Bowdoin College; Brunswick, ME; September 29, 2017.
- 28) 2017-2018 BMS Lecturer of Organic Chemistry; Princeton University; Princeton, NJ; September 5, 2017.
- 27) ACS National Meeting, Overberger Prize Symposium in Honor of Craig Hawker; Washington, DC; August, 2017.
- 26) ACS National Meeting, Journal of Polymer Science Innovation Award Symposium in Honor of Luis Campos; Washington, DC; August, 2017.
- 25) ACS National Meeting, 8th Symposium on Controlled Radical Polymerization; Washington, DC; August, 2017.
- 24) Polymer GRC; Mount Holyoke, MA; June 15, 2018 (Poster).
- 23) Emergent Macromolecular Systems Symposium; Hunter College; New York, NY; June 1, 2017.
- 22) University of Wisconsin, Madison; Student Invited McElvain Seminar; Madison, WI; April 10, 2017.
- 21) ACS National Meeting, Polymer Chemistry Lectureship Symposium; San Francisco, CA; April 4, 2017.
- 20) ACS National Meeting, Switchable Catalysis Symposium; San Francisco, CA; April 3, 2017.
- 19) ACS National Meeting, ACS PMSE Young Investigator Symposium; San Francisco, CA; April 2, 2017.
- 18) The City College of New York; New York, NY; March 27, 2017.
- 17) 36th Australasian Polymer Symposium; Lorne, Australia; November, 23, 2016.
- 16) Clarkson University; Potsdam, NY; September 9, 2016.
- 15) ACS National Meeting, Henkel Award Symposium in honor of Maxwell J. Robb; Philadelphia, PA; August 21, 2016.
- 14) Stereochemistry GRC; Newport, RI; July 24, 2016 (Poster).
- 13) Stereochemistry GRC; Short Talk; Newport, RI; July 24, 2016.
- 12) Japan-US Polymer Chemistry Symposium; Hokkaido, Japan; June 28, 2016.
- 11) Center for Sustainable Polymers Review; University of Minnesota; June 9, 2016.
- 10) 3M; St. Paul, Minnesota; June 2, 2016.
- 9) Center for Sustainable Polymers Meeting; University of Minnesota; April 21, 2016.
- 8) Polymer GRC; Mount Holyoke, MA; June 17, 2015 (Poster).
- 7) Cornell Center for Materials Research Symposium; Ithaca, NY; May 19, 2015.
- 6) PolyChar 23; Lincoln, NE; May 14, 2015.
- 5) PolyChar 23 Short Course; Lincoln, NE; May 11, 2015.

- 4) Cornell Science Sampler Series for Teachers, New York, NY; March 21, 2015.
- 3) SUNY Potsdam, Potsdam, NY; November 4, 2014.
- 2) St. Lawrence University, Canton, NY; November 4, 2014.
- 1) The Dow Chemical Company, Midland, MI; July 9, 2014.

Service

- Academic Integrity Hearing Board, Cornell College of Arts and Sciences; 2019 – present
- Executive Committee, Cornell Center for Materials Research; 2019
- Seminars Committee Chair; 2015 – present
- Curriculum Planning Member; 2016 – present
- Seminars Committee Member; 2014, 2015
- Safety Committee Member; 2014 – 2017
- Graduate Program Committee Member; 2014 – present
- Faculty Search Committee Member; 2014 – present
- Co-Organizer of Stephen L. Buchwald's 60th Birthday Symposium
- Co-Organizer of the Cornell Center for Materials Research Symposium – 2015
- Co-Organizer of the Symposium on Photochemistry and Polymers; 2018 ACS National Meeting
- Reviewer – National Science Foundation, Department of Energy, Petroleum Research Fund
- Reviewer – Journal of the American Chemical Society, Macromolecules, ACS Macro Letters, Polymer Chemistry, Journal of Organic Chemistry, Macromolecular Rapid Communications, Nature Chemistry, Journal of Polymer Science Part A: Polymer Chemistry, Advanced Synthesis and Catalysis, Chemical Reviews, Journal of the Australian Chemical Society

Fors Group Outreach Program

- Harlem Children Zone – 2015, 2018
- Keynote Speaker at the CCMR Cornell Science Sampler Series for Teachers – March 21, 2015
- 4H Science Samplers – 2016, 2017, 2018
- Expanding Your Horizons – 2015, 2018
- East Ithaca Preschool – 2016, 2017, 2018
- Research Experience for Teachers – 2016, 2017, 2018
- Science Saturdays for Elementary Students – 2016
- Cornell Science Sampler Series for Elementary Teachers – 2015, 2015
- Southern Cayuga Elementary School – 2017
- Lansing Library Family Science Event – 2016
- Vestal High School – 2018
- Lansing Middle School – 2018
- Polymer Demonstrations for Children with Disabilities, Franziska Racker's Center – 2015
- Minnesota State Fair Outreach with the Center for Sustainable Polymers – 2018

COMPOSICIONES ADYUVANTES PARA PRODUCTOS QUÍMICOS PARA EL
TRATAMIENTO DE PLANTAS

REFERENCIA CRUZADA A SOLICITUDES RELACIONADAS

5 Esta solicitud reivindica el beneficio de las Solicitudes de
Patente Provisional E.U.A. Nos. de Serie 15/341.625, presentada
el 2 de noviembre de 2016, 62/440.794, presentada el 30 de
diciembre de 2016, y 62/445.124, presentada el 11 de enero de
2017, que se incorporan en la presente para referencia en su
10 totalidad.

CAMPO DE LA INVENCION

La presente solicitud se refiere a una composición adyuvante
para productos químicos para el tratamiento de plantas.

ANTECEDENTES DE LA INVENCION

15 Los agentes agrícolas, tales como insecticidas, fungicidas,
herbicidas, acaricidas y reguladores de crecimiento vegetal,
se aplican a menudo a una planta en forma de una composición
líquida. Para ayudar a la distribución o dispersión del agente
agrícola, dichas composiciones líquidas típicamente incluyen
20 uno o más compuestos adyuvantes para mejorar una o más
propiedades de la composición líquida.

Los adyuvantes pueden aumentar las propiedades físicas de
la composición líquida, lo que conduce a un producto final con
aumento de estabilidad de almacenamiento, facilidad de

manipulación o eficacia mejorada. Los adyuvantes, cuando se utilizan con la formulación de ingrediente activo agrícola, están diseñados para aumentar la eficacia del producto agrícola o para mejorar las características de aplicación del pesticida.

5 Por lo tanto, los adyuvantes se diseñaron para mejorar la "humectación" de las gotas durante la pulverización, para alterar la volatilidad de la mezcla de aerosol, para mejorar la resistencia a la lluvia del herbicida en la planta, para mejorar la penetración o distribución del ingrediente activo,

10 para regular el pH de la mezcla de aerosol, para mejorar la compatibilidad de los diversos componentes en un tanque de mezcla y para reducir la deriva durante la pulverización. Dado que el adyuvante actúa de algún modo para mejorar la eficacia del ingrediente activo, la cantidad de este último necesaria

15 para que sea eficaz puede reducirse en muchos casos sin pérdida de eficacia.

Sin embargo, en función del tipo de ingrediente agrícola utilizado, diversos adyuvantes tendrán distintos efectos en la capacidad del ingrediente agrícola para tratar de manera eficaz

20 la planta. Lo que se necesita es un adyuvante que permita una mejor dispersión de ingrediente agrícola en una superficie vegetal y proporcione un mejor recubrimiento de la planta que promueva la distribución del ingrediente agrícola. Asimismo, se necesita en la técnica una composición que contenga un

adyuvante y un ingrediente activo que, cuando se aplique a la superficie de una planta, mejore la eficacia del ingrediente activo.

La presente invención busca superar las carencias en la
5 técnica mencionadas anteriormente.

BREVE DESCRIPCIÓN DE LA INVENCION

Un aspecto de la presente invención se dirige a una composición adyuvante premezcla para uso en productos químicos para tratamiento de plantas. La composición adyuvante premezcla
10 incluye un espesante, una sal divalente soluble en agua, un agente de control de espuma, un agente formador de complejo y un agente de formación de película.

Un aspecto adicional de la presente invención se refiere a una composición adyuvante para uso en productos químicos para
15 tratamiento de plantas. Esta composición incluye la composición adyuvante premezcla de la presente invención y agua.

La presente invención también se refiere a una formulación química para tratamiento de plantas. Esta formulación incluye la composición adyuvante de la presente invención y uno o más
20 productos químicos para tratamiento de plantas.

Otro aspecto de la presente invención se refiere a un método para tratar plantas o semillas vegetales. El presente método implica proporcionar una semilla vegetal o una planta en crecimiento y aplicar la formulación química para

tratamiento de plantas de la presente invención a la semilla vegetal o planta en crecimiento.

Aun otro aspecto de la presente invención se refiere a un método para tratar una semilla vegetal o planta en crecimiento.

5 El presente método implica proporcionar una semilla vegetal o una planta en crecimiento. El método implica además aplicar una mezcla de un producto químico para tratamiento de plantas y un material de recubrimiento a superficies de la semilla vegetal o planta donde, después de que el material de
10 recubrimiento aplicado se seca en las superficies de la semilla vegetal o planta en crecimiento, el material de recubrimiento seco se caracteriza por adherirse a las superficies de la semilla vegetal o planta en crecimiento y permite la permeación del material acuoso a la semilla vegetal o planta en
15 crecimiento mientras minimiza la pérdida de humedad o pérdida del producto químico para tratamiento de plantas de la semilla vegetal o planta en crecimiento.

La composición adyuvante de la presente invención logra muchos beneficios. El tratamiento de plantas con formulaciones
20 pesticidas que comprenden adyuvante tuvo como resultado una mejora en la protección de enfermedades en comparación con el tratamiento únicamente con pesticidas. El tratamiento de plantas con formulaciones herbicidas con resistencia reducida que comprenden adyuvante tuvo como resultado una mejora de los

efectos herbicidas en comparación con el uso de formulaciones únicamente con herbicidas con resistencia total. El uso de adyuvante en diversas formulaciones pesticidas también aumentó el rendimiento de frutos comerciables y redujo la cantidad de pesticida y/o las aplicaciones de pesticidas necesarias para alcanzar un efecto en particular.

La composición adyuvante de la presente invención es un protector de planta a base de polímero que proporciona una mejor eficacia del producto agrícola mediante: (i) el aumento de la eficacia del aerosol; (ii) la mejora de la efectividad nutricional y química; (iii) la reducción del costo del programa de aerosol; (iv) la conservación de humedad de modo más eficiente; (v) la conservación de productos durante períodos de tiempo más prolongados al reducir el escurrimiento y desperdicio; (vi) proporcionar protección al congelamiento al disminuir el umbral en el cual ocurre el daño por congelamiento; y (vii) proporcionar una adhesión duradera.

La composición adyuvante de la presente invención mejora la eficacia del uso químico mediante: (i) el aumento de la duración entre aplicaciones, lo que reduce la cantidad de aplicaciones necesarias; (ii) la maximización de la efectividad de los pesticidas y los reguladores de crecimiento de plantas, lo que permite el uso de menores tasas etiquetadas e intervalos de aerosol más prolongados; y (iii) el aumento de absorción

del fertilizante foliar que tiene como resultado una mejora de la salud y fuerza de la planta al reducir el "escurrimiento".

La composición adyuvante de la presente invención también proporciona propiedades antitranspirantes y de agentes humectantes para atraer y retener la humedad, lo que reduce la demanda de suministros de agua y aumenta la tasa de retención del agua aplicada. La aplicación de la composición adyuvante de la presente invención a una hoja de planta proporciona un recubrimiento "similar a la cera" que protege la planta del entorno, la cual, por su propia naturaleza química, adora el agua. Las propiedades de "equilibrio de pH" de la composición adyuvante de la presente invención espesan este recubrimiento, lo que proporciona más lugar para atraer la humedad. En otras palabras, la composición adyuvante atrapa la humedad cada vez que entra en contacto con humedad, rocío, lluvia o irrigación.

BREVE DESCRIPCIÓN DE LOS DIBUJOS

Las FIGURAS 1A-1B son imágenes de plantas de pimiento tratadas con una formulación química que comprende silicio y adyuvante (FIGURA 1A) o únicamente silicio (FIGURA 1B) en el día 66.

Las FIGURAS 2A-2H son imágenes del día 83 de arbustos leñosos (FIGURA 2A) y gramíneas mezcladas (FIGURA 2B) tratados con formulaciones de imazapir y triclopir mejoradas con adyuvante que comprenden una reducción del 30% en los volúmenes de herbicida, arbustos leñosos (FIGURA 2C) y gramíneas

mezcladas (FIGURA 2D) tratados con una formulación de imazapir y triclopir mejorada que comprende una reducción del 15% en los volúmenes de herbicida, arbustos leñosos (FIGURA 2E) y gramíneas mezcladas (FIGURA 2F) tratados con una formulación de imazapir y triclopir mejorada que comprende volúmenes habituales de herbicida; y arbustos leñosos (FIGURA 2G) y gramíneas mezcladas (FIGURA 2H) tratados con una formulación de imazapir y triclopir que comprende volúmenes habituales de herbicida.

La FIGURA 3 es un gráfico que compara el peso acumulado de las fresas comerciables cosechadas de plantas tratadas con un protocolo típico y un protocolo mejorado con adyuvante que comprende adyuvante y 67% de los productos típicos.

La FIGURA 4 muestra las condiciones climáticas durante la ejecución de las pruebas de campo.

Las FIGURAS 5A-5C muestran la cantidad total de hojas de banana (FIGURA 5A), las hojas más jóvenes con infección (FIGURA 5B) y las hojas más jóvenes con manchas (FIGURA 5C) en cada grupo de tratamiento.

Las FIGURAS 6A-6B muestran la distribución espacial y los tratamientos en el transcurso del tiempo ("DD1A" = días después de la primera aplicación).

Las FIGURAS 7A-7B muestran la evaluación del control de la Sigatoka negra (*Mycosphaerella fijiensis*) en la banana de

variedad Grand Naine.

La FIGURA 8 muestra imágenes de árboles de banana 75 días después de la primera aplicación, 20 días después de la última aplicación de fungicida protectora y 5 días después de la última aplicación de fungicida sistémico para cada una de las nueve condiciones de tratamiento.

Las FIGURAS 9A-9B muestran imágenes de hojas de banana que muestran el efecto de los tratamientos en las manchas y el tejido necrótico con adyuvante (FIGURA 9A, izquierda) y sin (FIGURA 9A, derecha) 30 días después de la última aplicación y un gráfico de las manchas y la necrosis detectada en las hojas de banana de los grupos de tratamiento 3 y 4 (FIGURA 9B).

Las FIGURAS 10A-10G muestran los resultados de la aplicación de diversas formulaciones para tratamiento de plantas en hojas de banana. La FIGURA 10A muestra el efecto de la aplicación de Mancozeb (Banazeb 60 SC) solo (cuadrado superior izquierdo), Mancozeb (Banazeb 60 SC) más adyuvante (cuadrado superior derecho) y Vondozeb® 62 SC (cuadrado inferior) para humectar las hojas de banana. También se muestran imágenes detalladas de las hojas tratadas con Mancozeb (Banazeb 60 SC) más adyuvante (FIGURA 10B) y Mancozeb (Banazeb 60 SC) sin adyuvante (FIGURA 10C). También se muestra el efecto del agua para lavado de la aplicación de Mancozeb (Banazeb 60 SC) más adyuvante (FIGURA 10D) y Mancozeb (Banazeb 60 SC) sin

adyuvante (FIGURA 10E). Las FIGURAS 10F-10G muestran el efecto del agua para lavado en el uso de Mancozeb (Banazeb 60 SC) (FIGURA 10F) y Mancozeb (Banazeb 60 SC) más adyuvante (FIGURA 10G) en hojas de banana quemadas por el sol.

5 Las FIGURAS 11A-11B muestran imágenes de una mezcla de aceite y adyuvante (FIGURA 11A) y agua y adyuvante (FIGURA 11B).

Las FIGURAS 12A-12B muestran el efecto de la aplicación del adyuvante en la hoja de banana y el control de Sigatoka 18 días después de la aplicación (FIGURA 12A) y 32 días después de la aplicación (FIGURA 12B).

DESCRIPCIÓN DETALLADA DE LA INVENCION

Un aspecto de la presente invención se dirige a una composición adyuvante premezcla para uso en productos químicos para tratamiento de plantas. La composición adyuvante premezcla incluye un espesante, una sal divalente soluble en agua, un agente de control de espuma, un agente formador de complejo y un agente de formación de película.

Diversos espesantes se conocen en la técnica e incluyen, por ejemplo, espesantes asociativos y no asociativos (véase Gregory D. Shay, capítulo 25, "Alkali-Swellable and Alkali-Soluble Thickener Technology A Review", Polymers in Aqueous Media - Performance Through Association, Advances in Chemistry Serie 223, J. Edward Glass (ed.), ACS, pp. 457-494, Área de

materiales poliméricos, Washington, DC (1989); Chassenieux et ál., "Rheology of Associative Polymer Solutions," *Current Opinion in Colloid & Interface Science* 16(1):18-26 (2011); Winnik et ál., "Associative Polymers in Aqueous Solution,"
5 *Current Opinion in Colloid & Interface Science* 2(4):424-36 (1997); y Antunes et ál., "Gelation of Charged Bio-Nanocompartments Induced by Associative and Non-Associative Polysaccharides," *Colloids Surf B Biointerfaces*. 661(1):134-40 (2008), que se incorporan en su totalidad a la presente
10 mediante referencia).

Tal como se usa en la presente, el término "espesante asociativo" se refiere a un polímero soluble en agua con grupos hidrofóbicos que interactúan entre sí y los otros elementos de la composición para crear una red tridimensional. Los
15 espesantes asociativos de ejemplo incluyen polímeros reológicos de uretano etoxilado hidrofóbicamente modificado (HEUR, por sus siglas en inglés), polímeros de emulsión dilatable en medio alcalino hidrofóbicamente modificada (HASE, por sus siglas en inglés), polímeros de poliéter
20 hidrofóbicamente modificado (HMPE, por sus siglas en inglés), hidroxietilcelulosa hidrofóbicamente modificada (HMHEC, por sus siglas en inglés) y aminoplasto etoxilado hidrofóbicamente modificado (HEAT, por sus siglas en inglés)

Tal como se usa en la presente, el término "espesante no

asociativo" se refiere a un polímero soluble en agua de alto peso molecular con grupos hidrofóbicos que interactúan entre sí para crear una red tridimensional. Los espesantes no asociativos adecuados incluyen polímeros de emulsión soluble
5 en medio alcalino (ASE, por sus siglas en inglés) y éteres de celulosa.

En una modalidad, el espesante es un espesante asociativo aniónico. Los espesantes asociativos aniónicos de ejemplo se describen en la publicación de patente europea EP2542598 A1
10 otorgada a Nguyen et ál., que se incorpora a la presente en su totalidad mediante referencia. En un ejemplo, el espesante asociativo aniónico se selecciona del grupo que consiste en un polímero de emulsión dilatable en medio alcalino hidrofóbicamente modificada (HASE), un polímero de emulsión
15 soluble en medio alcalino (ASE) y mezclas de estos.

De manera alternativa, el espesante es un espesante asociativo no iónico seleccionado del grupo que consiste en polímeros reológicos de uretano etoxilado hidrofóbicamente modificado (HEUR), polímeros de aminoplasto etoxilado
20 hidrofóbicamente modificado (HEAT) y mezclas de estos.

En una modalidad, el espesante se selecciona del grupo que consiste en un polímero alcalino hidrofóbicamente modificado, un polímero de emulsión soluble en medio alcalino, un polímero de uretano etoxilado hidrofóbicamente modificado y

mezclas de estos. Los espesantes asociativos de ejemplo incluyen, de modo no taxativo, ACUSOL® 801S, ACUSOL® 805S, ACUSOL® 810A, ACUSOL® 820, ACUSOL® 823, ACUSOL® 830, ACUSOL® 835, ACUSOL® 842, ACUSOL® 880 y ACUSOL® 882. ACUSOL es una marca
5 registrada de Rohm and Haas Company, Filadelfia, Pensilvania.

El agente de control de espuma se puede seleccionar del grupo que consiste en poliacrilatos de alquilo, ácidos grasos, alcoholes grasos, monoglicéridos, diglicéridos, triglicéridos, un agente de control de espuma a base de silicona y mezclas de
10 estos.

Los ácidos grasos o alcoholes grasos son especies que tienen desde 10 a 20 carbonos en su cadena alquilo. Los ácidos grasos adecuados son saturados o insaturados y pueden obtenerse de fuentes naturales (por ejemplo, aceite de palma, aceite de
15 coco, aceite de babasu, aceite de cártamo, aceite de pino, aceite de ricino, aceites de pescado y cebo, grasa y mezclas de estos) o pueden prepararse de manera sintética. Los ejemplos de ácidos grasos adecuados para uso en la presente invención incluyen ácido cáprico, ácido láurico, ácido mirístico, ácido
20 palmítico, ácido esteárico, ácido araquídico y ácido behénico.

Los alcoholes grasos derivados de los ácidos grasos mencionados anteriormente son adecuados para los agentes de control de espuma de la presente invención. Los alcoholes grasos de ejemplo incluyen, de modo no taxativo, alcohol

caprílico, alcohol laurílico, alcohol miristílico, alcohol palmitoleílico, alcohol estearílico, alcohol araquidílico y alcohol benehílico.

Tal como se usa en la presente, el término "glicérido" se
5 refiere a ésteres en donde uno, dos o tres de los grupos -OH del glicerol fueron esterificados. Los monoglicéridos, diglicéridos y triglicéridos pueden comprender ésteres de cualquiera de los ácidos grasos descritos anteriormente.

Tal como se usa en la presente, el término "agente de
10 control de espuma a base de silicona" se refiere a un polímero con una estructura principal de silicio. En una modalidad, el agente de control de espuma es un agente de control de espuma a base de silicona. Los agentes de control de espuma a base de silicona adecuados incluyen, de modo no taxativo, fluido de
15 polidimetilsiloxano y sílice tratado con polidimetilsiloxano.

La sal divalente soluble en agua puede formarse a partir de un catión divalente seleccionado del grupo que consiste en bario, calcio, cromo (II), cobalto (II), cobre (II), hierro (II), plomo (II), magnesio, manganeso (II), estroncio, zinc
20 (II), estaño (II) y mezclas de estos. En una modalidad, la sal divalente soluble en agua se selecciona del grupo que consiste en acetato de zinc (II), bromuro de zinc (II), clorato de zinc (II), cloruro de zinc (II), fluoruro de zinc (II), formiato de zinc (II), yoduro de zinc (II), nitrato de zinc (II), sulfato

de zinc (II) monohidratado, sulfato de zinc (II) heptahidratado, sulfato de zinc (II) hexahidratado, sulfato de zinc (II) anhidro y mezclas de estos. En otra modalidad, la sal divalente soluble en agua es un sulfato de zinc.

5 Tal como se usa en la presente, el término "agente formador de complejo" se refiere a una sustancia que tiene la capacidad de formar complejos de iones de metal. El agente formador de complejo puede seleccionarse del grupo que consiste en ácido dietilentriaminopentaacético (DTPA), ácido
10 etilendinitrilotetraacético (EDTA), ácido nitrilotriacético (NTA), dietanolamina (DEA), trietanolamina (TEA) y mezclas de estos.

En una modalidad, el agente formador de complejo es trietanolamina (TEA). En otra modalidad, el agente formador de
15 complejo es una mezcla de trietanolamina (TEA) y dietanolamina (DEA).

Tal como se usa en la presente, el término "agente de formación de película" se refiere a un agente que funciona para mejorar la formación de películas. Los agentes de formación de
20 película pueden seleccionarse del grupo que consiste en alcohol polivinílico, acetato polivinílico y mezclas de estos. En una modalidad, el agente de formación de película es alcohol polivinílico con un peso molecular de 25 000 a 175 000. De manera alternativa, el agente de formación de película es

alcohol polivinílico con un peso molecular de 80 000 a 150 000.

Por ejemplo, el agente de formación de película puede ser alcohol polivinílico con un peso molecular de 100 000.

La composición adyuvante premezcla puede comprender

5 espesante al 30 a 60% en peso, 35 a 60% en peso, 40 a 60% en peso, 40 a 55% en peso, 45 a 60% en peso, 50 a 60% en peso, 55 a 60% en peso; sal divalente soluble en agua al 0,5 a 10% en peso, 0,5 a 15% en peso, 0,5 a 5% en peso, 0,5 a 1,5% en peso, 1,0 a 4,0% en peso, o 2,0 a 3,0% en peso; agente de control de

10 espuma al 0,5 a 10% en peso, 0,5 a 15% en peso, 0,5 a 5, 0,5 a 1,5% en peso, 1,0 a 4,0, 1,5 a 3,5% en peso, 2,0 a 3,0% en peso; agente formador de complejo al 30 a 60% en peso, 35 a 60% en peso, 40 a 60% en peso, 45 a 60% en peso, 50 a 60% en peso, 55 a 60% en peso; y agente de formación de película al

15 0,5 a 10% en peso, 0,5 a 15% en peso; 0,5 a 5, 0,5 a 1,5% en peso, 1,0 a 4,0, 2,0 a 3,0% en peso.

En una modalidad, la composición adyuvante premezcla comprende 30 a 60% en peso del espesante; 0,5 a 5% en peso de la sal divalente soluble en agua; 0,5 a 5% en peso del agente

20 de control de espuma; 30 a 60% en peso del agente formador de complejo; y 0,5 a 5% en peso del agente de formación de película.

En otra modalidad, la composición adyuvante premezcla comprende 45 a 55% en peso del espesante; 1,8 a 2,8% en peso

de la sal divalente soluble en agua; 1,8 a 2,8% en peso del agente de control de espuma; 45 a 55% en peso del agente formador de complejo; y 1,8 a 2,8% en peso del agente de formación de película.

5 De manera alternativa, la composición adyuvante premezcla comprende 42 a 50% en peso del espesante; 2,1 a 2,6% en peso de la sal divalente soluble en agua; 2,1 a 2,6% en peso del agente de control de espuma; 42 a 50% en peso del agente formador de complejo; y 2,1 a 2,6% en peso del agente de
10 formación de película.

Un aspecto adicional de la presente invención se refiere a una composición adyuvante para uso en productos químicos para tratamiento de plantas. Esta composición incluye la composición adyuvante premezcla de la presente invención y agua.

15 De acuerdo con este aspecto de la invención, el espesante, el agente de control de espuma, la sal divalente soluble en agua, el agente formador de complejo y el agente de formación de película de la composición adyuvante premezcla de la presente invención se seleccionan tal como se describió
20 anteriormente.

La composición adyuvante para uso con los productos químicos para tratamiento de plantas comprende espesante al 1,00 a 3,00% en peso, 1,00 a 2,50% en peso, 1,00 a 2,00% en peso, 1,50 a 2,00% en peso, o 1,50 a 2,50% en peso; sal

divalente soluble en agua al 0,05 a 0,10% en peso, 0,05 a 0,15% en peso, 0,05 a 0,50% en peso, 0,05 a 0,35% en peso, 0,10 a 0,40% en peso, 0,15 a 0,35% en peso, 0,20 a 0,30% en peso; agente de control de espuma al 0,05 a 0,10% en peso, 0,05 a 0,15% en peso, 0,05 a 0,50% en peso, 0,05 a 0,35% en peso, 0,10 a 0,40% en peso, 0,15 a 0,35% en peso, 0,20 a 0,30% en peso; agente formador de complejo al 1,00 a 3,00% en peso, 1,00 a 2,50% en peso, 1,00 a 2,00% en peso, 1,50 a 2,00% en peso, o 1,50 a 2,50% en peso; agente de formación de película al 0,05 a 0,10% en peso, 0,05 a 0,15% en peso, 0,05 a 0,50% en peso, 0,05 a 0,35% en peso, 0,10 a 0,40% en peso, 0,15 a 0,35% en peso, 0,20 a 0,30% en peso; y agua al 90 a 99% en peso, 92 a 99% en peso, 94 a 99% en peso, 96 a 99% en peso, 97 a 99% en peso, o 98 a 99% en peso.

En una modalidad, la composición adyuvante para uso en productos químicos para tratamiento de plantas comprende 1,00 a 3,00% en peso del espesante; 0,05 a 0,15% en peso de la sal divalente soluble en agua; 0,05 a 0,15% en peso del agente de control de espuma; 1,00 a 3,00% en peso del agente formador de complejo; 0,05 a 0,15% en peso de un agente de formación de película; y 90 a 99% en peso de agua.

En otra modalidad, la composición adyuvante para uso en productos químicos para tratamiento de plantas comprende 1,6 a 2,4% en peso del espesante; 0,08 a 0,12% en peso de la sal

divalente soluble en agua; 0,08 a 0,12% en peso del agente de control de espuma; 1,6 a 2,4% en peso del agente formador de complejo; 0,8 a 0,12% en peso de un agente de formación de película; y 97,6 a 98,4% en peso de agua.

5 De manera alternativa, la composición adyuvante para uso en productos químicos para tratamiento de plantas comprende 1,8 a 2,2% en peso del espesante; 0,09 a 0,11% en peso de la sal divalente soluble en agua; 0,09 a 0,11% en peso del agente de control de espuma; 1,8 a 2,2% en peso del agente formador
10 de complejo; 0,09 a 0,11% en peso de un agente de formación de película; y 97,8 a 98,2% en peso de agua.

La presente invención también se refiere a una formulación química para tratamiento de plantas. Esta formulación incluye la composición adyuvante premezcla de la presente invención y
15 uno o más productos químicos para tratamiento de plantas.

De acuerdo con este aspecto de la invención, el espesante, el agente de control de espuma, la sal divalente soluble en agua, el agente formador de complejo y el agente de formación de película de la composición adyuvante premezcla de la
20 presente invención se seleccionan tal como se describió anteriormente.

El producto químico para tratamiento de plantas puede seleccionarse del grupo que consiste en un pesticida, un fertilizante y un agente regulador de crecimiento.

Tal como se usa en la presente, el término "pesticida" se refiere a un agente que puede utilizarse para controlar y/o matar una plaga u organismo. Los pesticidas se conocen en la técnica e incluyen, por ejemplo, herbicidas, dirigidos al control de plantas y malezas nocivas; insecticidas, dirigidos al control de insectos; fungicidas, dirigidos al control de hongos; miticidas, dirigidos al control de ácaros; nematicidas, dirigidos al control de nematodos; acaricidas, dirigidos al control de arácnidos o arañas; y viricidas dirigidos al control de virus. El producto químico para tratamiento de plantas puede ser un pesticida seleccionado del grupo que consiste en un herbicida, un insecticida, un fungicida, un miticida y un nematicida.

En una modalidad, el producto químico para tratamiento de plantas es un herbicida seleccionado del grupo que consiste en inhibidores de acetil CoA carboxilasa (ACCase), inhibidores de sintasa de acetolactato (ALS), inhibidores del montaje de microtúbulos (MT), reguladores de crecimiento (GR, por sus siglas en inglés), inhibidores A de sitio de unión de fotosíntesis II (PSII(A)), inhibidores B de sitio de unión de fotosíntesis II (PSII(B)), inhibidores C de sitio de unión de fotosíntesis II (PSII(C)), inhibidores de brotes (SHT, por sus siglas en inglés), inhibidores de enolpiruvil-shikimato-fosfato sintasa (EPSP), inhibidores de glutamina sintasa (GS),

inhibidores de fitoeno desaturasa sintasa (PDS), inhibidores de diterpeno (DITERP), inhibidores de la protoporfirinógeno oxidasa (PPO), inhibidores de brotes y raíces (SHT/RT), desviadores de electrones en el fotosistema 1 (ED), inhibidores de síntesis de hidroxifenilpiruvato dioxigenasa (HPPD) y combinaciones de estos.

Los herbicidas adecuados incluyen, de modo no taxativo, los enumerados en la Tabla 1.

Tabla 1. Ejemplos de herbicidas

10	Sitio de acción de ingrediente activo	Tipo de ingrediente activo	Nombre genérico de ingrediente activo	Producto comercial
	ACCasa	Ciclohexeno oxima	Setoxidim	Poast®
	ACCasa	Fenoxi	Quizalofop-P	Assure® II
	ALS	Sulfonilurea	Primisulfurón	Beacon®
	ALS	Imidazolinona	Imazamox	Raptor®
	MT	Dinitroanilina	Trifluralina	Passport®
15	MT	Dinitroanalina	Pendimetalín	Prowl®
	GR	Fenoxi	2,4-D	Amsol®
	GR	Ácido benzoico	Dicamba	Banvel®
	PSII(A)	Triazina	Atrazina	Atrazine®
	PSII(A)	Triazina	Cinazina	Blandex®
	PSII(B)	Nitrito	Bromoxilin	Butracil®
	PSII(C)	Fenilurea	Diurón	Karmex®
20	SHT	Tiocarbamato	EPTC	Eptam®
	EPSP	Organofósforo	Glifosato	Roundup®
	GS	Organofósforo	Glufosinato	Liberty®
	PDS	Piridazinona	Norflurazón	Zorial®
	DITERP	sin clasificar	Clomazona	Command®
	PPO	Difenil éter	Fomesafén	Reflex®
	SHT/RT	Cloroacetanilida	Alaclor	Lasso®

SHT/RT	Cloroacetanilida	Acetoclor	Surpass®
ED	Amonio cuaternario	Diquat	Reglone®
HPPD	Ciclopropilisoxazola	Isoxaflutola	Balance®

En otra modalidad, el producto químico para el tratamiento de plantas es un insecticida seleccionado del grupo que consiste en carbamatos, organoclorado, nicotinoides, fosforamidotioatos, organofosfatos, piretroides y combinaciones de estos.

Los insecticidas adecuados incluyen, de modo no taxativo, los enumerados en la Tabla 2.

Tabla 2. Ejemplos de insecticidas

Tipo de ingrediente activo	Nombre genérico de ingrediente activo	Producto comercial
Carbamato	Aldicarb	Temik®
Organoclorado	Endosulfán	Thidan®
Nicotinoide	Imidacloprid	Merit®
Fosforamidotioato	Acefato	Orthene®
Organofosfato	Dimetoato	Roxion®
Piretroide	Permetrina	Ambush®

El producto químico para tratamiento de plantas puede ser un fungicida seleccionado del grupo que consiste en nitrógenos alifáticos, bencimidazoles, dicarboximidas, ditiocarbamatos, imidazoles, estrobinas, anilidas, aromáticos, derivados de azufre, derivados de cobre y combinaciones de estos.

Los fungicidas adecuados incluyen, de modo no taxativo,

los enumerados en la Tabla 3.

Tabla 3. Ejemplos de fungicidas

	Tipo de ingrediente activo	Nombre genérico de ingrediente activo	Producto comercial
	Aromático	Clorotalonilo	Bravo®
5	Cobre	Hidróxido de cobre	Kocide®
	Azufre	Flores de azufre	Kumulus®
	Nitrógeno alifático	Cimoxanilo	Curzate®
	Bencimidazol	Tiabendazol	Thiabendazole®
	Dicarboximida	Captan	Captan®
	Dicarboximida	Vinclozolin	Ronilan®
	Dicarboximida	Mancozeb	Dithane®
10	Dicarboximida	Maneb	Manex®
	Dicarboximida	Meritram	Polyram®
	Dicarboximida	Tiram	Thiram®
	Dicarboximida	Ziram	Ziram®
	Imidazol, dicarboximida	Iprodiona	Rovral®
	Organofosfato	Fosetil-aluminio	Aliente®
	Ditiocarbamato	Mancozeb	Dithane®
15	Estrobina	Azoxistrobina	Abound®
	Anilida	Metalaxilo	Ridomil®

El producto químico para tratamiento de plantas puede ser un miticida seleccionado del grupo que consiste en carbamatos, carbazatos, difenil oxazolinas, glicidas, compuestos macrocíclicos, acaricidas METI, derivados de naftoquinona, organoclorados, organofosfatos, organoestaños, aceites, piretroides, piridazinona, pirroles, jabones, azufre, tetrazinas, ácidos tetrónicos y combinaciones de estos.

Los miticidas adecuados incluyen, de modo no taxativo,

los enumerados en la Tabla 4.

Tabla 4. Ejemplos de miticidas

	Tipo de ingrediente activo	Nombre genérico de ingrediente activo	Producto comercial
5	Carbamato	Carbarilo	Sevin®
	Carbamato	Formetanato	Carzol®
	Carbamato	Hexitiazox	Savey®
	Carbazato	Bifenazato	Acrimite®
	Difenil oxazolina	Etoxazol	Tetrasan®
	Glucósido	Abamectina	Avid®
	Compuesto macrocíclico	Abamectina	Affirm®
	Compuesto macrocíclico	Milbemectina	Milbeknock®
10	Acaricida METI	Fenpiroximato	Akari®
	Acaricida METI	Piridaben	Sanmite®
	Derivado de naftoquinona	Acequinocilo	Shuttle®O
	Organoclorado	Dicofol	Kethane®
	Organofosfato	Diazinón	Spectracide®
	Organofosfato	Dimetoato	Cygon®
	Organofosfato	Disulfotón	Di-Syston®
15	Organoestaño	Óxido de fenbutatin	Vendex®
	Aceite	Aceite de clavo	Pest Out®
	Aceite	Aceite de semilla de algodón	Sea-cide® OG
	Aceite	Aceite de ajo	Captiva®
	Aceite	Aceite mineral	Ultra-Pure® Oil
	Aceite	Aceite de neem	Triact® 70
	Aceite	Aceite de menta	Ecotec®
	Aceite	Aceite de petróleo	Biocover®
20	Aceite	Aceite de romero	Captiva®
	Aceite	Aceite de soya	Captiva®
	Piretroides	Bifentrina	Talstar®
	Piretroides	Fenpropatrina	Danitol®
	Piretroides	Fluvalinato	Yardex®
	Piretroides	Lambda-cihalotrina	Scimitar® GC
	Piridazinona	Piridaben	Pyramite®

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Pirroles	Clorfenapir	Pylon®
Jabones	Sales de potasio de ácidos grasos	Des-X®
Azufre	Azufre	Micro Sulf®
Tetrazina	Clofentezina	Apollo®
Ácido tetrónico	Espiromesifeno	Judo®
Ácido tetrónico	Espirotetramato	Kontos®

10

El producto químico para tratamiento de plantas puede ser un nematocida seleccionado del grupo que consiste en carbamatos, organofosfatos, hidrocarburos halogenados, liberadores de metil isotiocianato y combinaciones de estos.

Los nematocidas adecuados incluyen, de modo no taxativo, los enumerados en la Tabla 5.

Tabla 5. Ejemplos de nematocidas

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Tipo de ingrediente activo	Nombre genérico de ingrediente activo	Producto comercial
Carbamato	Aldicarb	Temik®
Carbamato	Aldoxicarb	Standak®
Carbamato	Carbofurán	Furadan®
Carbamato	Oxamilo	Vydate®
Hidrocarburo halogenado	Cloropicrina	Telone® II
Hidrocarburo halogenado	Bromuro de metilo	Meth-O-Gas®
Liberador de metil-isotiocianato	Dazomet	Basamid® G
Liberador de metil-isotiocianato	Metam sódico	Vapam® HL
Organofosfato	Cadusafós	Rugby®
Organofosfato	Etoprop	Mocap®
Organofosfato	Fenamifos	Nemacur®
Organofosfato	Fensulfotión	Dasanit®
Organofosfato	Terbufós	Plydox®

En una modalidad, el producto químico para tratamiento de plantas es un fertilizante que contiene nutrientes vegetales seleccionado del grupo que consiste en azufre, fósforo, magnesio, calcio, potasio, nitrógeno, molibdeno, cobre, zinc, 5 manganeso, hierro, boro, cobalto, cloro y combinaciones de estos.

En una modalidad adicional, el producto químico para tratamiento de plantas es un agente regulador de crecimiento seleccionado del grupo que consiste en auxinas, citoquininas, 10 defoliantes, liberadores de etileno, giberelinas, inhibidores de crecimiento, retardantes del crecimiento, estimulantes de crecimiento y combinaciones de estos.

Los reguladores de crecimiento adecuados incluyen, de modo no taxativo, los enumerados en la Tabla 6.

15 **Tabla 6. Ejemplos de reguladores de crecimiento**

Tipo de ingrediente activo	Nombre genérico de ingrediente activo	Producto comercial
Citoquinina	Zeatina	
Defoliante	Tidiazurón (ISO)	Dropp®
Estimulante del crecimiento	Forclorfenurón	
Inhibidor del crecimiento	Cloruro de mepiquat (ISO)	Pix®
20 Inhibidor del crecimiento	Hidrazida maleica (ISO-E)	Sprout Stop®
Retardante del crecimiento	Palclobutrazol (ISO)	Bonzi®
Difoliante, liberador de etileno	Etefón (ANSI)	Prep®
Giberelina	Ácido giberélico	RyzUp®
Giberelina	BAP + ácido giberélico	Accel®
Auxina	ácido α -naftalenacético (ISO)	Tre-Hold®
Auxina	IBA	Seradix®

La composición adyuvante para uso con los productos químicos para tratamiento de plantas puede comprender espesante al 1,00 a 3,00% en peso, 1,00 a 2,50% en peso, 1,00 a 2,00% en peso, 1,50 a 2,00% en peso, o 1,50 a 2,50% en peso; sal divalente soluble en agua al 0,05 a 0,10% en peso, 0,05 a 0,15% en peso, 0,05 a 0,50% en peso, 0,05 a 0,35% en peso, 0,10 a 0,40% en peso, 0,15 a 0,35% en peso, 0,20 a 0,30% en peso; agente de control de espuma al 0,05 a 0,10% en peso, 0,05 a 0,15% en peso, 0,05 a 0,50% en peso, 0,05 a 0,35% en peso, 0,10 a 0,40% en peso, 0,15 a 0,35% en peso, 0,20 a 0,30% en peso; agente formador de complejo al 1,00 a 3,00% en peso, 1,00 a 2,50% en peso, 1,00 a 2,00% en peso, 1,50 a 2,00% en peso, o 1,50 a 2,50% en peso; agente de formación de película al 0,05 a 0,10% en peso, 0,05 a 0,15% en peso, 0,05 a 0,50% en peso, 0,05 a 0,35% en peso, 0,10 a 0,40% en peso, 0,15 a 0,35% en peso, 0,20 a 0,30% en peso; y agua al 90 a 99% en peso, 92 a 99% en peso, 94 a 99% en peso, 96 a 99% en peso, 97 a 99% en peso, o 98 a 99% en peso. De acuerdo con regulaciones federales y estatales, la formulación para tratamiento de plantas puede comprender 0,1 a 1,00% en peso, 0,1 a 0,50% en peso o 0,10 a 0,25% en peso del producto químico para tratamiento de plantas.

En una modalidad, la formulación química para tratamiento de plantas comprende 1,00 a 3,0% en peso del espesante; 0,05 a

0,15% en peso de la sal divalente soluble en agua; 0,05 a 0,15% en peso del agente de control de espuma; 3,00 a 6,00% en peso del agente formador de complejo; 0,05 a 0,15% en peso de un agente de formación de película; 90 a 99% en peso de agua y 5 0,1 a 1,00% en peso del producto químico para tratamiento de plantas.

En otra modalidad, la formulación química para tratamiento de plantas comprende 1,6 a 2,4% en peso del espesante; 0,08 a 0,12% en peso de la sal divalente soluble en agua; 0,08 a 0,12% 10 en peso del agente de control de espuma; 1,6 a 2,4% en peso del agente formador de complejo; 0,8 a 0,12% en peso de un agente de formación de película; 97,6 a 98,4% en peso de agua y 0,10 a 1,00% en peso de un producto químico para tratamiento de plantas.

15 De manera alternativa, la formulación química para tratamiento de plantas comprende 1,8 a 2,2% en peso del espesante; 0,09 a 0,11% en peso de la sal divalente soluble en agua; 0,09 a 0,11% en peso del agente de control de espuma; 1,8 a 2,2% en peso del agente formador de complejo; 0,09 a 20 0,11% en peso del agente de formación de película; 97,8 a 98,2% en peso de agua y 0,10 a 1,00% en peso de un producto químico para tratamiento de plantas.

Otro aspecto de la presente invención se refiere a un método para tratar plantas o semillas vegetales. El presente

método implica proporcionar una semilla vegetal o una planta en crecimiento y aplicar la formulación química para tratamiento de plantas de la presente invención a la semilla vegetal o planta en crecimiento.

5 De acuerdo con este aspecto de la invención, el espesante, el agente de control de espuma, la sal divalente soluble en agua, el agente formador de complejo y el agente de formación de película de la formulación química para tratamiento de plantas de la presente invención se seleccionan tal como se
10 describió anteriormente.

El producto químico para tratamiento de plantas puede seleccionarse del grupo que consiste en un pesticida, un fertilizante y un agente regulador de crecimiento, tal como se describió anteriormente.

15 En una modalidad, la formulación química para tratamiento de plantas comprende 1,00 a 3,00% en peso del espesante; 0,05 a 0,15% en peso de la sal divalente soluble en agua; 0,05 a 0,15% en peso del agente de control de espuma; 1,00 a 3,00% en peso del agente formador de complejo; 0,05 a 0,15% en peso de
20 un agente de formación de película; 90 a 99% en peso de agua y 0,1 a 1,00% en peso del producto químico para tratamiento de plantas.

En otra modalidad, la formulación química para el tratamiento de plantas comprende 1,6 a 2,4% en peso del

espesante; 0,08 a 0,12% en peso de la sal divalente soluble en agua; 0,08 a 0,12% en peso del agente de control de espuma; 1,6 a 2,4% en peso del agente formador de complejo; 0,8 a 0,12% en peso de un agente de formación de película; 97,6 a 98,4% en peso de agua y 0,10 a 1,00% en peso de un producto químico para tratamiento de plantas.

De manera alternativa, la formulación química para tratamiento de plantas comprende 1,8 a 2,2% en peso del espesante; 0,09 a 0,11% en peso de la sal divalente soluble en agua; 0,09 a 0,11% en peso del agente de control de espuma; 1,8 a 2,2% en peso del agente formador de complejo; 0,09 a 0,11% en peso de un agente de formación de película; 97,8 a 98,2% en peso de agua y 0,10 a 1,00% en peso de un producto químico para tratamiento de plantas.

Tal como se usa en la presente, el término "planta" se refiere a todo organismo viviente que pertenezca al reino plantae, lo que incluye, de modo no taxativo, árboles, hierbas, arbustos, gramíneas y vides. El término se refiere tanto a monocotiledóneas como dicotiledóneas. Las plantas de ejemplo incluyen, de modo no taxativo, maíz, papas, rosas, manzanos, girasoles, trigo, arroz, bananas, tomates, calabazas, calabacín, lechuga, col, robles, guzmania, geranios, hibiscos, clemátides, flor de pascua, caña de azúcar, taro, lentejas de agua, pinos, pasto azul de Kentucky, zoysia, árboles cocoteros,

vegetales de hojas brassicas (por ejemplo, brócoli, brócoli rabe, coles de Bruselas, col, col chino (por ejemplo, bok choy y napa), coliflor, col silvestre, coles, kale, col rábano, mostaza castaña, colza forrajera y otros cultivos vegetales de
5 hojas brassica), vegetales de bulbo (por ejemplo, ajo, puerro, cebolla (de bulbo seco, de verdeo y Welsh), echalote y otros cultivos vegetales de bulbo), frutas cítricas (por ejemplo, toronja, limón, lima, naranja, tanjarina, híbridos cítricos, pomelo y otros cultivos de frutas cítricas), cucurbitáceas (por
10 ejemplo, pepino, chilacayote, cucurbitas comestibles, pepinillos, melones almizcleros (incluso híbridos y/o variedades cultivadas de melones), sandía, melón cantalupo y otros cultivos de cucurbitáceas), frutos (incluso berenjena, tomate cherry, pepino, pimiento, tomate, tomatillo y otros
15 cultivos de frutos), uva, vegetales de hojas (por ejemplo, lechuga romana), vegetales de maíz y raíz/tubérculo (por ejemplo, papa) y frutos secos (por ejemplo, almendras, nuez pacana, pistachos y nueces), bayas (por ejemplo, tomates, agracejo, grosellas, saúcos, uvas crispas, madreselva,
20 podófilo, viburnum lentago, mahonia, espino amarillo, celtis, gayuba, arándano rojo, fresas, uva de playa, moras, mora de los pantanos, rubus loganobaccus, frambuesa, rubus spectabilis, rubus parviflorus y frambuesa japonesa), cultivos de cereales (por ejemplo, maíz, arroz, trigo, cebada, sorgo,

mijo, avena, centeno, triticales, trigo sarraceno, fonio y quínoa), frutas pomáceas (por ejemplo, manzanas, peras), drupas (por ejemplo, café, azufaifa, mango, oliva, coco, palmas oleaginosas, pistachos, almendras, damascos, cerezas, ciruelos de Damasco, nectarinas, duraznos y ciruelas), vides (por ejemplo, uvas de mesa y uvas de vino), cultivos de fibra (por ejemplo, cáñamo y algodón), ornamentales y similares.

Tal como se usa en la presente, el término "planta en crecimiento" se refiere a una planta que se encuentra en aumento de masa o cantidad celular. Las plantas pueden cultivarse mediante cualquier método conocido en la técnica, que incluyen en el suelo, en cultivo de agua (por ejemplo, de forma hidropónica), en medios, en cultivo de arena, en cultivo de grava y en cultivo con nutrientes absorbidos (ver, por ejemplo, McCall WW, Nakagawa Y. 1970. Growing plants without soil. Honolulu (HI): Universidad de Hawái. 22p. (Circular;440), que se incorpora a la presente en su totalidad mediante referencia). En una modalidad, se trata una planta en crecimiento.

Tal como se usa en la presente, el término "semilla" se refiere a propágulos vegetales que incluyen, de modo no taxativo, semillas reales, partes de semillas, macollos, cormos, bulbos, frutos, tubérculos, granos, recortes, brotes cortados y similares. En una modalidad, se trata una semilla

vegetal.

La semilla o planta en crecimiento puede seleccionarse del grupo que consiste en canola, alfalfa, arroz, trigo, cebada, centeno, algodón, girasol, maní, maíz, papa, camote,
5 alubia, chícharo, achicoria, lechuga, endibia, col, col de Bruselas, remolacha, chirivía, coliflor, brócoli, nabo, rábano, espinaca, cebolla, ajo, berenjena, pimiento, apio, zanahoria, calabacín, calabaza, calabacita, pepino, manzana, pera, melón, cítricos, fresa, uva, frambuesa, piña, soya,
10 tabaco, tomate, sorgo y caña de azúcar.

En una modalidad, la planta en crecimiento o semilla vegetal se selecciona del grupo que consiste en *Arabidopsis thaliana*, *Saintpaulia*, petunia, pelargonio, flor de pascua, crisantemo, clavel y zinnia.

15 Los métodos para aplicar las formulaciones químicas para tratamiento de plantas a las plantas en crecimiento se conocen en la técnica e incluyen, de modo no taxativo, pulverización, humedecimiento, remojo, rocío, empapado, riego, nebulización, inmersión, humectación, salpicadura y aspersión (ver, por
20 ejemplo, Matthews, G. A. (2000) *Pesticide Application Methods*, tercera edición, Blackwell Science Ltd, Oxford, Reino Unido, que se incorpora a la presente en su totalidad mediante referencia).

En una modalidad, la semilla vegetal se trata antes de

plantarse en un medio de crecimiento.

Los métodos de aplicación de formulaciones químicas para tratamiento de plantas a las semillas antes de que estas se planten en un medio de crecimiento incluyen espolvoreo, 5 recubrimiento y pulverización (ver, por ejemplo, Matthews, G. A. (2000) Pesticide Application Methods, tercera edición, Blackwell Science Ltd, Oxford, Reino Unido, que se incorpora a la presente en su totalidad mediante referencia).

Los métodos de la presente invención se dirigen al 10 tratamiento precosecha de plantas en crecimiento y a las semillas a plantarse. El término "precosecha" se refiere a un producto agrícola, tal como una planta, producto vegetal (por ejemplo, flor o semilla) que aún se encuentra unido a un árbol, arbusto, planta de flores, etc., o que aún se encuentra en el 15 suelo (por ejemplo, una zanahoria o tubérculo) en cualquier momento temporal antes de su cosecha (por ejemplo, desprendido de un árbol, arbusto o planta de flores, o extirpado del suelo o escindido, cortado o de otro modo removido de un tallo, vid, etc.) para su venta, comercialización, consumo u otro uso 20 humano.

El tratamiento precosecha de la presente invención difiere de un tratamiento poscosecha (que no es el objeto de la presente invención). Tal como se usa en la presente, el término "poscosecha" se refiere al momento temporal en el cual un

producto agrícola se cosecha para su venta, comercialización, consumo u otro uso humano. Con respecto a los productos comestibles, por ejemplo, vegetales y frutas, o a los productos no comestibles que se recolectan, por ejemplo, flores, el
5 producto comercial comienza su existencia como "poscosecha" después de la recolección. Para los productos no comestibles, por ejemplo, árboles, arbustos, plantas de flores y/o reserva de plántulas, la poscosecha es el momento en el cual el producto se empaca, cosecha o se prepara de otro modo para su
10 comercialización.

En algunas modalidades, la planta en crecimiento o semilla vegetal es una semilla vegetal o planta en crecimiento precosecha. Por consiguiente, la planta en crecimiento o semilla vegetal no es una planta poscosecha ni una semilla
15 poscosecha (por ejemplo, una fruta cosechada).

Aun otro aspecto de la presente invención se refiere a un método para tratar una semilla vegetal o una planta en crecimiento. El presente método implica una semilla vegetal o una planta en crecimiento. El método implica además aplicar
20 una mezcla de un producto químico para tratamiento de plantas y un material de recubrimiento a superficies de la semilla vegetal o planta donde, después de que el material de recubrimiento aplicado se seca en las superficies de la semilla vegetal o planta en crecimiento, el material de recubrimiento

seco se caracteriza por adherirse a las superficies de la semilla vegetal o planta en crecimiento y permite el permeado del material acuoso a la semilla vegetal o planta en crecimiento mientras minimiza la pérdida de humedad o pérdida del producto químico para tratamiento de plantas de la semilla vegetal o planta en crecimiento.

De acuerdo con este aspecto de la invención, el material de recubrimiento se produce a partir de una mezcla que comprende un espesante, un agente de control de espuma, una sal divalente soluble en agua, un agente formador de complejo, un agente de formación de película y agua, tal como se describió anteriormente. Esta mezcla se formula y aplica a semillas vegetales y plantas en crecimiento, tal como se describió anteriormente.

El producto químico para tratamiento de plantas se selecciona del grupo que consiste en un pesticida, un fertilizante y un agente regulador de crecimiento, tal como se describió anteriormente.

EJEMPLOS

20 Materiales y métodos para los Ejemplos 1-2

Ubicaciones de experimentación. Se llevaron a cabo pruebas de campo en la Universidad de Florida, Southwest Florida Research and Education Center, Immokalee, Florida. Para los ensayos de pimientos, las temperaturas máxima y mínima en promedio por

mes fueron 36,6°C y 21°C [98°F y 70°F] en el primer mes; 34,4°C y 17,2°C [94°F y 63°F] en el segundo mes; y 34,4°C y 10,5°C [94°F y 51°F] en el tercer mes; las precipitaciones totales fueron 280, 24 y 61,2 mm [11,02, 0,95 y 2,41 pulgadas] para los mismos períodos mensuales, respectivamente. Para los ensayos de calabacín, las temperaturas máxima y mínima en promedio por mes fueron 33,8°C y 7,2°C [93°F y 45°F] en el primer mes; 35,5°C y 12,7°C [96°F y 55°F] en el segundo mes; y 35,5°C y 12,7°C [96°F y 55°F] en el tercer mes; las precipitaciones totales fueron 50,8, 85 y 142 mm [2,00, 3,35 y 5,59 pulgadas] para los mismos períodos mensuales, respectivamente.

Establecimiento de trasplante para los ensayos de campo.

En todos los ensayos, las plántulas se trasplantaron a arena fina de Immokalee en el día 0. Los tratamientos se dispusieron en un diseño de bloque completamente aleatorio de tratamiento con cuatro replicaciones. Para los ensayos de pimiento, se dispusieron plántulas de 'Capistrano' en parcelas que comprendían 10 plantas en una única fila con separación de 25,4 cm [10 pulgadas] en una fila con ancho de 91,4 cm [36 pulgadas] y con 1,5 m [5 pies] de separación entre cada parcela y 3,7 m [12 pies] de distancia entre los centros de las filas. Para los ensayos de calabacín, se dispusieron plantas 'Dixie' de cuatro semanas en parcelas que comprendían ocho plantas con

separación de 0,9 m [3 pies] entre sí con una fila de 8,2 m [27 pies] y 3 m [10 pies] de separación entre cada parcela.

Aplicación del tratamiento. Se aplicó mediante pulverización de aerosol cada formulación de tratamiento. Para
5 los ensayos de pimiento, las formulaciones de tratamiento se aplicaron mediante el uso de un rociador de mochila de CO₂ a 2,812 kg/cm² (40 psi) con una única boquilla de cono hueco a 113,56 litros (30 gal)/A. Se aplicó silicio como metasilicato de sodio nonahidratado (Na₂SiO₃•9H₂O). Para los ensayos de
10 calabacín, las formulaciones de tratamiento se aplicaron con un rociador de depuración alta 3,22 kmh [2 mph] y a 14,06 kg/cm² (200 psi). Un tractor pulverizador de doble plataforma equipado con seis boquillas suministraron un volumen de pulverización de 340,68 litros (90 gal)/A para plantas de tomate o 302,83
15 litros (80 gal)/A para plantas de calabacín.

Inoculación bacteriana. Para los ensayos de pimiento, se aplicó una suspensión de inóculo de cepas que contenían manchas bacterianas de diversas razas en el día 22 y se introdujo un nuevo inóculo de manera periódica durante todo el resto del
20 ensayo.

Recopilación y análisis de datos. Para cada ensayo, se evaluó la gravedad de la enfermedad mediante la estimación visual del porcentaje de follaje con síntomas de la enfermedad. Para los ensayos de pimiento, se examinaron las plantas con

respecto a los síntomas de mancha bacteriana. Para los ensayos de calabacín, se examinaron las plantas con respecto al oídio. El área bajo la curva del progreso de la enfermedad (AUDPC, por sus siglas en inglés) se calculó a partir de las clasificaciones de gravedad de la enfermedad. En algunos ensayos, los frutos se cosecharon y se evaluó la cantidad de fruto comerciable producido por parcela. Los datos se analizaron en el programa estadístico ARM 9,1 (ensayos de pimiento) o ARM 9,0 (ensayos de tomate y calabacín) mediante ANOVA y con promedio separado por LSD.

Ejemplo 1 - Evaluación de formulaciones químicas para la gestión de mancha bacteriana en el pimiento

Las plántulas de pimiento 'Capistrano' *Capsicum annuum* trasplantadas se agruparon en uno de los seis grupos de tratamiento. El grupo uno fue un control sin tratamiento. Los restantes cinco grupos se trataron mediante pulverización con formulaciones que diferían en sus composiciones químicas (Tabla 7).

Tabla 7. Mancha bacteriana en el pimiento

Código de aplicación, tasa y tratamiento ^a	Gravedad de la enfermedad ^b					AUDPC ^c
	Día 41	Día 47	Día 58	Día 61	Día 71	
1 Control sin tratamiento	4,8 a ^d	17,3 a	27,5 a	25 a	25 a	577,83 ab
2 Hidróxido de cobre, Arcilla, Ácido 2- propenoico, Homopolímer o (Kocide® 3000 DF) Mancozeb, Etileno tiourea	12.75 Kg/A A-K 0,68 kg23.3 A-K	2,8 a 20,9 a	20 ab	16,3 ab	20 ab	470,04 b

5

	(Manzate® Pro-Stik 75DF)	kg/A							
3	Hidróxido de cobre, Arcilla, Ácido 2-propenoico, Homopolímero (Kocide® 3000 DF) Adyuvante ^e Mancozeb, Etileno tiourea (Manzate® Pro-Stik 75DF)	2.75/A 7,8E-3 lt 0,68 kg3.3 kgA	A-K A-K A-K	12,3 a	14,1 a	13,8 bc	17,5 a	12 bc	375,46 b
4	Adyuvante ^e	7,8E-3 lt	A-K	16,5 a	21,6 a	30 a	23,3 a	30 a	686,71 a
5	Silicio	100 g/mL	A-K	10,3 a	21,5 a	21,3 ab	15 ab	22,5 ab	518,42 ab
6	Adyuvante ^e Silicio	7,8E-3 lt 100 g/mL	A-K A-K	1,5 a	3,8 b	4,3 c	3 b	7 c	94,42 c
	Valor p			0,4562	0,0085	0,0102	0,0498	0,0040	0,0005

^aFecha de aplicación: Fecha de aplicación de los tratamientos llevados a cabo A = día 14; B = día 21; C = día 28; D = día 35; E = día 42; F = día 49; G = día 56; H = día 64; I = día 71; J = día 77; K = día 84

^bLa gravedad de la enfermedad es un estimado del porcentaje del follaje sintomático

^cÁrea bajo la curva del progreso de la enfermedad

^dLos promedios seguidos por la misma letra no difieren significativamente en el valor *P* indicado en la columna.

^eLa formulación adyuvante comprende agua al 95,70% en peso, ACUSOL® 823 al 2,00% en peso, PVA (100 000 MW) al 0,10% en peso, ZnSO₄ monohidratado al 0,10% en peso, Antifoam® 8810 al 0,10% en peso y TEA al 2,00% en peso.

Las formulaciones químicas que se muestran en la Tabla 7 se aplicaron a plantas los días 14, 21, 28, 35, 42, 49, 56, 64, 71, 77 y 84. Las plantas se inocularon con una suspensión

bacteriana (*Xanthomonas euvesicatoria*) el día 22 y de manera periódica durante el resto del ensayo. La gravedad de la enfermedad se evaluó en los días 19, 25, 36, 39 y 49 mediante la estimación del porcentaje del follaje sintomático.

5 Tal como se muestra en la Tabla 7, las plantas tratadas con formulaciones químicas que comprenden adyuvante y silicio (Grupo 6) mostraron una reducción significativa en la gravedad de la enfermedad en comparación con el control sin tratamiento (Grupo 1), las plantas tratadas con diversas combinaciones de
10 compuestos comercialmente disponibles (Grupos 2 y 3), las plantas tratadas únicamente con adyuvante (Grupo 4) y las plantas tratadas únicamente con silicio (Grupo 5). Las plantas del Grupo 6 también mostraron un crecimiento mejorado en comparación con aquellas en el grupo únicamente con silicio
15 (Grupo 5) (FIGURAS 1A-1B).

El fruto se cosechó en los días 61 y 83.

Tabla 8. Datos de cosecha de pimiento

20

Tratamiento	Día 61		Día 83			
	Cantidad de frutos comerciables por parcela	Frutos comerciables en libras por parcela	Cantidad de frutos comerciables por parcela	Cantidad de frutos comerciables en libras por parcela	Frutos no comerciables por parcela	Frutos no comerciables en libras por parcela
1 Control sin tratamiento	13 a	3,25 a	33,8 a	10,73 a	0 b	0 a
2 Kocide® 3000 DF Mancozeb, Etileno tiourea (Manzate® Pro-Stik 75DF)® Pro- Stik 75DF	19,3 a	4,58 a	40 a	13,28 a	2 a	0,55 a

5	3 Kocide® 3000 DF Adyuvante (Mancozeb, Etileno tiourea (Manzate® Pro-Stik 75DF	19,8 a	4,65 a	43,8 a	12,58 a	0,5 b	0,18 a
	4 Adyuvante	17,3 a	2,85 a	30,3 a	9,18 a	0,3 b	0,18 a
	5 Silicio	12 a	2,9 a	26,3 a	7,38 a	1 ab	0,35 a
	6 Adyuvante Silicio	24,5 a	5,4 a	38,5 a	14,63 a	0,3 b	0,05 a
	Valor p	0,5643	0,5484	0,1299	0,086	0,0408	0,0515

Tal como se muestra en la Tabla 8, las plantas tratadas con adyuvante y silicio (Grupo 6) tuvieron los mejores resultados en libras de frutos comerciables y los mejores resultados tanto para la cantidad de frutos no comerciables y libras de frutos no comerciables por parcela en comparación con las plantas en el grupo de control sin tratamiento (Grupo 1), las plantas tratadas con Hidróxido de cobre, Arcilla, Ácido 2-propenoico, Homopolímero (Kocide® 3000 DF) y Mancozeb, Etileno tiourea (Manzate® Pro-Stik 75DF) (Grupo 2), las plantas tratadas con Hidróxido de cobre, Arcilla, Ácido 2-propenoico, Homopolímero (Kocide® 3000 DF), adyuvante y Mancozeb, Etileno tiourea (Manzate® Pro-Stik 75DF) (Grupo 3), las plantas tratadas únicamente con adyuvante (Grupo 4) y las plantas tratadas únicamente con silicio (Grupo 5).

Ejemplo 2 - Evaluación de formulaciones químicas para la gestión del oídio en el calabacín

Las plantas de calabacín 'Dixie' *Cucurbita pepo* trasplantadas

se agruparon en uno de 9 grupos de tratamiento. El Grupo 1 fue un control sin tratamiento; los restantes 8 grupos se trataron mediante pulverización con formulaciones que diferían en sus composiciones químicas (Tabla 9).

5 **Tabla 9. Tabla de media ANOVA de la gravedad de enfermedad de**
oídio

Código de aplicación, tasa y tratamiento	Gravedad de la enfermedad (% de hojas cubiertas con oídio)			AUDPC
	Día 39	Día 46	Día 52	
Control sin tratamiento	2,1	21,7 a	19,9 ab	207 a
1 Myclobutanil, Caolín, Polisilicato de calcio, Sílice cristalino (cuarzo), Dióxido de Titaneo (Rally® 40WSP) 0.15 lt/A ACE	1,0	3,9 b	8,5 cd	54 cd
15 Quinoxifeno, propilenglicol (Quintec® 2SC) 0.18 lt/A BD				
2 Myclobutanil, Caolín, Polisilicato de calcio, Sílice cristalino (cuarzo), Dióxido de Titaneo (Rally® 40WSP) 0.15 lt/A ACE	0,1	1,3 b	3,1 cd	17 d
15 Quinoxifeno, propilenglicol (Quintec® 2SC) 0.18 lt/A BD				
20 Adyuvante 121 lt A-E				
4 Myclobutanil, Caolín, Polisilicato de calcio, Sílice cristalino (cuarzo), Dióxido de 0.15 lt/A AE	5,0	3,7 b	14,0 bc	83 d

5		Titaneo (Rally® 40WSP) Quinoxifeno, propilenglicol (Quintec® 2SC)	0.18	lt/A	C							
	5	Myclobutanil, Caolín, Polisilicato de calcio, Sílice cristalino (cuarzo), Dióxido de Titaneo (Rally® 40WSP)	0.15	lt/A	AE	3,5	1,8	b	2,6	d	31	d
	10	Quinoxifeno, propilenglicol Quinoxifeno, propilenglicol (Quintec® 2SC)	0.18	lt/A	C							
		Adyuvante	121	lt	ACE							
15	6	Myclobutanil, Caolín, Polisilicato de calcio, Sílice cristalino (cuarzo), Dióxido de Titaneo (Rally® 40WSP)	0.098	lt/A	ACE	0,3	1,4	b	4,0	cd	21	d
		Quinoxifeno, propilenglicol (Quintec® 2SC)	0.12	lt/A	BD							
20	7	Myclobutanil, Caolín, Polisilicato de calcio, Sílice cristalino (cuarzo), Dióxido de Titaneo (Rally® 40WSP)	0.098	lt/A	ACE	0,7	1,1	b	2,6	d	17	d
		Quinoxifeno, propilenglicol (Quintec® 2SC)	0.118	lt/A	BD							
		Adyuvante	0.0074	lt/A	A-E							
	8	Mancozeb, Etileno tiourea	0.089	ka/A	A-E	3,8	12,4	ab	26	a	171	ab

	(Manzate® Pro-Stik 75DF)								
	Mancozeb, Etileno tiourea (Manzate® Pro-Stik 75DF)								ab
9	Stik 75DF)	0.089	ka/A	A-E	3,9	10,2	ab	19,6	ab 138 c
	Adyuvante	121	lt	A-E					
5	LSD P=0,05				4,43	12,25		10,95	98,007
	Desviación estándar				3,1	8,57		7,66	68,581
	Tratamiento prob F:				0,2003	0,0552		0,0004	0,0019

Los promedios seguidos por la misma letra o sin letra en una columna no son significativamente diferentes en el valor P indicado; las aplicaciones se llevaron a cabo A = día 24; B = día 30; C = día 37; D = día 44; E = día 49.

La formulación adyuvante comprende agua al 95,70% en peso, ACUSOL® 823 al 2,00% en peso, PVA (100 000 MW) al 0,10% en peso, ZnSO₄ monohidratado al 0,10% en peso, Antifoam® 8810 al 0,10% en peso y TEA al 2,00% en peso.

Las plantas se trataron en los días 24, 30, 37, 44 y 49 tal como se indican en la Tabla 9. La gravedad de la enfermedad se evaluó en los días 31 y 42 mediante la estimación del porcentaje del follaje sintomático.

El fruto se cosechó en los días 44 y 53. Tal como se muestra en la Tabla 10 a continuación,

Tabla 10. Tabla de promedios ANOVA de la cosecha de calabacín

Código de aplicación, tasa y tratamiento	Prom # fruto/planta	Prom lb/planta	Prom # fruto/planta	Prom lb/planta
	Día 44		Día 53	
Control si 1 tratamiento	3,7	1,6	1,6	0,4

5	2	Myclobutanil, Caolín, Polisilicato d calcio, Sílic cristalino (cuarzo), Dióxido d Titaneo (Rally 40WSP)	0.15	lt/A	ACE	3,8	2,0	1,8	0,5
		Quinoxifeno, propilenglicol (Quintec® 2SC)	0.18	lt/A	BD				
10	3	Myclobutanil, Caolín, Polisilicato d calcio, Sílic cristalino (cuarzo), Dióxido d Titaneo (Rally 40WSP)	0.15	lt/A	ACE	2,3	1,0	1,8	0,5
		Quinoxifeno, propilenglicol (Quintec® 2SC)	0.18	lt/A	BD				
15		Adyuvante	7,8E-3	lt/GAL	A-E				
	4	Myclobutanil, Caolín, Polisilicato d calcio, Sílic cristalino (cuarzo), Dióxido d Titaneo (Rally 40WSP)	.05	lt/A	AE	2,1	1,0	2,5	1,1
20		Quinoxifeno, propilenglicol (Quintec® 2SC)	0.18	lt/A	C				
	5	Myclobutanil,	0.15	lt/A	AE	2,9	1,4	2,2	0,8

5	Caolín, Polisilicato d calcio, Sílic cristalino (cuarzo), Dióxido d Titaneo (Rally 40WSP) Quintec® 2SC 0.18 lt/A C Adyuvante 7,8E-3 Lt/t ACE				
10	6 Myclobutanil, Caolín, Polisilicato d calcio, Sílic cristalino (cuarzo), Dióxido d Titaneo (Rally 40WSP) 7,8E-3 lt/A ACE Quinoxifeno, propilenglicol (Quintec® 2SC) 0.12 lt/A BD	4,7	2,3	1,4	0,5
15	7 Myclobutanil, Caolín, Polisilicato d calcio, Sílic cristalino (cuarzo), Dióxido d Titaneo (Rally 40WSP) 7,8E-3 lt/A ACE Quinoxifeno, propilenglicol (Quintec® 2SC) 0.12 lt/A BD Adyuvante 7,8E-3 lt/ A-E	3,1	1,7	1,4	0,4
20	8 Mancozeb, Etileno tioure (Manzate® Pro-Stik 75DF) 1.36 kg/A A-E	2,9	1,3	2,0	0,8

5	Mancozeb, Etileno tioure (Manzate®)							
	9 Pro-Stik 75DF	1.36 lg/A	A-E	3,1	1,4	1,8	0,6	
	Adyuvante	7,8E-3 FL It	A-E					
	LSD P=0,05			1,439	0,982	1,396	0,522	
	Desviación estándar			1,007	0,687	0,977	0,365	
10	Tratamiento prob F:			0,0376	0,3115	0,8277	0,313	

Los promedios seguidos por la misma letra o sin letra en una columna no son significativamente diferentes en el valor P indicado; las aplicaciones se llevaron a cabo A = día 24; B = día 30; C = día 37; D = día 44; E = día 49. La formulación adyuvante comprende agua al 95,70% en peso, ACUSOL® 823 al 2,00% en peso, PVA (100 000 MW) al 0,10% en peso, ZnSO₄ monohidratado al 0,10% en peso, Antifoam® 8810 al 0,10% en peso y TEA al 2,00% en peso.

Las plantas en el Grupo 6 tuvieron un aumento de cantidad de frutos comerciables por parcela y frutos comerciables en libras por parcela en comparación con las plantas en cualquier otro grupo de control o tratamiento en el día 44.

El control del oídio en el calabacín se midió mediante el uso de diferentes formulaciones de Myclobutanil, Caolín, Polisiilicato de calcio, Sílice cristalino (cuarzo), Dióxido de Titaneo (Rally®) y Quinoxifeno, propilenglicol (Quintec®) con o sin adyuvante. Se midió el uso de 5 oz/galón de Myclobutanil, Caolín, Polisiilicato de calcio, Sílice cristalino (cuarzo), Dióxido de Titaneo (Rally®) y 6 oz/galón de Quinoxifeno,

propilenglicol (Quintec®) solos o en combinación con 0,25 oz/galón de adyuvante. La adición de aplicaciones semanales de Myclobutanil, Caolín, Polisilicato de calcio, Sílice cristalino (cuarzo), Dióxido de Titaneo (Rally®) y Quinoxifeno, propilenglicol (Quintec®) produjo una reducción eficaz del 35% en el% de hojas cubiertas con oídio en comparación con el control. Un intervalo de aplicación de 14 días con adición de adyuvante superó a los fungicidas solos en una reducción aproximada del 30% en comparación con el control. Las tasas de fungicida se redujeron en un 33% con la adición de adyuvante y otorgaron un control superior a las tasas de etiqueta totales en 30% de las hojas cubiertas con oídio en comparación con el control.

Materiales y métodos para el Ejemplo 3

Ubicaciones de experimentación. Se llevaron a cabo pruebas de campo en la Universidad de Florida, Southwest Florida Research and Education Center ("SWFREC"), Immokalee, Florida. El sitio fue el bloque del rancho Adams #1 que contenía árboles de toronja de tres años.

Aplicación del tratamiento. Cada formulación de tratamiento se aplicó por pulverización de aerosol mediante el uso de equipos de productores en los lados centrales y las zanjas de los árboles.

Recopilación y análisis de datos. Para cada ensayo, se

seleccionaron las hojas con respecto al tamaño uniforme y la ubicación alrededor de árboles individuales. Se recolectaron aproximadamente diez hojas en una bolsa plástica a partir de un único árbol. Las hojas se colocaron en hielo y se transportaron al laboratorio en SWFREC, Immokalee. Luego, las hojas se lavaron tres veces en serie en agua desionizada. Se utilizó una perforadora para remover el tejido cerca de la vena central de diversas hojas y se combinó un total de 1 gramo de tejido y se colocó en un tubo Eppendorf y liofilizó durante la noche. Un kit comercial ELISA (Kit ELISA de análisis de oxitetraciclina, Bioo Scientific Corp, Austin, TX) para detectar la oxitetraciclina de diversos productos alimenticios se adaptó y utilizó para este análisis utilizando las instrucciones para el kit del fabricante. Cada muestra se procesó en duplicado y la placa ELISA contenía los controles positivos y negativos adecuados tal como se suministran en el kit. Los resultados se leyeron en un lector de placa ELISA.

Ejemplo 3 - Detección de oxitetraciclina luego de las aplicaciones por pulverizador a las hojas de cítricos

Se aplicó mediante pulverización de aerosol cada formulación de tratamiento en el día 0. El diseño de experimentación fue un bloque aleatorizado con cuatro replicaciones. Una fila completa de árboles sirvió dado que la replicación y las aplicaciones se llevaron a cabo en ambos lados (zanja y centro)

de los árboles. Las formulaciones de tratamiento se muestran en la Tabla 11 más adelante.

Tabla 11. Mediciones de oxitetraciclina en hojas de cítricos

5	Grupos de tratamiento			Repetición				Oxitetra-ciclina presente en hoja
	Grupo	Tratamiento	Tasa de aplicación	1	2	3	4	Día 2
10	1	(Oxitetraciclina de calcio, Sílice cristalina (cuarzo), Pirofilita, 1.81 kg/A Mica, Caolín (Mycoshield®))		R-3	R-17	R-32	R-44	1,05 ppm
	2	(Oxitetraciclina de calcio, Sílice cristalina (cuarzo), Pirofilita, 1.81 kg/A Mica, Caolín (Mycoshield®) Adyuvante ^x 0.015 lt		R-8	R-28	R-40	R-60	1,17 ppm
	3	(Oxitetraciclina de calcio, Sílice cristalina (cuarzo), Pirofilita, 1.81 kg/A Mica, Caolín (Mycoshield®) Alquilarilpolietoxi etanol, Ácidos grasos libres e Isopropanol (Spread®R) 0.24 lt/A		R-13	R-24	R-36	R-56	1,10 ppm
15	4	Control sin tratamiento		Filas exteriores	Filas exteriores	Filas exteriores	Filas exteriores	0,02 ppm

* La formulación adyuvante comprende agua al 95,70% en peso, ACUSOL® 823 al 2,00% en peso, PVA (100 000 MW) al 0,10% en peso, ZnSO₄ monohidratado al 0,10% en peso, Antifoam® 8810 al 0,10% en peso y TEA al 2,00% en peso.

Cuarenta y ocho horas después del tratamiento, las hojas se recolectaron de los árboles. En cada repetición, se

recolectaron tres árboles de un total de 12 árboles para cada grupo de tratamiento. Se seleccionaron tres árboles en una fila (repetición) en función de la salud del árbol relativamente uniforme y la ubicación cerca de la sección este, central y oeste de la fila. Tal como se muestra en la Tabla 11, las hojas de los árboles en el Grupo 2 (Oxitetraciclina de calcio, Sílice cristalina (cuarzo), Pirofilita, Mica, Caolín (Mycoshield® + Adyuvante) tuvieron mayores niveles de absorción de oxitetraciclina en comparación con las hojas recolectadas de los árboles en el Grupo 1 (Mycoshield® solo) y el Grupo 3 (Oxitetraciclina de calcio, Sílice cristalina (cuarzo), Pirofilita, Mica, Caolín + Alquilarilpolietoxi etanol, Ácidos grasos libres e Isopropanol + Alquilarilpolietoxi etanol, Ácidos grasos libres e Isopropanol (Mycoshield® + Spread® R).

Los resultados en el Ejemplo 3 demuestran que el uso de (Oxitetraciclina de calcio, Sílice cristalina (cuarzo), Pirofilita, Mica, Caolín (Mycoshield®) en combinación con la composición adyuvante de la presente solicitud indujo aproximadamente 11,5% más "absorción de hoja" de oxitetraciclina que cuando se aplicó (Oxitetraciclina de calcio, Sílice cristalina (cuarzo), Pirofilita, Mica, Caolín (Mycoshield®) sin adyuvante y aproximadamente 7% más "absorción de hoja" de oxitetraciclina que cuando se aplicó (Oxitetraciclina de calcio, Sílice cristalina (cuarzo),

Pirofilita, Mica, Caolín (Mycoshield®) en combinación con Alquilarilpolietoxi etanol, Ácidos grasos libres e Isopropanol (Spread®R). Estos resultados sugieren que la composición adyuvante de la presente solicitud puede mejorar el suministro de productos químicos para tratamiento de plantas.

Ejemplo 4 - Análisis de reducción de herbicida mejorado en arbustos leñosos y gramíneas mezcladas

Las formulaciones químicas para tratamiento de plantas que comprenden los herbicidas imazapir y triclopir se aplicaron por vía aérea a un campo cercado de arbustos leñosos y gramíneas mezcladas. Los campos recibieron una formulación herbicida o una formulación herbicida mejorada con adyuvante que comprende un volumen de herbicida con resistencia total, un volumen de herbicida con reducción de 30% o un volumen de herbicida con reducción de 30%. Tres meses después de la aplicación, los arbustos leñosos rociados con las formulaciones herbicidas mejoradas (resistencia total, reducción de 30% y reducción de 15% de la resistencia) demostraron reacciones más rápidas a los herbicidas aplicados, incluso a volúmenes de herbicida reducidos, cuando se compara con las plantas rociadas con la mezcla habitual de herbicida sin adyuvante (FIGURAS 2A-2H). Normalmente se requieren de 2 a 5 meses con imazapir para comenzar a ver un efecto en las gramíneas. En el día 83, las gramíneas mezcladas tratadas con formulaciones adyuvantes

mostraron amarillamiento y degradación. Esta eficacia y velocidad de acción tanto en arbustos leñosos como en gramíneas mezcladas se atribuye a los polímeros de la composición adyuvante (FIGURAS 2A-2H).

5 Los resultados del Ejemplo 4 demuestran que el uso de un adyuvante en combinación con una formulación herbicida con resistencia total y con resistencia reducida proporcionó una respuesta más rápida al herbicida aplicado.

Ejemplo 5 - Evaluación de fungicidas para controlar múltiples
10 **enfermedades en fresa anual**

En el día 0, plantas *Fragaria x ananassa* del 'Festival de la Fresa' de Canadá se trasplantaron en suelo fumigado con bromuro de metilo:cloropicrina (50:50) en lechos elevados con mantillo plástico. Los trasplantes se irrigaron mediante aspersores de
15 techo durante 10 días para ayudar al establecimiento, luego se irrigaron y fertilizaron mediante cinta de goteo. Los lechos tenían un ancho de 71 cm [28 pulgadas] y centros de 1,2 m [4 pies]. Cada lecho contenía dos filas escalonadas de plantas separadas por 38,1 cm [15 pulgadas] en las filas y 30,5 cm [12
20 pulgadas] entre cada fila. Los tratamientos se dispusieron en un diseño de bloque completamente aleatorizado con cuatro bloques, cada uno en un lecho distinto. Las aplicaciones de fungicida se realizaron semanalmente desde el día 67 hasta el día 162 (15 aplicaciones) mediante el uso de un rociador de

tipo mochila de CO₂ calibrado para suministrar 378.54 litros (100 gal)/A a 2.81 kg/cm² (40 psi) mediante un tractor con dos boquillas de cono hueco TeeJet separadas por 30,5 cm [12 pulgadas]. Los productos de experimentación se aplicaron solos, en mezclas en tanque o en programas de bloque con otros productos. Los frutos se cosecharon dos veces por semana desde el día 92 hasta el día 172 (24 cosechas). Los frutos comerciables se contaron y pesaron para determinar el rendimiento. También se contaron los frutos pequeños con un peso menor que 10 g, frutos con enfermedad antracnosis (*Colletotrichum acutatum*) y Botrytis y otros frutos no comerciables. La incidencia de la enfermedad se expresa como porcentaje de la cantidad total de los frutos comerciables y no comerciables. La gravedad de la mancha angular de hoja (ALS, por sus siglas en inglés; *Xanthomonas fragariae*) se determinó en tratamientos seleccionados al final de la temporada mediante el examen de seis plantas centrales por parcela. La cantidad de hojas muertas o parcialmente marchitas por ALS se expresó como porcentaje de la cantidad total de hojas por planta. Las variables de experimentación se analizaron mediante ANOVA de dos vías.

El clima inusualmente seco durante el período de florecimiento (semanas 6-9) y luego en la temporada (semanas 10-15) contribuyó a la baja incidencia de putrefacción de

frutos de esta temporada. La putrefacción de frutos de Botrytis fue menor que 1,0% en todos los tratamientos. La incidencia de la putrefacción de frutos de antracnosis fue baja y todos los tratamientos redujeron la incidencia de antracnosis con la excepción de Actinovate® solo y el agente humidificante Free-Flow® solo. Sin embargo, ninguno de los tratamientos proporcionó un mejor control de antracnosis que un tratamiento estándar únicamente con captan o un tratamiento estándar que consistía en Captano (Captevate®) alternado con Switch durante el florecimiento seguido por aplicaciones a fines de temporada de 1,2-propanodiol, Bentonita, Metil (E) -2- {2- [6 [(2-cianofenoxi) pirimidin -4-iloxi] fenil} -3-metoxiacrilato (Abound® 2,08F) alternado con captan (Tabla 12).

Tabla 12. Gravedad de la enfermedad de la fresa

Tratamiento (productos y tasas/A) ^z	Cronograma (sem) ^y	Gravedad de ALS (%) ^x	Incidencia de AFR (%) ^x	Rendimiento (lb/A)
Captan (Captan® 80WDG) (0,68 kg) temprano Captan (Captan® 80WDG) (1.36 kg) florecimiento y tardío	1-5 6-15	41,0 abc	0,3 a	26 400 a
Thiram® Granuflo (0,91 kg/0,91 kg)	1-15	--	0,3 a	26 300 a
Captan (Captan® 80WDG) (0,68 kg) temprano Thiram® Granuflo 75WDG (1.54 kg/1.54 kg) florecimiento Captan (Captan® 80WDG) (1.36 kg) tardío	1-5 6-9 10-15	--	0,4 a	25 700 abc
Captan (Captan® 80WDG) (0,68 kg) temprano Captano (Captevate® 68WDG) (1.98 kg) alt Switch 62,5WG (0,41 lt) florecimiento 1,2-propanodiol, Bentonita, Metil (E) -2- {2- [6 [(2-cianofenoxi) pirimidin -4-iloxi] fenil} -3-metoxiacrilato (Abound® 2,08F) (4,55 lt) alt Captan (Captan® 80WDG) (1.36 kg) tardío	1-5 6-9 10-15	42,0 a-d	0,4 a	25 600 abc

5	Captan (Captan® 80WDG) (0,68 kg) temprano Captano (Captevat® 68WDG) (1.98 kg) alt Switch 62,5WG (0,41 lt) florecimiento Fluoxastrobina (Evito® 480SC) (0,15 lt) + Adyuvante Induce (0,25%) Captan (Captan® 80WDG) (1.36 kg) tardío	1-5 6-9 10,12,14 11,13,15	48,3 e	0,3 a	25 000 abc
	Cabrio® EG (0,41 lt) Captano (Captevat® 68WDG) (1.98 kg) Captan (Captan® 80WDG) (1.36 kg)	1,3,6,8 7,9 2,4,5, 11-15	--	0,6 ab	26 300 a ^w
	Captan® 80WDG (0,68 kg) temprano Cabrio® EG (0,41 lt) alt Captano (Captevat 68WDG) (1.98 kg) florecimiento Captan (Captan® 80WDG) (1.36 kg) tardío	1-5 6-10 11-15	--	0,4 a ^w	25 000 abc
10	Captan (Captan® 80WDG) (0,68 kg) temprano Scala® (18 fl oz) florecimiento Trifloxistrobina, Tierra de diatomeas (Flint® 50WG) (3 oz) tardío	1-5 6-9 12-15	--	0,2 a	23 400 cd
	Captan (Captan® 80WDG) (0,68 kg) temprano Captano (Captevat® 68WDG) (1.98 kg) alt Scala (18 fl oz) florecimiento Trifloxistrobina, Tierra de diatomeas (Flint® 50WG) (3 oz) alt Captan (Captan 80WDG) (1.36 kg) tardío	1-5 6-9 10-15	--	0,5 ab	24 400 abc
	Captan (Captan® 80WDG) (0,68 kg) temprano Captano (Captevat® 68WDG) (1.98 kg) florecimiento Scala® (18 fl oz) + Captan (Captan® 80WDG) (0,68 kg) florecimiento (Trifloxistrobina, Tierra de diatomeas (Flint® 50WG) (3,0 oz) alt Captan (Captan® 80WDG) (1.36 kg) tardío	1-5 6,8 7,9 10-15	--	0,4 a	26 400 a
15	Actinovate® (6 oz) + adyuvante Induce® (1,0 pt)	1-15	46,8 cde	1,8 bc	21 800 d
	Actinovate® (12 oz) + adyuvante Induce® (1,0 pt)	1-15	44,4 bcd	1,0 abc	23 500 bcd
	Actinovate® (6 oz) + Captan (Captan® 80WDG) (0,68 kg) temprano Actinovate® (12 oz) + Captan (Captan® 80WDG) (1.36 kg) florecimiento y tardío	1-5 6-15	39,4 ab	0,4 a	26 600 a
20	MOI-106 (0,5% = 2 qt) temprano MOI-106 (2 qt) + Captano (Captevat® 68WDG) (1.98 kg) florecimiento 1,2-propanodiol, Bentonita, Metil (E) -2- {2- [2- cianofenoxi] pirimidin -4-iloxi] fenil} -3-metoxiacrilato	1-5 6-9 10-15	47,4 de	0,3 a	25 300 abc

5	(Abound® 2,08F) (4,55 lt) alt MOI-106 (2 qt) tardío				
	Adyuvante (1:250 w.v) + Captan (Captan® 80WDG) (0,45 kg) temprano				
	Captano (Captevate® 68WDG) (1,31 kg) alt Switch® 62,5WG (9,3 oz) florecimiento ^y	1-5			
	1,2-propanodiol, Bentonita, Metil (E) -2- [2- [(2-cianofenoxi) pirimidin -4-iloxi] fenil] -3-metoxiacrilato	6-9	38,1 a	0,8 ab	26 000 abc
	(Abound® 2,08F) (10,3 fl oz) alt Captan (Captan®) (0.90 kg) tardío	10-15			
	Agente humidificante bacteriano Free-Flow™	1-15	36,5 a	2,3 cd	24 700 abc
	Agente humidificante bacteriano Free-Flow™	1-15			
	Captan (Captan® 80WDG) (1.36 kg)	1-15	--	0,6 ab	25 100 abc
	Control no tratado	--	36,9 a	2,3 cd	23 600 bcd

^zMezclas en tanque de los productos indicados con signos de más

10 “+”; alternancias de productos indicadas con “alt”.

^ySemana de aplicación de una serie de 15 aplicaciones semanales.

^xALS = mancha angular de hoja; AFR = putrefacción de frutos por antracnosis.

15 ^wLos promedios en las columnas seguidos por la misma letra no difieren significativamente mediante la prueba de LSD protegida de Fisher ($P \leq 0,05$).

^vTodos los fungicidas en este tratamiento se mezclaron en tanque con adyuvante a 1:250 p/v de la solución final. La formulación adyuvante comprendió agua al 95,70% en peso, ACUSOL® 823 al 2,00% en peso, PVA (100 000 MW) al 0,10% en peso, ZnSO₄ monohidratado al 0,10% en peso, Antifoam® 8810 al 0,10% en peso y TEA al 2,00% en peso.

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La gravedad de ALS fue alta debido a la frecuente

irrigación de techo para la protección del congelamiento. ALS no se redujo mediante ninguno de los tratamientos y, de hecho, aumentó para los tratamientos con adyuvante Induce® y MOI-10⁶. Diversos tratamientos aumentaron el rendimiento comerciable con respecto al control no tratado, pero ningún tratamiento aumentó significativamente el rendimiento comerciable en comparación con los estándares. El tratamiento con Actinovate® más Induce®, y Scala® al florecimiento seguido de Trifloxistrobina, Tierra de diatomeas (Flint®) produjo rendimientos comerciables menores que el tratamiento con captan estándar. El rendimiento comerciable y la incidencia de antracnosis en el tratamiento con adyuvante fue similar al correspondiente tratamiento estándar, pero con un tercio menos de cada fungicida.

El Ejemplo 5 muestra que el uso de formulaciones químicas para tratamiento de plantas que comprenden 1/3 menos que el protocolo de aerosol típico de un pesticida y en presencia de adyuvante tuvo como resultado rendimientos levemente mayores (aproximadamente 2% más de fruto comerciable) y no hubo diferencia significativa en el control de la enfermedad (FIGURA 3). Además de una respuesta más rápida, hay una deshidratación y mortalidad más completa de las malezas y brozas objetivo. El adyuvante permite el control comercial de malezas y brozas difíciles de controlar con reducciones de tasa de 15% y 30%.

Ejemplo 6 - Ensayo de cámara de crecimiento de tomate

Los tratamientos químicos se aplicaron a 18 plantas de tomate de cinco semanas mediante el uso de un rociador de mano y se permitió que se secaran al aire completamente. Se incluyeron 5 nueve plantas adicionales como un control no tratado. Después de que los tratamientos químicos se secaron, las plantas en cada tratamiento se separaron en dos grupos de nueve para un grupo con lavado y sin lavado. El grupo sin lavado se apartó. Para analizar la resistencia a la lluvia, las plantas 10 individuales en el grupo con lavado se sumergieron completamente 4 veces a intervalos de 1 segundo en volúmenes separados de 18.92 litros (5 gal) de agua con un flujo continuo para cambiar el agua. Después de que el grupo con lavado se secó, las plantas de ambos grupos y todos los tratamientos se 15 dispusieron en un diseño completamente aleatorizado y se inocularon con una aplicación de aerosol de 1×10^6 cfu/ml de suspensión de *X. perforans*. Se permitió que las plantas se secaran al aire luego de la inoculación antes de incubarse a 25°C con humedad relativa de 100% durante 48 h y luego se 20 mantuvieron adicionalmente a 25°C con una HR de 65% durante 4 - 6 días adicionales para fomentar el desarrollo de síntomas e infección. La gravedad de la enfermedad se evaluó como la cantidad total de lesiones de hoja por cm² de área de hoja, tal como se mide con un medidor de hoja LICOR.

El procedimiento de inoculación condujo a una presión de enfermedad excelente que osciló entre 6,9 y 60,9 lesiones por cm² de área de hoja. Hubo una diferencia significativa entre los tratamientos con un valor P menor que 0,0001 para el experimento. El adyuvante solo con y sin lavado redujo de forma estadística la mancha bacteriana con respecto al control no tratado (Tabla 13).

Tabla 13. Efecto de PDS en la resistencia a la lluvia de Cuprofix (sulfato de cobre) y la gravedad de la mancha bacteriana de hoja (BLS) provocada por *Xanthomonas perforans*.

Tratamientos:	Lesiones BLS/cm ² de área de hoja:	
	Plantas no lavadas	Plantas lavadas
Adyuvante* (250:1)	45,8 (35,5 – 56,2)	36,9 (26,6 – 47,3)
Adyuvante* (250:1) + Cuprofix (1.36 kgs/A)	8,2 (0 – 18,5)	18,3 (8,0 – 28,7)
Adyuvante* (250:1) + Cuprofix (0,68 kgs/A)	10,7 (0,3 - 21)	21,9 (11,5 – 32,2)
Cuprofix (1.36 kgs/A)	6,9 (0 – 17,3)	23,7 (13,3 – 34,1)
Cuprofix (0,68 kgs/A)	8,8 (0 – 19,2)	23,9 (13,5 – 34,3)
Control	60,9 (50,5 – 71,2)	
P > F	< 0,0001	

*La formulación adyuvante comprende agua al 95,70% en peso, ACUSOL® 823 al 2,00% en peso, PVA (100 000 MW) al 0,10% en peso, ZnSO₄ monohidratado al 0,10% en peso, Antifoam® 8810 al 0,10% en peso y TEA al 2,00% en peso.

Si bien no fue de manera significativa, las tasas más altas de cobre equivalieron a una mejor supresión de mancha bacteriana tal como se midió mediante una reducción en las lesiones por área de hoja. Se observaron diferencias significativas entre los tratamientos lavados y no lavados para los tratamientos con cobre. El adyuvante no tuvo un efecto

significativo en la mancha bacteriana en los tratamientos de cobre, independientemente de si las hojas se lavaron o no. Sin embargo, ambas tasas de cobre con adyuvante tuvieron un mejor rendimiento numérico que el cobre solo en los tratamientos de lavado. En el transcurso del tiempo, esta diferencia posiblemente podría amplificarse a condiciones de campo.

El adyuvante no tuvo un efecto significativo en la mancha bacteriana en los tratamientos de cobre, independientemente de si las hojas se lavaron o no. Sin embargo, ambas tasas de cobre con adyuvante tuvieron un mejor rendimiento numérico que el cobre solo en los tratamientos de lavado. En el transcurso del tiempo, esta diferencia posiblemente podría amplificarse a condiciones de campo.

Ejemplo 7 - pruebas de campo de enfermedad de cítricos

El adyuvante se incorporó en el programa de pulverización para aproximadamente el 70% de la superficie de toronja y naranja administrada por un único productor en el área Vero Beach/Fort Pierce. Además, se llevaron a cabo pruebas de pulverización de campo directas con el uso de adyuvante con glifosato. Se agregó adyuvante al programa de pulverización normal para aproximadamente 600.95 de 851.86 hectáreas (1485 de 2105 acres) totales (70%) implicadas en el ensayo. Las actividades de pulverización en todas las áreas de arboleda eran idénticas en todos los aspectos excepto con respecto al uso de adyuvante

(es decir, los equipos utilizados, el personal, lo que se roció, cuándo se roció, etc.). Las diferencias observadas en el fruto tratado con adyuvante en comparación con el fruto no tratado con adyuvante incluyen: (i) una mejora significativa en el control de cancro, melanosis, minador y *Alternaria*; (ii) la capacidad de las formulaciones adyuvantes para mantener los productos de aerosol en los frutos y las hojas durante más tiempo lo que le permite al productor tener períodos más largos entre pulverizaciones y/o la interrupción de algunos de los productos utilizados (por ejemplo, cobre); y (iii) rendimientos aproximadamente 20% mayores de los árboles de frutos tratados con adyuvante (Tabla 14).

Tabla 14. Rendimiento de frutos cítricos cosechados

Cosecha n.º	Rendimiento de fruto con tratamiento con adyuvante*	Rendimiento de fruto sin tratamiento con adyuvante*
1	90%	65%
2	88%	68%
3	87%	64%

*La formulación adyuvante comprende agua al 95,70% en peso, ACUSOL® 823 al 2,00% en peso, PVA (100 000 MW) al 0,10% en peso, ZnSO₄ monohidratado al 0,10% en peso, Antifoam® 8810 al 0,10% en peso y TEA al 2,00% en peso.

Se llevaron a cabo pruebas paralelas de campo con el uso de adyuvante con diferentes diluciones de glifosato. Niveles variables de glifosato se rociaron y observaron a partir de la tasa de dilución típica y en comparación con 5 niveles menores

que oscilaron de 89% hasta 44% de la base. En función de 16
semanas de observación y los resultados de "eliminación",
parecería que el uso de adyuvante le permite al productor
reducir la cantidad de material de glifosato desde un 50% (lo
5 que es significativo dado la reciente duplicación del costo de
los materiales de glifosato para los productores).

Materiales y métodos para el Ejemplo 8

Diseño experimental. El diseño experimental implica la
aplicación de diversos tratamientos especificados en la Tabla
10 15.

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Tabla 15. Grupos de tratamiento

Trat n.º	Tipo	Nombre del tratamiento		Conc de form	Unidad de form	Tipo de form	Tasa l/ha	Tasa g g ai/ha	Dif ai	%	Apl n.º
1	CTRL	Control sin tratamiento									
2	ADY ADY	Carbonato de calcio, Dimetil éter, Nitrógeno licuado (Spraytex M 100 % S.L) Alcohol Graso etoxilado- 0-80 (IMBIREX CR 80 SL)	Aceite mineral Alcohol Graso Etoxilado	100 800	% GA/L	SL SL	5 0,05	5000 40			8 8
3	FUNG FUNG ADY* ADY ADY	Fenpropimorfo (Volley 88 OL) Mancozeb (Banazeb 60 SC) Adyuvante Alcohol Graso etoxilado- 0-80 (IMBIREX CR 80 SL)Carbonato de calcio, Dimetil éter, Nitrógeno licuado (Spraytex M 100 % S.L)	-Fenpropimorf -mancozeb -Sal sódica de polímero acrílico -Alcohol Graso Etoxilado Aceite mineral	880 600 6 800 100	GA/L GA/L % GA/L %	OL SC SL SL SL	0,7 2 0,1 0,05 5	616 1200 6 40 5000	6 2500	 50	8 8 8 8 8
4	FUNG FUNG ADY ADY	Fenpropimorfo (Volley 88 OL Mancozeb (Banazeb 60 SC) Alcohol Graso etoxilado-0-80 (IMBIREX CR 80 SL)Carbonato de calcio, Dimetil éter, Nitrógeno licuado (Spraytex M 100 % S.L)	-Fenpropimorf -mancozeb -Alcohol Graso Etoxilado Aceite mineral	880 600 800 100	GA/L GA/L GA/L %	OL SC SL SL	0,7 2 0,05 5	616 1200 40 5000	2500	50	8 8 8 8
5	FUNG FUNG ADY* ADY ADY	Fenpropimorfo (Volley 88 OL Mancozeb (Banazeb 60 SC) Adyuvante Alcohol Graso etoxilado- 0-80 (IMBIREX CR 80 SL) Carbonato de calcio, Dimetil éter, Nitrógeno licuado (Spraytex M 100 % S.L) L	-Fenpropimorf -mancozeb -Sal sódica de polímero acrílico -Alcohol Graso Etoxilado -Aceite de Petróleo	880 600 6 800 100	GA/L GA/L % GA/L %	OL SC SL SL SL	0,7 2 0,1 0,025 2,5	616 1200 6 20 2500	6		8 8 8 8 8

6	FUNG ADY*	Mancozeb (Banazeb 60 SC) Adyuvante	-mancozeb - Sal sódica de polímero acrílico	600 6	GA/L %	SC SL	1,5 0,1	900 6	6		12 12
7	FUNG	Mancozeb (Banazeb 60 SC)	-mancozeb	600	GA/L	SC	2	1200	300	33	12
8	FUNG ADY* ADY ADY	Fenpropimorfo (Volley 88 OL Adyuvante Alcohol Graso etoxilado-0-80 (IMBIREX CR 80 SL)Carbonato de calcio, Dimetil éter, Nitrógeno licuado (Spraytex M 100 % S.L)	-Fenpropimorf - Sal sódica de polímero acrílico -Alcohol Graso Etoxilado Aceite mineral	880 6 800 100	GA/L % GA/L %	OL SL SL SL	0,5 0,1 0,05 5	440 6 40 5000	6		8 8 8 8
9	FUNG ADY ADY	Fenpropimorfo (Volley 88 OL Alcohol Graso etoxilado-0-80 (IMBIREX CR 80 SL)Carbonato de calcio, Dimetil éter, Nitrógeno licuado (Spraytex M 100 % S.L)	-Fenpropimorf -Alcohol Graso Etoxilado Aceite mineral	880 800 100	GA/L GA/L %	OL SL SL	0,7 0,05 5	616 40 5000	176	40	8 8 8

*La formulación adyuvante comprende agua al 95,70% en peso, ACUSOL® 823 al 2,00% en peso, PVA (100 000 MW) al 0,10% en peso, ZnSO₄ monohidratado al 0,10% en peso, Antifoam® 8810 al 0,10% en peso y TEA al 2,00% en peso.

Los fungicidas se aplicaron 8 veces en intervalos de 10 días mientras que los tratamientos protectores se aplicaron 12 veces en intervalos de 5 días. Cada grupo de tratamiento comprendía una parcela individual de plantas de banana. Los
5 ensayos se realizaron por triplicado.

Cantidades de aceite aplicadas en cada uno de los tratamientos. En la Tabla 16 se muestra la cantidad de aceite aplicado durante cada uno de los tratamientos.

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Tabla 16. Cantidad de aceite aplicado

			Aceite de Carbonato de calcio, Dimetil éter, Nitrógeno licuado (Spraytex) QT litro	Aceite Banazeb QT litro	Aceite total	Dif con tratamiento con menos aceite
	Control sin tratamiento	Tasa de banazeb	Apl de fungicida n.º			
5	Aceite mineral		8	40	40,0	30,46
	Fenpropimorfo (Volley 88 OL) + Mancozeb (Banazeb 60 SC) + Adyuvante* + Carbonato de calcio, Dimetil éter, Nitrógeno licuado (Spraytex)	2	8	8,48	48,5	38,94
	Fenpropimorfo (Volley 88 OL+ Mancozeb (Banazeb 60 SC) + Carbonato de calcio, Dimetil éter, Nitrógeno licuado (Spraytex)	2	8	8,48	48,5	38,94
10	Fenpropimorfo (Volley 88 OL+ Mancozeb (Banazeb 60 SC) + Adyuvante + Carbonato de calcio, Dimetil éter, Nitrógeno licuado (Spraytex)	2	8	8,48	28,5	18,94
	Mancozeb (Banazeb 60 SC) + Adyuvante*	1,5	12	9,54	9,5	0
	Mancozeb (Banazeb)	2	12	12,72	12,7	3,18
	Fenpropimorfo (Volley 88 OL+ Adyuvante* + Carbonato de calcio, Dimetil éter, Nitrógeno licuado (Spraytex)		8	40	40,0	30,46
15	Volley 88 OL + Carbonato de calcio, Dimetil		8	40	40,0	30,46

éter, Nitrógeno licuado (Spraytex)						
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*La formulación adyuvante comprende agua al 95,70% en peso, ACUSOL® 823 al 2,00% en peso, PVA (100 000 MW) al 0,10% en peso, ZnSO₄ monohidratado al 0,10% en peso, Antifoam® 8810 al 0,10% en peso y TEA al 2,00% en peso.

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Equipos y condiciones climáticas durante las aplicaciones. Los tratamientos se aplicaron a los árboles de banana tal como se muestra en las Tablas 17 y 18. Las condiciones climáticas durante las pruebas de campo se muestran en la FIGURA 4.

Tabla 17. Aplicaciones del tratamiento

Número de aplicación	1	2	3	4	5	6	7
Fecha de aplicación:	Día 0	Día 5	Día 10	Día 15	Día 20	Día 25	Día 30
Hora de inicio de aplicación:	6:30 a.m.	7:00 a.m.	6:20 a.m.	6:40 a.m.	7:00 a.m.	7:15 a.m.	7:30 a.m.
Hora de fin de aplicación:	7:25 a.m.	7:20 a.m.	7:45 a.m.	7:05 a.m.	7:20 a.m.	7:30 a.m.	8:30 a.m.
Método de aplicación:	AEROSOL	AEROSOL	AEROSOL	AEROSOL	AEROSOL	AEROSOL	AEROSOL
Lugar de aplicación:	FOLIAR	FOLIAR	FOLIAR	FOLIAR	FOLIAR	FOLIAR	FOLIAR
Aplicado por:	J.G Cubillo	J.G Cubillo	J.G Cubillo	J.G Cubillo	J.G Cubillo	J.G Cubillo	J.G Cubillo
Temperatura del aire, unidad:	26	26	25,6	26,2	26	26	26
% de humedad relativa:	90	90	92	90	89	90	89
Velocidad del viento, KPH:	0	0	0	0	0	0	0
Equipo de aplicación:	Solo Port423	Solo Port423	Solo Port423	Solo Port423	Solo Port423	Solo Port423	Solo Port423
Tipo de equipo:	mochila	mochila	mochila	mochila	mochila	mochila	mochila
Tipo de boquilla:	Micronair	Micronair	Micronair	Micronair	Micronair	Micronair	Micronair
Tamaño de boquilla:	AU 8000	AU 8000	AU 8000	AU 8000	AU 8000	AU 8000	AU 8000
Calibración de boquilla, ml/min:	150	150	150	150	150	150	150
Tiempo para trat 1 parcela, SEG	45	45	45	45	45	45	45

Tabla 18. Aplicaciones del tratamiento

Número de aplicación	8	9	10	11	12	13	14
Fecha de aplicación:	Día 35	Día 40	Día 45	Día 50	Día 55	Día 60	Día 70
Hora de inicio de aplicación:	7:15 a.m.	7:15 a.m.	7:00 a.m.	6:20 a.m.	6:25 a.m.	7:20 a.m.	7:15 a.m.
Hora de fin de aplicación:	7:30 a.m.	8:00 a.m.	7:20 a.m.	7:45 a.m.	7:45 a.m.	7:55 a.m.	8:20 a.m.
Método de aplicación:	AEROSOL	AEROSOL	AEROSOL	AEROSOL	AEROSOL	AEROSOL	AEROSOL
Lugar de aplicación:	FOLIAR	FOLIAR	FOLIAR	FOLIAR	FOLIAR	FOLIAR	FOLIAR
Aplicado por:	J.G Cubillo	J.G Cubillo	J.G Cubillo	J.G Cubillo	J.G Cubillo	J.G Cubillo	J.G Cubillo
Temperatura del aire, unidad:	26,2	24,7	26,1	25,9	26	26,3	26
% de humedad relativa:	90	82	90	90	95	90	92
Velocidad del viento, KPH:	0	0	0	0	0	0	0
Equipo de aplicación:	Solo Port423	Solo Port423	Solo Port423	Solo Port423	Solo Port423	Solo Port423	Solo Port423
Tipo de equipo:	mochila	mochila	mochila	mochila	mochila	mochila	mochila
Tipo de boquilla:	Micronair	Micronair	Micronair	Micronair	Micronair	Micronair	Micronair
Tamaño de boquilla:	AU 8000	AU 8000	AU 8000	AU 8000	AU 8000	AU 8000	AU 8000
Calibración de boquilla, ml/min:	150	150	150	150	150	150	150
Tiempo para trat 1 parcela, SEG	45	45	45	45	45	45	45

Recopilación y análisis de datos. Se evaluaron cada 15 días las hojas más jóvenes con infección (YLI, por sus siglas en inglés), las hojas más jóvenes con mancha (YLS, por sus siglas en inglés), el índice de infección y la cantidad total

de hojas. Los análisis se llevaron a cabo mediante un análisis bajo la curva de la variable.

Ejemplo 8 - pruebas de campo de banana

Los árboles de banana se trataron con diversas formulaciones para tratamiento de plantas, tal como se describió en la Tabla 18. A lo largo de la prueba de campo, se evaluaron los árboles con respecto a las hojas totales (FIGURA 5A), las hojas más jóvenes con infección (FIGURA 5B) y las hojas más jóvenes con mancha (FIGURA 5C). La distribución de los tratamientos en el transcurso del tiempo se muestra en las FIGURAS 6A-6B. La FIGURA 7A muestra el control de Sigatoka negra (*Mycosphaerella fijiensis*) en plantas de banana tratadas con diversas formulaciones químicas (Tabla 19).

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Tabla 19. Control de Sigatoka negra

Fecha de clasificación				Día 0	Día 15	Día 30	Día 45	Día 60	Día 75
Momento de clasificación				A0	A1	A2	A3	A4	A5
Días después de la primera/última aplicación				00	15 5	30 5	45 5	60 5	75 5
Intervalo trat-eval				0	15	15	15	15	15
Tratamiento	Tasa	Unidad	Código						
Control sin tratamiento				18,53 a	40,77 a	54,00 a	50,30 a	60,20 a	59,33 a
5 Carbonato de calcio, Dimetil éter, Nitrógeno licuado (Spraytex)/ Alcoolol Graso etoxilado-0-80 (IMBIREX)	5/0,05	l/ha	8	12,60 a	31,27 cd	41,50 bc	44,33 ab	48,20 b	49,37 b
Fenpropimorfo (Volley)/ Mancozeb (BANAZEB)/ Adyuvante* / Alcoolol Graso etoxilado-0-80 (IMBIREX) Carbonato de calcio, Dimetil éter, Nitrógeno licuado (Spraytex)/	0,7/2/0,1/0,05/5	l/ha	8	13,70 a	27,93 d	34,00 d	35,23 cd	33,30 e	36,47 d
Fenpropimorfo (Volley)/Mancozeb Alcoolol Graso etoxilado-0-80 (IMBIREX)/ Carbonato de calcio, Dimetil éter, Nitrógeno licuado (Spraytex)/	0,7/2/0,05/5	l/ha	8	18,17 a	30,30 cd	33,93 d	34,67 d	36,77 de	33,63 d
10 Fenpropimorfo (Volley)/BANAZEB/ Adyuvante* /l Alcoolol Graso etoxilado-0-80 (IMBIREX)/ Carbonato de calcio, Dimetil éter, Nitrógeno licuado (Spraytex)/	0,7/2/0,1/0,025/2,5	l/ha	8	11,77 a	27,90 d	36,07 d	34,77 d	33,03 e	33,73 d
Mancozeb (BANAZEB)/ Adyuvante	1,5/0,1	l/ha	12	14,47 a	34,20 bc	44,40 b	37,77 bcd	34,10 e	37,50 cd
Mancozeb (BANAZEB/60 SC)	2	l/ha	12	14,10 a	36,83 ab	43,97 b	34,53 d	32,37 e	34,13 d
Fenpropimorfo (Volley)/ Adyuvante* / Alcoolol Graso etoxilado-0-80 (IMBIREX)/ Carbonato de calcio, Dimetil éter, Nitrógeno licuado (Spraytex)/	0,5/0,1/0,05/5	l/ha	8	12,97 a	30,80 cd	41,43 bc	43,20 abc	46,17 bc	48,33 b
15 Fenpropimorfo (Volley)/ Alcoolol Graso etoxilado-0-80 (IMBIREX)/ Carbonato de calcio, Dimetil éter, Nitrógeno licuado (Spraytex)/	0,7/0,05/5	l/ha	8	13,33 a	32,60 bc	37,07 cd	39,90 bcd	40,57 cd	43,87 bc

LSD P=0,05	4,774	4,307	4,656	8,278	5,668	7,084
Desviación estándar	2,783	2,51	2,714	4,825	3,304	4,129
CV	19,32	7,72	6,69	12,24	8,15	9,87

Los promedios seguidos por la misma letra no difieren de forma significativa (P=0,5, LSD) .

*La formulación adyuvante comprende agua al 95,70% en peso, ACUSOL® 823 al 2,00% en peso, PVA (100 000 MW) al 0,10% en peso, ZnSO₄ monohidratado al 0,10% en peso, Antifoam® 8810 al 0,10% en peso y TEA al 2,00% en peso.

El control de Sigatoka negra en cada grupo de tratamiento se muestra en la FIGURA 7B. El análisis de variación y separación promedio del índice de infección (II), YLI, YLS y las hojas totales (HT) para cada tratamiento con fungicida se muestra en la Tabla 20.

Tabla 20. Tabla de promedios

Tratamiento	II		YLI		YLS		HT	
Control sin tratamiento	3663,00	e	254	a	315	a	650	a
Aceite mineral	2943,67	d	295	b	360	b	720	bcd
Fenpropimorfo (Volley 88 OL)+ Mancozeb (BANAZEB)/ 60 SC + Adyuvante* + Carbonato de calcio, Dimetil éter, Nitrógeno licuado (Spraytex)/	2332,67	a	321	c	407	d	754	cd
Fenpropimorfo (Volley 88 OL)+ Mancozeb (Banazeb 60 SC) + Carbonato de calcio, Dimetil éter, Nitrógeno licuado (Spraytex)/	2422,67	ab	322	c	402	d	755	d

Fenpropimorfo (Volley 88 OL)+ Mancozeb (Banazeb 60 SC) + Adyuvante* + Spraytex	2302,67	a	323	c	396	cd	736	cd
Mancozeb (Banazeb 60 SC) + Adyuvante*	2647,33	bcd	312	bc	388	cd	714	bc
Mancozeb (Banazeb)	2577,67	abc	321	c	377	bc	686	ab
Fenpropimorfo (Volley 88 OL)+ Adyuvante* + Carbonato de calcio, Dimetil éter, Nitrógeno licuado (Spraytex)/	2884,33	cd	292	b	359	b	730	cd
Fenpropimorfo (Volley 88 OL)+ Carbonato de calcio, Dimetil éter, Nitrógeno licuado (Spraytex)/	2682,00	bcd	296	b	378	bc	742	cd

Los promedios en la misma columna con la misma letra no son significativamente diferentes

5 (p > 0,01). Test: LSD Fisher alfa = 0,01

*La formulación adyuvante comprende agua al 95,70% en peso, ACUSOL® 823 al 2,00% en peso, PVA (100 000 MW) al 0,10% en peso, ZnSO₄ monohidratado al 0,10% en peso, Antifoam® 8810 al 0,10% en peso y TEA al 2,00% en peso.

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La FIGURA 8 muestra plantas de banana 75 días después de la primera aplicación, 20 días después de la última aplicación de fungicida protector y 5 días después de la última aplicación de fungicida sistémico. El efecto de los tratamientos en la
5 mancha y el tejido necrótico con y sin TPS (30 días después de la última aplicación) se muestra en las FIGURAS 9A-9B.

El efecto de la aplicación de adyuvante en hojas de banana húmedas se muestra en las FIGURAS 10A-10G. La FIGURA 10A muestra el efecto de la aplicación de Mancozeb (Banazeb 60 SC)
10 solo (cuadrado superior izquierdo), Mancozeb (Banazeb 60 SC) más adyuvante (cuadrado superior derecho) y Vondozeb® 62 SC (cuadrado inferior) para humectar las hojas de banana. También se muestran imágenes detalladas de las hojas tratadas con Banazeb®60SC más adyuvante (FIGURA 10B) y Mancozeb (Banazeb 60
15 SC) sin adyuvante (FIGURA 10C).

También se muestra el efecto del agua para lavado de la aplicación de Mancozeb (Banazeb 60 SC) más adyuvante (FIGURA 10D) y Mancozeb (Banazeb 60 SC) sin adyuvante (FIGURA 10E). Las FIGURAS 10F-10G muestran el efecto del agua para lavado en
20 el uso de Mancozeb (Banazeb 60 SC) (FIGURA 10F) y Mancozeb (Banazeb 60 SC) más adyuvante (FIGURA 10G) en hojas de banana quemadas por el sol.

Una mezcla representativa de aceite con adyuvante se muestra en la FIGURA 11A, mientras que la FIGURA 11B muestra

una mezcla de agua con adyuvante.

El efecto de la aplicación de una formulación adyuvante a
hojas de banana se muestra a los 18 días después de la
aplicación en la FIGURA 12A y a los 32 días después de la
5 aplicación en la FIGURA 12B.

Los resultados del Ejemplo 8 muestran que no hay un efecto
fungicida directo del adyuvante sobre la Sigatoka tanto antes
como después de la infección. Estos resultados también indican
que el adyuvante no se mezcla bien con el aceite de cultivo.
10 Por lo tanto, es necesario un emulsionante para asegurar una
mezcla homogénea. El adyuvante tiene un fuerte efecto de
"resistencia a la lluvia", dado que no se lava fácilmente
después de que se secó. El adyuvante también mejora la
redistribución de ingredientes activos en las hojas húmedas,
15 lo que es especialmente efectivo para los protectores. El
tratamiento con las composiciones adyuvantes mantuvo un control
satisfactorio con reducciones de 50% en los volúmenes de aceite
de cultivo. Por lo tanto, el adyuvante funciona mejor con bajas
dosis de aceite. La aplicación de prueba de campo se realizó
20 con precipitaciones de 626,2 mm, un año extremadamente húmedo.
El adyuvante otorgó un control equivalente con una reducción
del 30% en la tasa de los fungicidas tanto sistémicos como de
contacto.

Aunque modalidades preferidas se han representado y

descrito en detalle en la presente, resultará evidente para los expertos en la técnica pertinente que se pueden realizar varias modificaciones, adiciones, sustituciones y similares sin alejarse del espíritu de la invención y, por lo tanto, se
5 considerarán dentro del alcance de la invención tal como se define en las reivindicaciones a continuación.

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SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO

NIT: 800.176.089-2

COMPROBANTE DE RECAUDO SISTEMA SIPI

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Recibo: 21-37530

Fecha: 09/04/2021

CAROLINA MERCEDES DAZA MONTALVO

CC: 66.783.790

Pago PSE No: 522422

CUS: 951104494

Patente PCT

COMPOSICIONES ADYUVANTES PARA PRODUCTOS QUÍMICOS PARA EL TRATAMIENTO DE PLANTAS

Detalle del pago

Id.	Rentístico	Concepto y Servicio	Cant.	Val. Unit.	Subtotal
1	50005-01-03	Modificaciones / Correcciones al registro Patente PCT (DESCUENTO INTERNET)	1	\$ 171,500	\$ 171,500
TOTAL					\$ 171,500