



Clarke, Modet & Co.

COLOMBIA

E-MAIL: clarkemodet@clarkemodet.com.co

SANTAFÉ DE BOGOTÁ, A.º -----

SUPERINDUSTRIA Y COMERCIO

SEÑORES

DIVISION DE NUEVAS CREACIONES

SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO

E.

S.

D.

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Trámite : 002 PATENTES D 1 REGISTRO/ 329 COMPLEMEN

Dependencia: 2020 DIVISION DE NUEVAS CREACIONES

COD:08

REF.:

EXPEDIENTE No. 02074350

TITULO: MODIFICACIÓN DE FORMA FÍSICA DE AGENTES

AGRÍCOLAS BASADOS EN ALMIDÓN DISPERSABLE EN AGUA

SOLICITANTE: NATIONAL STARCH AND CHEMICAL INVESTMENT

HOLDING CORPORATION e ICI AMERICAS, INC.

FECHA DE SOLICITUD: AGOSTO 23, 2002

ASUNTO: PRESENTACION PRIORIDAD

DILIA RODRIGUEZ D'ALEMAN, en mi condición de apoderada de la sociedad solicitante, por el presente escrito me permito presentar:

- Copia certificada de la prioridad estadounidense reivindicada N°09/938,376 de Agosto 24 de 2001 y su traducción al español.

Esta prioridad esta siendo presentada dentro del término de 16 meses que exige la Decisión 486 de la comisión de la Comunidad Andina toda vez que la solicitud fue presentada el 23 de Agosto de 2.002.

Agradezco continuar con el presente trámite.

Señor Jefe,

DILIA RODRIGUEZ D'ALEMAN

RCH/srr

P. 449

PA 889052

THE UNITED STATES OF AMERICA

~~TO ALL TO WHOM THESE PRESENTS SHALL COME:~~

UNITED STATES DEPARTMENT OF COMMERCE

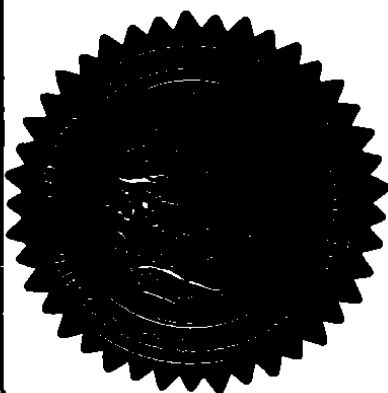
United States Patent and Trademark Office

July 19, 2002

THIS IS TO CERTIFY THAT ANNEXED HERETO IS A TRUE COPY FROM THE RECORDS OF THE UNITED STATES PATENT AND TRADEMARK OFFICE OF THOSE PAPERS OF THE BELOW IDENTIFIED PATENT APPLICATION THAT MET THE REQUIREMENTS TO BE GRANTED A FILING DATE UNDER 35 USC 111.

APPLICATION NUMBER: 09/938,376

FILING DATE: August 24, 2001



By Authority of the
COMMISSIONER OF PATENTS AND TRADEMARKS

E. Bornett

E. BORNETT

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JUAN PABLO PIEN... Certifying Officer
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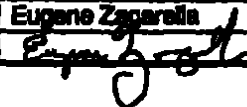
UTILITY PATENT APPLICATION TRANSMITTAL (Only for new unpublished applications under 37 CFR 1.53(a))	Attorney Docket No.: 1947
	First Invention: Hartmann et al.
	Title: Water Dispersible Starch Based Physical Form Modification Of Agricultural Agents
	Express Mail Label No.: ELA0038376

APPLICATION ELEMENTS See MPEP chapter 600 concerning utility patent application contents	ADDRESS TO: Commissioner for Patents Box Patent Application Washington, DC 20231
1. ☒ Fee Transmittal Form (e.g., PTO/BB/17) (Submit an original, and a duplicate for fee processing) 2. ☐ Applicant claims small entity status. See 37 CFR 1.27. 3. ☒ Specification (Total Pages 55) (preferred arrangement set forth below) - Descriptive title of the invention - Cross Reference to Related Applications - Statement Regarding Fed sponsored R & D - Reference to sequence listing, a table, or computer program listing appendix - Background of the invention - Brief Summary of the invention - Brief Description of the Drawings (if filed) - Detailed Description - Claims - Abstract of the Disclosure 4. ☐ Drawing(s) (35 USC 113) (Total Sheets _____) 5. ☐ Oath or Declaration (Total Pages _____) a. ☐ Newly executed (original or copy) b. ☐ Copy from a prior application (37 CFR 1.53(d)) (for continuation/divisional with Box 19 completed) 6. ☐ DELETION OF INVENTOR(S) Signed statement attached deleting inventor(s) named in the prior application, see 37 CFR 1.53(d)(2) and 1.53(b). 7. ☐ Application Data Sheet. See 37 CFR 1.78	7. ☐ CD-ROM or CD-R in duplicate, large table or Computer Program (Appendix) 8. ☐ Nucleotide and/or Amino Acid Sequence Submission (if applicable, all necessary) a. ☐ Computer Readable Form (CRF) b. ☐ Specification Sequence Listing on: 1. ☐ CD-ROM or CD-R (2 copies); or 2. ☐ paper c. ☐ Statements verifying identity of above copies ACCOMPANYING APPLICATION PARTS 9. ☐ Assignment Papers (cover sheet & document(s)) 10. ☐ 37 CFR 1.73(b) Statement ☐ Power of Attorney (when there is an assignee) 11. ☐ English Translation Document (if applicable) 12. ☐ Information Disclosure ☐ Copies of IDS Statement (IDS)/PTO-1449 Citations 13. ☐ Preliminary Amendment 14. ☒ Return Receipt Postcard (MPEP 582) (Should be specifically itemized) 15. ☐ Certified Copy of Priority Document(s) (if foreign priority is claimed) 16. ☐ Nonpublication Request and Certification under 35 U.S.C. 122 (b)(2)(B)(i). Applicant must attach form PTO/BB/28 or its equivalent. 17. ☐ Other
18. If a CONTINUING APPLICATION, check appropriate box, and supply the requisite information below and in a Preliminary Amendment, or in an Application Data Sheet under 37 CFR 1.78: ☐ Continuation ☐ Divisional ☐ Continuation-in-Part (CIP) of prior application No. _____ Prior application Information: Examiner _____ Group/Art Unit: _____ For CONTINUATION or DIVISIONAL APPS only: The entire disclosure of the prior application, from which an Oath or Declaration is supplied under Box 5b, is considered a part of the disclosure of the accompanying Continuation or Divisional application and is hereby incorporated by reference. The incorporation can only be relied upon when a portion has been inadvertently omitted from the submitted application parts.	

10502 U.S. PTO
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09/938376-082401

09/938376
08/24/01

18. CORRESPONDENCE ADDRESS					
☐ Customer Number or Bar Code Label			☐ Correspondence address below		
(Insert Customer No. or Attach bar code label here)					
Name	Karen G. Kelsar				
Address	NATIONAL STARCH AND CHEMICAL COMPANY				
	10 Findeme Avenue				
City	Bridgewater	State	New Jersey	Zip Code	08807-0500
Country	U.S.A.	Telephone:	808-575-8152	Fax:	808-707-3708
Name (Print/Type)	Eugene Zapparella		Registration No. (Attorney/Agent)		25,251
Signature			Date		August 24, 2001

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PTO/55/17 (11-00)

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FEE TRANSMITTAL
for FY 2001

Patent fees are subject to annual revision

Complete if Known

Application Number	
Filing Date	
First Named Inventor	Hartmann, et al.
Examiner Name	
Group Art Unit	
Attorney Docket No	1947

TOTAL AMOUNT OF PAYMENT (\$)**1464.00****METHOD OF PAYMENT**

- 1.
- ☒
- The Commissioner is hereby authorized to charge indicated fees and credit any overpayments to:

Deposit Account Number	14-0455
Deposit Account Name	

- ☐
- Charge Any Additional Fee Required Under 37 CFR 1.18 and 1.17
-
- ☐
- Applicant claims small entity status See 37 CFR 1.17

☐ Payment Enclosed:
☐ Check ☐ Credit card ☐ Money Order ☐ Other
FEE CALCULATION**1. BASIC FILING FEE**

Large Entity Fee Code (S)	Small Entity Fee Code (S)	Fee Description	Fee Paid
101	251	Utility filing fee	710.00
106	328	Design filing fee	
107	400	Plant filing fee	
108	710	Restoration filing fee	
114	150	Provisional filing fee	

SUBTOTAL (1) (\$)**710.00****2. EXTRA CLAIM FEES**

Total Claims	Extra Claims	Fee from	Fee Paid
53	33	18.00	594.00
5	2	80.00	160.00

Large Entity Fee Code (S)	Small Entity Fee Code (S)	Fee Description
103	18	Claims in excess of 20
102	30	Independent claims in excess of 3
104	270	Multiple dependent claim, if not said
109	30	Rescued independent claims over original claims
110	18	Rescued claims in excess of 20 and over original patent

SUBTOTAL (2) (\$)**754.00**

*For number previously said is greater. For Rescued, see above

FEE CALCULATION (continued)**3. ADDITIONAL FEES**

Large Entity Fee Code (S)	Small Entity Fee Code (S)	Fee Description	Fee Paid
105	130	Surcharge - late filing fee or cash	
127	30	Surcharge - late provisional filing fee or cover sheet	
138	130	Non-English specification	
147	2,520	For filing a request for or prior reexamination	
112	920	Requesting publication or SR prior to Examiner action	
113	1,840	Requesting publication of SR after Examiner action	
115	110	Extension for reply within first month	
116	380	Extension for reply within second month	
117	590	Extension for reply within third month	
118	1,390	Extension for reply within fourth month	
128	1,880	Extension for reply within fifth month	
119	310	Notice of Appeal	
120	310	Filing a brief in support of an appeal	
121	270	Request for oral hearing	
135	1,310	Patent to institute a post-use proceeding	
140	110	Person to review - unworkable	
141	1,240	Patent to review - unworkable	
142	1,240	Utility issue fee (or rescue)	
143	440	Design issue fee	
144	800	Plant issue fee	
122	130	Patents to the Commissioner	
123	50	Processing fee under 37 CFR 1.17(a)	
129	180	Submission of Information Disclosure Sheet	
101	40	Recording each patent assignment per priority (times number of priorities)	
148	710	Filing a submission after final rejection (37 CFR 1.129(a))	
149	710	For each additional invention to be examined (37 CFR 1.129(a))	
179	710	Request for Continued Examination (RCE)	
188	900	Request for expedited examination of a foreign application	

Other fee (specify):

*Reduced by Small Entity Fee Paid

SUBTOTAL (3) (\$)

SUBMITTED BY

Name (Print/Type) Eugene Zagarella

Registration No. 25,251

Complete if selected

Telephone 908-575-6152

Signature Eugene Zagarella

Date August 24, 2001

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

Burden Hour Statement: This form is estimated to take 0.2 hours to complete. Time will vary depending upon the needs of the individual case. Any comments on the amount of time you are required to complete this form should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, Washington, DC 20231. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Assistant Commissioner for Patents, Washington, DC 20231.

Patent # 1947

Frank D. J. Hartmann
James L. Eden
Daniel B. Solarek
Johan C. G. Rommens
Mahroussa I. Auda

**WATER DISPERSIBLE STARCH BASED PHYSICAL FORM
MODIFICATION OF AGRICULTURAL AGENTS****FIELD OF THE INVENTION**

This invention relates to water dispersible, stable, solid products or formulations of selected starches, active agricultural agents, and surfactants and/or adjuvants. These solid products are readily water soluble or dispersible. Furthermore, these products have a starch matrix or carrier structure which changes the physical form of the product, makes it compatible when dispersed, allows for a high loading of active material and permits use of a broad range of surfactants, adjuvants and other ingredients. Furthermore and surprisingly, it has been found

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that such starch containing agrochemical products can exhibit increased biological efficacy of the active material.

Various formulations of agricultural active ingredients have been developed to satisfy the needs for agricultural crop protection and other related areas. Oftentimes these products have been in the form of liquid formulations.

Recently, in crop protection formulation technology there has been a desire to move away from liquid formulations to solid products such as dry granules or powders. Such solid products would reduce the use of solvents, be more environmentally friendly and reduce transportation costs. However, the ability to provide solid products using a combination of active ingredients such as glyphosate, and surfactants such as polyoxyethylene sorbitan esters, e.g. Tween 20, has been difficult because such materials are not compatible and are not easy to process or work with. Although much effort has been made to develop solid agricultural products, most of the useful solid, starch based products exhibit extended or delayed release characteristics.

U.S. Patent No. 6,228,807 issued on May 8, 2001 to M. Kuchikata et al, discloses dry, water-soluble herbicidal compositions of glyphosate with selected surfactants. While

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such compositions are water dispersible, it is difficult to form compatible solutions since many surfactants are not compatible with glyphosate in concentrated form.

5 Despite the various disclosures of active agricultural products, including the recent '807 patent noted above, and solid products showing extended release properties, there is still the need for solid agricultural type products which are water dispersible, compatible when dispersed and exhibit quick release characteristics.

10 Accordingly, what is desired for use in agricultural applications, is a stable, solid product which has quick release properties, provides high load of active materials and can combine multiple components into a compatible system.

15 SUMMARY OF THE INVENTION

Now it has been found that stable, water dispersible solid products of agricultural active agents are provided when combined with selected starches and optionally surfactants and/or adjuvants.

20 More particularly, this invention is directed to a stable, dry solid formulation which is water dispersible and provides a rapid,

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compatible, homogeneous dispersion and comprises:

- a) a chemically modified starch,
- b) a biologically active agricultural material, and
optionally
- 5 c) a surfactant and/or adjuvant.

This invention further involves agrochemical formulations containing combinations of two or more active materials.

DETAILED DESCRIPTION OF THE INVENTION

- 10 This invention involves stable, water dispersible solid products of selected starches, agricultural active agents, and surfactants and/or adjuvants. These dry solid products or formulations are rapidly dispersed in aqueous medium, compatible when dispersed and provide quick release of the
- 15 bioactive agent. These formulations also provide a high loading of the active ingredient and have been found especially useful in agricultural crop protection. Furthermore, the solid product of this invention has a starch matrix which allows for the use of one or more different active materials and the use of a wide
- 20 variety of surfactants, adjuvants and other ingredients while still providing a compatible dispersion and high load capacity.

Stable, solid products are those where there is no bleeding or separation of individual components. Generally a product is considered stable when this condition exists for at least six months.

- 5 Dispersible, solid products are those which are functionally uniform or homogeneous when dispersed. The dispersed or water solubilized product may be in the form of a solution, emulsion or suspension.

- 10 Compatible solutions are those where the individual components remain homogeneous in the final aqueous solution.

- Compatible emulsions in water are those that remain stable, do not coalesce, phase out or separate, flocculate, aggregate or produce sediment. For compatible suspensions in water, the solids remain homogeneously suspended in the end use dispersion, i.e. they do not drop out. The compatible solutions or dispersions provide relatively or functionally uniform distributions of the components in the end use liquid.
- 15

- Compositions are typically considered compatible when these conditions exist for at least 4 hours and more particularly 24 hours or more.
- 20

Rapidly or readily dispersible is defined as a mixture with cold water and minimal agitation that gives a dispersion in less than 10 minutes, more particularly less than 3 minutes.

Solid products are those such as the type having a particulate form or structure and having a wide range of sizes and shapes, such as powders, granules (dust free powders), flakes, chips, sheets, tablets, pellets, agglomerates, etc.

The solid product or formulation of this invention will comprise either the combination of starch, active material and surfactant and/or adjuvant; starch and active material; or starch and surfactant and/or adjuvant. Any of the above formulations may also include optional additive ingredients.

The active ingredients used in the system or formulations of this invention include a broad range of materials and this includes active ingredients some of which don't form free standing powders on their own. Some of the useful active materials may be liquid while others may be solids with low or high melting points. Particularly useful active ingredients for this invention are liquids at room temperature or low melting (e.g. <80°C) materials and high melting (e.g. >80°C) crystalline materials.

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The agricultural active agents which are used in the formulations of this invention can be any one or more of a wide range of water dispersible agrochemically active materials.

Description of the actives as water dispersible means that they
5 are water soluble or can be suspended or emulsified in water.

More particularly, it may be one or more herbicides, pesticides, for example insecticides, fungicides, acaricides, nematocides, miticides, rodenticides, bactericides, molluscicides and bird repellants, and/or plant growth regulators. Especially useful
10 active materials are herbicides, insecticides and fungicides.

Usually, the active material will be a water insoluble or immiscible material, although granules can be made including water soluble active materials. Specific examples of active materials include:

15 Herbicides such as 6-chloro-N-ethyl-N-(1-methylethyl)-1,3,5-triazine-2,4-diamine (common name atrazine); N,N'-bis(1-methylethyl)-6-(methylthio)-1,3,5-triazine-2,4-diamine (common name prometryn); substituted ureas such as diuron or N'-(3,4-dichlorophenyl)-N,N-dimethylurea); sulfonyl ureas such as
20 metasulfuron-methyl{2-[[(4-methoxy-6-methyl-1,3,5-triazin-2-yl)amino]carbonyl]amino)sulfonyl]benzoate}; triasulfuron {2-[2-

chloroethoxy)-N-[[[4-methoxy-6-methyl-1,3,5-triazin-2-yl)amino]carbonyl]benzenesulfonamide); tribenuron-methyl {methyl 2-[[[4-methoxy-6-methyl-1,3,5-triazin-2-yl)-methylamino]carbonyl]amino]sulfonyl]benzoate} and
5 chlorsulfuron {2-chloro-N-[[[4-methoxy-6-methyl-1,3,5-triazin-2-yl)amino]carbonyl] benzenesulfonamide}; bis-carbamates such as phenmedipham or {3-[(methoxycarbonyl)amino] phenyl (3-methylphenyl)carbamate}, aryloxyalkanoic acids like [(3,5,6-trichloro-2 pyridinyl)oxy] acetic acid (commonly known as
10 triclopyr) and its salts or esters like triclopyr-triethanolammonium, triclopyr-butyl, (2,4 dichlorophenoxy) acetic acid (commonly known as 2,4-D) and its salts or esters like 2,4-D butyl, 2,4-D-dimethylammonium, 2,4-D-diolamine, 2,4-D-2-ethylhexyl, 2,4-D-isooctyl, 2,4-D-isopropyl, [(4-amino-3,5-
15 dichloro-6-fluoro-2-pyridinyl)oxy] acetic acid (commonly known as fluoropyr) and its esters like furoxypyr-neptyl and furoxypyr-2-butoxy-1-methylethyl, 2-(4-aryloxyphenoxy) propionic acids like butyl (+/-)-2-[[5-(trifluoromethyl) 2 pyridinyl]oxy]phenoxy] - propanoate (commonly known as fluzafop-butyl), (+/-)-2-[4-[[3-
20 chloro-5-(trifluoromethyl)-2-pyridinyl]oxy]phenoxy]propanoic acid (commonly known as haloxyfop) and its esters haloxyfop-stetyl,

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haloxyfop-methyl, haloxyfop-P-methyl, butyl (R)-2-[4-(4-cyano-2-fluorophenoxy) phenoxy]propanate (commonly known as cyhalofop-butyl), cyclohexanedione oximes like (+/-)(EZ)-2-(1-ethoxyiminobutyl)-5-[2-(ethylthio)propyl]-3-hydroxycyclohex-2-enone (commonly known as sethoxydim). Additional useful herbicides include alpha-chloro-2', 6'-diethyl-N-methoxymethyl acetanilide (commonly known as alachlor), N-butoxymethyl-alpha-chloro-2',6'-diethylacetanilide (commonly known as butachlor), 2'-methyl-6'-ethyl-N-(1-methoxy-prop-2-yl)-2-chloroacetanilide (commonly known as metolachlor), isobutyl ester of (2,4-dichlorophenoxy) acetic acid, 2-chloro-N-(ethoxymethyl)-6'-ethyl-o-acetotoluidide (commonly known as acetochlor), 1-(1-cyclohexan-1-yl)-3-(2-fluorophenyl)-1-methyl urea, S-2,3,3-trichloro-allyl-diisopropyl thiocarbamate (commonly known as triallate), and alpha, alpha, alpha-trifluoro-2,6-dinitro-N,N-dipropyl-p-toluidine (commonly known as trifluralin).

Fungicides such as thiocarbamates, particularly alkylenebis(dithiocarbamate)s, for example maneb or {[1,2-ethanedithiylbis[carbamodithiato] (2-)] manganese} and mancozeb or {[1,2-ethanedithiyl-bis[carbamodithiato]](2-)]

manganese mixture with [[1,2-ethanedithiol]bis(carbamodithiolato)]
 (2-)]zinc); strobilurins such as azoxystrobin (methyl (E)-2-[[6-(2-
 cyanophenoxy)-4-pyrimidinyl]oxy]-a-(methoxymethylene)
 benzeneacetate] and kresoxim-methyl {(E)-a-(methoxyimino)-2-
 5 [(2-methylphenoxy)methyl]benzylacetic acid methyl ester};
 dicarbonylides such as lprodione {3-(3,5-dichlorophenyl)-N-
 isopropyl-2,4-dioxoimidazoline-1-carboxamide}; azoles such as
 propiconazole or {1-[2-(2,4-dichlorophenyl)-4-propyl-1,3-
 dioxolan-2-yl-methyl-1H-1,2,4-triazole and tebuconazole or
 10 {(RS)-1-p-chlorophenyl-4,4-dimethyl-3-(1H-1,2,4-triazole-1-
 ylmethyl)-pentan-3-ol]; halophthalonitriles such as chlorothalonil
 or 2,4,5,6-tetrachloro-1,3-dicyanobenzene); and inorganic
 fungicides such as copper hydroxide or Cu(OH)₂.

Insecticides including benzoyl ureas such as
 15 diflubenzuron or N-[[[(4-chlorophenyl)amino]carbonyl]-2,6-
 difluorobenzamide; carbamates including solid and liquid forms
 such as carbaryl or 1-naphthyl methyl carbamate, aldicarb,
 methomyl, carbofuran, bendiocarb, oxamyl, thiodicarb,
 trimethylcarb; organophosphates e.g. malathion, parathion,
 20 demeton, dimethoate, chlorpyrifos, diazinon, azinphosmethyl
 and phosmet; compounds which break down an insect's

digestive tract tissue including fluorine compounds (cryolite),
 zinc and mercury; nicotine; rotenone; neem oil or azadirachtin;
 natural or synthetic pyrethrins, permethrin, lambda-cyhalothrin,
 cypermethrin, petroleum oils; and microbials e.g. bacillus
 5 thuringiensis and entomopathic viruses such as the baculovirus.

Acaricides such as clofentazine or 3,6-bis(2-chlorophenyl)-1,2,4,5-tetrazine.

Among water soluble active materials, non-selective
 10 herbicides, particularly N-(phosphonomethyl) glycine type herbicides such as glyphosate and sulphosate, respectively the iso-propylamino and trimethylsulphonium salts of N-phosphonomethyl glycine, and other salts such as ammonium, sodium and potassium; and phosphinyl amino acids such as
 15 glufosinate or 2-amino-4-(hydroxymethylphosphinyl)butanoic acid, particularly as the ammonium salt. Such water soluble actives can be used as the sole active in water dispersible granules or in combinations thereof, but can also be used in combination with water insoluble or immiscible actives in multi-
 20 active formulations.

The agrochemical formulation of this invention can include one or more surfactants and/or adjuvants and other additive ingredients. Surfactants have surface active properties and help to increase the dispersibility of the active material and/or can also act as an emulsifier, solubilizer, wetting agent or suspending agent. Adjuvants are materials that help to increase the biological efficacy of the active material and include surfactants, oils such as mineral oils, vegetable oils and alkyl esters of fatty acids, and combinations thereof. Other additive ingredients and materials can be used to provide a variety of functional attributes to the formulation and include materials such as buffering agents, rheological modifiers, antifoam / defoamers, drift /mist control agents, viscosifiers, emulsifiers, dispersants, suspending agents, solvents and fillers. One or more of such surfactants, adjuvants and other additives may be used and they are not limited by physical form such as liquid, paste or wax; or by being water soluble (i.e. from fully water soluble to water insoluble) or water dispersible (e.g. forming aqueous solutions, dispersions or emulsions). The surfactant or adjuvant may help increase the biological efficacy of the active material. The particular surfactant and/or adjuvants that are

used in the formulation will depend on the active material and its properties.

The surfactant used in the formulation may be non-ionic, cationic, anionic, amphoteric or a blend or combination thereof.

- 5 Exemplary non-ionic surfactants include alcohol alkoxyates, e.g. ethoxyates, particularly C8 to C18 alcohols which can be linear, branched or linear/branched mixtures; alkylamine alkoxyates, e.g. ethoxyates and particularly C8 to C18 alkylamines; sorbitol and sorbitan fatty acid esters, particularly
- 10 C8 to C18 fatty acids esters and their ethoxylated derivatives; and chemically modified low molecular weight polysaccharides, particularly C8 to C14 alkyl polysaccharides such as alkylpolyglycosides. Other non-ionics include polyoxyethylene-polyoxypropylene block copolymers, glycerol esters, glycol
- 15 esters, alkoxyated and non-alkoxyated sorbitan esters, sucrose esters, sucrose glycerides, polyoxyalkylene alkylaryl ethers, polyoxyalkylene alkyl esters and fatty acid ethoxyates.

- Cationic surfactants that are useful include primary, secondary and tertiary alkylamines, tertiary polyoxyalkylene
- 20 alkylamines, polyoxyalkylene and non-polyoxyalkylene alkylamine oxides, tertiary polyoxyalkylene alkyetheramines,

polyoxyalkylene alkyletheramine oxides, and tetra
alkylammonium halides.

Useful anionic surfactants include alkyl sulfates and
phosphates, olefin sulfonates, alkylaryl sulfonates, polyoxy-
5 alkylene alkylether sulfates and phosphates, sulfosuccinate
derivatives, sulfosuccinates, sarcosinates, taurates, sulfates and
sulfonates of oils.

Useful amphoteric surfactants include N-alkylbetaines,
alkyl amidobetaines and imidazoline derivatives.

10 The selected starch component which can be used in the
solid products or formulations of this invention are chemically
modified starches and more particularly are starch esters and
starch ethers. The starch esters and starch ethers may contain
nonionic or ionic substrate groups such as cationic, e.g. tertiary
15 amine and quaternary ammonium groups, or anionic groups,
and may be crosslinked. Modified starches of these types are
described in "Starch: Chemistry and Technology", edited by R.
L. Whistler et al, Chapter X, 1984. Preferred modified starches
are those containing an ester or ether group. The base starch
20 may be any starch, native or converted, and includes those
derived from any plant source such as maize, tapioca, potato,

wheat, rice, sago, sorghum, waxy maize, waxy potato and high amylose starch, i.e. starch having at least 40% by weight of amylose content. Also included are the conversion products derived from any of the former bases including, for example, 5 dextrin prepared by hydrolytic action of acid and/or heat; oxidized starches prepared by treatment with oxidants such as sodium hypochlorite or hydrogen peroxide; and fluidity or thin boiling starches prepared by enzyme conversion or mild acid hydrolysis.

10 Modified starch esters include starch acetate, starch propionate, starch butyrate, starch hexanoate etc. as well as the half-esters of dicarboxylic acids, particularly the alkenylsuccinic acids. Starch ethers include the hydroxyalkyl ethers such as hydroxyethyl and hydroxypropyl starch. The starch esters and 15 ethers used in this invention may be prepared by processes known in the art such as disclosed in "Starch: Chemistry and Technology", noted above.

The preparation of starch esters typically involves reacting starch with organic acid anhydrides such as acetic 20 anhydride in either aqueous or non-aqueous systems, e.g. anhydrous pyridine. A review of such preparations may be

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found in "Starch: Chemistry and Technology", edited by R. L. Whistler et al, Chapter X, 1984, as well as in U. S. Patents 2,661,349 issued to C. Caldwell et al on December 1, 1953 and 5,321,132 issued to R. Billmers et al on June 14, 1994. The
5 '349 and '132 patents are hereby incorporated herein by reference.

One modification of starch that is especially useful in this invention is a starch ester prepared from an organic acid anhydride having a hydrophobic group such as octenyl or
10 dodecenyl succinic anhydride. More particularly, the hydrophobic group is a hydrocarbon group such as alkyl, alkenyl, aralkyl or aralkenyl having 2 to 22 carbons, preferably 5 to 18 and more preferably 8 to 12 carbons. Generally the starch will be treated with up to 60%, more particularly 1 to 60% and
15 preferably 5 to 20% by weight of the anhydride, based on the weight of starch.

Another modification of starch that is especially useful in this invention is the etherification with alkylene oxides, particularly those containing 2 to 6, preferably 2 to 4 carbon
20 atoms. Ethylene oxide, propylene oxide and butylene oxide are exemplary compounds that are useful in etherifying the starting

starch materials. Although varying amounts of such reagent compounds may be used, generally up to 25%, more particularly 1 to 25% and preferably 1 to 10% by weight, based on the weight of starch, will be used.

5 The modified starches as used herein may be degraded or converted to achieve certain viscosity characteristics and allow for better interaction with components. The modified starches may also be pregelatinized or crosslinked. The degraded starches can vary from 15 to 90 WF (i.e. water
10 fluidity). In addition, dextrans and/or multi-dextrans of <10 DE (dextrose equivalent) can be used. Degradation can be carried out using conventional processes such as oxidative hydrolysis including treatment with hydrogen peroxide, enzyme hydrolysis or acid hydrolysis. Such degradation can be performed either
15 before or after modification is made to the starch.

 The important feature of this invention is being able to provide an agrochemical formulation or surfactant and/or adjuvant system in the modified physical form of a stable, solid such as a free-flowing powder. This can be accomplished when
20 using either a water soluble active material or a water insoluble active material, i.e. emulsifiable or suspendable oily or non-

water soluble active materials. This can include mixtures of two or more different active materials such as two or more water soluble or two or more water insoluble active materials or combinations thereof. The active materials do not have to be of the same physical form, e.g. liquid or solid. The ability to do this is provided by use of the selected modified starches as defined herein. The starch provides a matrix for the system and changes the physical form thereby allowing for the use of different surfactants and adjuvants including those in aqueous solutions, oils, waxes, emulsions, etc. Additionally, while previously it has been difficult to incorporate liquid surfactants or adjuvants into the formation of solid products such as powders, the use of starch as described herein, has allowed for the use of such liquids as well as solid surfactants or adjuvants.

The dry solid can be made by dissolving or dispersing the active material, surfactant and/or adjuvant in a starch cook by either mixing the components with raw starch then cooking, e.g. jet cooking, or by mixing the components into cooked starch. Raw starch is generally refined and recovered from plant tissue as microscopic semi-crystalline particles termed granules. These raw granules must be disrupted or gelatinized, usually by

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heating in a water suspension or slurry, to produce a colloidal dispersion, solution or starch cook. Gelatinization in water or other solvent, is required to allow the starch cook to provide film or matrix forming properties after drying. A wide range of

6 cooking processes are generally suitable, such as, atmospheric pressure batch cooking, elevated pressure batch cooking (autoclaving), steam injection cooking (jet cooking) at either theoretical or excess steam addition ratios, or non diluting heat transfer methods. See "Chemistry of the Carbohydrates", by

10 W. W. Pigman and R. M. Goepf, Academic Press, 1948, p. 561f. Pre-gelatinized starches that do not require the cooking step before adding the starch to the surfactant and/or adjuvant can also be used. The pre-gelatinized starches are readily available and can be produced by many methods such as

15 disclosed in U. S. Patents 4,280,851 issued to Pitchon et al. in July, 1981; 5,571,552 issued to Kasica et al. in November, 1998; 3,088,890 issued to Sarko et al. in April, 1963; 3,637,656 issued to Germino et al. in Jan., 1972 and 3,137,592 issued to Protzman et al. in June, 1964. All of these patents are hereby

20 incorporated herein by reference. These mixtures are then dried into a solid such as powder by spray drying or using other

drying techniques such as drum drying, extrusion, belt drying or freeze drying.

In a similar manner, the solid product can be made by dissolving or dispersing a) the active material, or b) the surfactant and/or adjuvant in a starch cook by either mixing the components with raw starch and cooking or by mixing the components with cooked starch or pre-gelatinized starch.

These mixtures are then dried into solids such as powders using drying techniques such as spray drying, drum drying, extrusion, belt drying or freeze drying. Also, similar products can be prepared with the addition of other additive materials to the components of the above described systems.

While the form of the solid pieces resulting from the process of preparation may be in various sizes and shapes, one particularly useful form are granules which are considered dustless or have particles with sizes of between about 250 to 800 microns. An especially useful process for drying the aqueous feedstock and obtaining dust free granules of useful diameters in one process step is disclosed in U. S. Patent 5,628,937 issued to Oliver et al., which is hereby incorporated by reference. Additional processing such as agglomeration,

compact granulation or extrusion can be used, if desired, to attain a more specific particle size range.

The solid formulations of this invention are characterized by high loading of the active ingredient and rapid homogeneous dispersibility in aqueous medium. The amount of starch in the system can vary but generally will be less than about 85% by weight. There should be enough starch to make stable solid such as a free flowing powder.

The amount of active material and other components in the load which make up the formulation can vary. Load is defined as the total amount of active material, surfactant, adjuvant and optional other additive ingredients in the formulation. The formulation will comprise, on a dry basis, from about 15 to 85% by weight of load and from about 15 to 85% by weight of starch, more particularly from about 20 to 80% by weight of load and from about 20 to 80% by weight of starch, and most particularly from about 30 to 70% by weight of load and about 30 to 70% by weight of starch. The percent (%) load is the anhydrous (dry) weight of the load divided by the anhydrous (dry) weight of the total formulation (i.e. load plus starch) x 100. The load may be comprised of from about 0 to

100% by weight of active, from about 0 to 100% by weight of
surfactant and/or adjuvant, and from about 0 to 90% of other
additive ingredients with the proviso that there be at least 10%
by weight of active and/or surfactant and/or adjuvant with other
5 additive ingredients. The load may also be completely
comprised of active material or surfactant/adjuvant when only
one of such components is present.

Any load component which is a non-water soluble liquid
or meltable solid usually must be emulsified. The
10 hydrophobically modified starches provide very useful
emulsifying properties. Small particle emulsions allow higher
loading of emulsified materials and remain as stable products
when dried. Furthermore, smaller particle size may give
increased efficacy of the active ingredients or improve the
15 agricultural activity of the other ingredients.

The formulation of this invention as described herein may
comprise more than one of the components, i.e. one or more
active materials, surfactant/adjuvants and starch materials and
combinations thereof. The different individual materials do not
20 have to be of the same physical form (e.g. liquid or solid). The
ability to be able to do this is due to the selected starch

component which forms a matrix and helps provide a stable, compatible system even when using materials or components with different physical forms.

It is further noted that while the solid formulated product containing an active material, and/or surfactant/adjuvant in a starch matrix is a desired or preferred embodiment of this invention, this is because such solid product can be readily dispersed in water to conveniently, quickly and accurately provide a tank spray mixture for ready use in an agrochemical application. However, the components may be used separately without forming a solid or powder. Thus the individual components, i.e. active material, and/or surfactant/adjuvant can be added or combined separately in water along with the starch to form an aqueous dispersion (e.g. in a spray tank). These materials can be used in agrochemical applications or may have other uses apparent to one skilled in the art. One such application involves the combination of starch and surfactant which can be used as a soil or substrate wetting agent. The varied and different useful applications are derived in part from the starch component, which not only is useful as a matrix or solid carrier for the active material and other components but

also helps to increase biological efficacy, i.e. it has adjuvant characteristics.

The aqueous dispersion, as noted above, containing starch and active material along with optional

5 surfactant/adjuvant, can be formed by redispersing the solid product of the components or by adding the components together or separately in water. This aqueous dispersion containing the active material along with starch and optional surfactant/adjuvant has an increased biological efficacy. This

10 makes the dispersion particularly useful as a herbicide, pesticide and plant growth regulator for applications to agricultural crops, vegetation, weeds, plants, insects, pests and soil. Particularly useful in providing biological efficacy are starches combined with glyphosate, such as glyphosate-isopropyl amine (IPA), and

15 strobilurin, such as azoxystrobin, active materials. Especially useful combinations are starches combined with glyphosate-isopropyl amine (IPA) and polyoxyethylene sorbitan ester (Tween 20) and starches combined with azoxystrobin and non-ionic surfactants, (ethoxylated C8 to C18 alcohols).

20 Besides being used as a redispersed solid or by application from an aqueous dispersion, the starch containing

products can also be used as a solid in dry form without dispersing in water. For example, the starch entrapped product can be broadcast onto soils as a powdered particulate or pest bait. Another embodiment of this invention involves a solid
5 product containing a surfactant or adjuvant, particularly a non-oil adjuvant, in a starch matrix.

The water soluble starch containing solid of this invention, is a stable mixture which is compatible and quickly releases the active ingredient and adjuvants once dispersed in
10 the spray or feed tank. These products have been found to provide a high loading of active ingredient and surfactant/adjuvant and also allow for use of a broad range of surfactant chemistries. Furthermore and surprisingly, use of these products result in beneficial properties such as increased
15 biological activity and increased rainfastness.

The invention is further illustrated by the following examples with all parts and percentages given by weight and all temperatures in degrees Celsius, unless otherwise noted.

EXAMPLE 1

20 Several samples of liquid alkyl (C8-C10) polyglycoside with different starches were prepared by making an aqueous

feedstock solution, spray drying the feedstock and recovering the resulting powder.

The starches identified in Table 1 as samples A-F, were slurried in water and jet cooked in a model C-1 steam direct
5 Injection continuous cooker (National Starch & Chemical Co.) at about 140°C. The solids of the cooked starches A, B, and D-F were 30% while the solids of starch C was 20%. The polyglycoside amount, as shown in Table 1, was added to the cooled starch of each formula, mixed until uniform and then
10 heated to about 50°C. Water was added, if required, to dilute the feed to a rheology and viscosity suitable for atomization. Samples were processed on a Bowen laboratory scale dryer (GEA Niro, Columbia, MD) using a rotary wheel atomizer. Dryer inlet temperatures were about 205 to 230°C and outlet
15 temperatures were about 80 to 120°C.

In all cases the formed products were stable, free flowing and rapidly soluble powders. As further noted in the table below, relatively high loadings of up to 80% of the polyglycoside (APG) were formed into the water soluble, dry powder.

20

Table 1

Formulations spray dried into powder

	<u>Sample</u>	<u>Starch(1)</u>	<u>Ratio</u> <u>starch/polyglycoside</u>
5	A	waxy maize, OSA	50/50
	B	waxy maize, OSA/dextrin	50/50
	C	hydroxypropylated waxy maize (lightly degraded)	50/50
10	D	3% OSA modified waxy maize	32/68
	E	3% OSA modified waxy maize	20/80
	F	5% OSA modified waxy maize	20/80

(1) OSA - octenyl succinic anhydride

EXAMPLE 2

15 A tank spray mix solution was made by dissolving sample
B from Example 1 in water and adding glyphosate-IPA
(isopropyl amine) solution to give a ratio of glyphosate acid (acid
equivalent - a.e.) to alkyl polyglycoside of 2 to 1. A control tank
mix solution, without starch, was made by dissolving alkyl
20 polyglycoside in water and adding glyphosate-IPA solution to
give a ratio of glyphosate acid to alkyl polyglucoside of 2 to 1.

 The tank mixes were prepared to deliver by spraying at
two application rates as shown in Table 2, i.e. starch containing
solutions F2 and F4 and non-starch containing control solutions
25 F1 and F3.

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Table 2

Application Rates

<u>Samples</u>	<u>Glyphosate</u>	<u>Glycoside</u>	<u>Starch</u>
	(g a.e./ha)	(g/ha)	(g/ha)
5			
F1	400	200	-
F2	400	200	200
F3	800	400	-
10 F4	800	400	400

These formulations were applied by spraying onto plant weed species Barley and *Malva sylvestris* and the efficacy determined as % Kill (0% untreated control plants, 100% treated plants are dead) of the target weeds 7, 14 and 21 days after treatment (DAT). The results were compared with control samples F1 and F3 which did not contain the modified starch carrier. The results are shown below in Table 3 and the % fresh weight (amount of remaining plant tissue) was measured 25 DAT (days after treatment) and expressed as a percentage fresh weight compared to the untreated control.

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Table 3

		% Kill			
		<u>% Kill</u>			
		Barley			
		7 DAT	14 DAT	21 DAT	% Fresh Weight
5	F1	42.9	42.9	82.1	12.2
	F2	25	39.3	85.7	11.9
		Malva sylvestris			
10	F3	14.3	25	39.3	43.7
	F4	25	28.6	42.9	25.7

As shown in Table 3, the combination of starch and glycoside increased the biological efficacy resulting in increased % Kill and reduced % Fresh Weight.

EXAMPLE 3

Samples of starch with different surfactants were formed into dry powders as in Example 1. The successfully formed powders were stable, non-sticky, dry powders that quickly dissolved in water and were compatible when dispersed. The formulations and amounts of starch and surfactant components are given below in Table 4.

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Table 4

	<u>Starch(1)</u>	<u>Surfactant(2)</u>	<u>Ratio starch/surfactant</u>
5	Waxy maize-OSA	Tween 20	50/50
		Atplus MBA 1303	50/50
	Hydroxypropylated waxy maize (lightly degraded)	Tween 20	50/50
10	Waxy maize-OSA/ dextrin	Altos MBA 13/15	50/50
	Waxy maize-OSA/ dextrin	Tween 20	50/50
15	(1) OSA - octenyl succinic anhydride		
	(2) Tween 20 - polysorbate 20		
	Atplus MBA 1303 - C12-C15 monobranched ethoxylated and propoxylated alcohol		
20	Altos MBA 13/15 - C12-C15 monobranched ethoxylated alcohol		

EXAMPLE 4

Several sample formulations of glyphosate-IPA (isopropyl
amine) salt, with different starches and adjuvant/surfactants
were formed into free flowing powders as follows. The process
used consisted of preparing an aqueous feedstock solution,
spray drying the feedstock and recovering the resulting powder.
In all cases the product was a stable, free flowing, rapidly
soluble powder.

The starches identified in Tables 6 were slurried in water

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and jet cooked in a model C-1 steam direct injection continuous cooker (National Starch & Chemical Co.) at about 140°C.

Solids of the cooked starches as well as other drying conditions are show below in Table 5. The glyphosate and the

6 adjuvant/surfactant for each formula (identified in Table 6) were added to the cooked starch which was mixed until uniform and then heated to about 50°C. Water was added, if required, to dilute the feed to a rheology and viscosity suitable for atomization.

10

Table 5

	<u>Starch</u>	<u>Product Formulat.</u>	<u>Dryer</u>	<u>% Cook Solids</u>	<u>% Feed- stock Solids</u>	<u>Feedstock- Viscosity cps</u>
15	A	F1	M	10	23.5	150
		F3	M	10	-	-
		F5	M	10	21.8	215
	B	F6	M	20	28.0	7
20	B	F2	P	20	36.2	17.0
		F4	P	20	35.0	13.0
	C	F7	P	20	23.7	129
		F8	P	20	28.4	244
	D	F9	P	20	32.7	371
25		F10	P	20	24.5	287
	E	F11	P	10	11.5	1924

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Drying was done on two spray driers. Samples marked "M" in Table 5 were processed on a Mobile Minor laboratory scale dryer (GEA Niro, Columbia, MD) using a rotary wheel atomizer. Dryer inlet temperatures were about 205 to 230°C and outlet temperatures were about 90 to 120°C. Samples marked "P" in Table 5 were processed on a Production Minor pilot scale dryer (GEA Niro, Columbia, MD) using a rotary wheel atomizer. Dryer inlet temperatures were about 205 to 230°C and outlet temperatures are about 90 to 120°C.

The different sample formulations F1-F11 are shown below in Table 6.

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Table 6

Dry Powder Sample Formulations
(w/w %)

Samples	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11
5 Glyphosate-IPA	33.3	43.8	33.3	43.8	33.3	33.3	43.8	43.8	43.8	43.8	43.8
Surfactants											
Tween 20	18.7	18.2	-	-	-	-	-	18.2	18.2	-	18.2
C8-10 poly glycoside	-	-	18.7	18.2	-	-	18.2	-	-	18.2	-
10 Atplus MBA 1303	-	-	-	-	18.7	18.7	-	-	-	-	-
Starches(1)											
A	50	-	50	-	50	-	-	-	-	-	-
15 B	-	40	-	40	-	50	-	-	-	-	-
C	-	-	-	-	-	-	40	40	-	-	-
D	-	-	-	-	-	-	-	-	40	40	-
E	-	-	-	-	-	-	-	-	-	-	40
20 (1) A - hydroxypropylated waxy maize (lightly degraded) B - waxy maize octenyl succinic anhydride (OSA) C - 8% OSA modified waxy maize D - 5% OSA modified waxy maize E - cationic crosslinked waxy maize											

25 All of the starch entrapped glyphosate-IPA/surfactant powder formulations shown above in Table 6 were applied to test plants and screened and compared to commercial liquid glyphosate-IPA/adjuvant (Roundup Ultra and Roundup Ultra Max) formulations. The starch powder formulations of Table 6 showed similar to improved biological bio-efficacy to

30 the commercial liquid products.

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EXAMPLE 5

Several samples of the dry powder formulations of this invention were prepared as in the above examples and dissolved or dispersed in water.

The resulting dissolution times found in Table 7 show the ability of these

5 powders to rapidly or quickly dissolve/disperse in water.

Table 7

		<u>Sample</u>	<u>Starch(1)</u>	<u>Surfact./Adj.</u>	<u>Active</u>	<u>Wt. Ratio</u> <u>star/surf./adj./act.</u>	<u>Dissolution</u> <u>Time (3)</u>
10	1		A	C8-10 alkyl polyglycoside	-	80/20/-	>7'
	2		B	" " "	-	50/50/-	5'45"
	3		B	Tween 20	-	50/50/-	2'30"
15	4		C	C8-10 alkyl polyglycoside	-	68/32/-	6'30"
	5		D	" " "	-	50/50/-	4'
	6		D	Tween 20	-	50/50/-	1'
	7		E	Adox	-	42/58/-	1'30"
20	8		B	MBA 13/15 C8-10 alkyl polyglycoside	(2)	40/20/40	5'50"
	9		D	" " "	(2)	33/17/50	3'30"

25 (1) A-Amioca waxy maize, 3% octenyl succinic anhydride (OSA)
B-waxy maize-octenyl succinic anhydride (OSA)
C-3% OSA modified waxy maize
D-waxy maize, OSA, dextrin
E-tapioca dextrin

30 (2) glyphosate-IPA (isopropyl amine)

(3) ' = minutes
" = seconds

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particle is made containing no load. Subsequently a non-
aqueous liquid or molten load component is absorbed into the
porous structures to give a stable loaded particulate. These
powders containing the starch entrapped surfactant were tested
5 for the effect on azoxystrobin fungicide activity against *Septoria*
tritici fungus on winter wheat. In one sample, the azoxystrobin
was applied as a control using 0.5 l/ha of a commercial
formulation Quadris (Syngenta) which contained 250 g/l of
azoxystrobin (no surfactant), sample C. Additional treatments
10 were carried out applying 0.5 l/ha of the commercial formulation
Quadris containing 250 g/l of azoxystrobin and 0.1% weight by
volume (of the spray volume), of the starch entrapped surfactant
(samples A, B and D-E) and another comparative sample
containing the fungicide plus surfactant without starch (sample
15 C-1). These samples were applied to winter wheat cv Riband
by spraying at 200 l/ha. The % infection remaining was
determined on the second (2) and third (3) leaves of the treated
plants, 25 days after inoculation and are shown in Table 11.

Table 10

	<u>Sample</u>	<u>Starch</u>	<u>Ratio starch/surfactant</u>
5	A	3% OSA modif. waxy maize	50/50
	B	cationic crosslinked waxy maize	50/50
	D	puffed, spray dried waxy maize	50/50
	E	tapioca dextrin	50/50

Table 11

10 Effect of Starch/Surfactant with
 Fungicide on Winter Wheat

	<u>Sample</u>	<u>% Infection</u>	
		<u>Leaf 2</u>	<u>Leaf 3</u>
15	C (fungicide alone)	18.8	40.0
	C-1 (fungicide/surfactant)	4.7	33.0
	A (fungicide/starch/surfactant)	0	18.5
	B (fungicide/starch/surfactant)	1.8	10.4
	D (fungicide/starch surfactant)	1.2	8.1
20	E (fungicide/starch/surfactant)	4.7	11.3

As shown by the results given in Table 11, the
combination of starch and surfactant (samples A-E) increases
the biological efficacy of the fungicide used alone (sample C) or
25 the fungicide with surfactant (sample C-1).

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EXAMPLE 6

Several samples containing different starches with glyphosate-IPA (isopropyl amine) active material and Tween 20 adjuvant were prepared as solutions using amounts of active/adjuvant of 2/1 and active/adjuvant/starch of 2/1/1.3. These samples were tested for rainfastness by applying them to target weeds (velvetleaf - *Abutilon theophrasti*) using amounts of glyphosate-IPA active of 0.54 lb acid equivalent (a.e.)/acre (800g. a.e./ha) (low dose) and 0.9 lb a.e./acre (1000g. a.e./ha) (high dose). The samples were applied by forming solutions and spraying at 21.4 gal/acre (200l/ha). Rainfall was applied 1 hr. after treatment at 3 min./hr. for 1 hour. The results in Table 8 and Table 9 show the effects of rain, expressed as % kill, on the different starch formulations and the resulting fresh weight amount of remaining plant tissue 20 days after treatment (DAT).

15

Table 8

Effect of Rain on Starch formulations applied
on Abutilon theophrasti 20 DAT

5	% Kill				
	Low Dose		High Dose		
	Starch	No Rain	Rain	No Rain	Rain
10	None	80.71	32.14	96.43	42.86
	(1)	75	39.29	100	53.57
	(2)	82.14	42.86	92.86	60.71
	Sago	96.43	42.86	100	53.57
15	(3)	75	42.86	96.43	46.43

- (1) 6% octenyl succinic anhydride (OSA) modified waxy maize
(2) 70WF, 3% OSA modified waxy maize
(3) 75WF, 3% OSA modified corn starch

As shown in Table 8, the starch containing spray solutions improved the rainfastness resulting in an increased % Kill at both the low dose and high dose.

Table 9

Fresh Weight of *Abutilon theophrasti*
20 Days After Treatment (DAT)

6	<u>% Fresh Weight</u>				
		<u>Low Dose</u>		<u>High Dose</u>	
	<u>Starch</u>	<u>No Rain</u>	<u>Rain</u>	<u>No Rain</u>	<u>Rain</u>
	None	28.29	60.82	15.23	50.9
	(1)	22.1	68.58	15.51	38.1
10	(2)	19.78	52.07	13.57	35.82
	Sago	13.89	55.83	10.7	38.99
	(3)	23.89	60.17	9.97	42.29
	(1) 6% octenyl succinic anhydride (OSA) modified waxy maize				
15	(2) 70WF, 3% OSA modified waxy maize				
	(3) 75WF, 3% OSA modified corn starch				

As shown in Table 9, the starch containing spray
20 solutions improved rainfastness resulting in reduced % Fresh
Weight.

EXAMPLE 7

Several starch samples containing Atplus MBA 13/15
25 (C12-C15 monobranched ethoxylated alcohol) surfactant were
prepared as powders, as in the above examples, and identified
below in Table 10. Two of the samples, D and E, are made by a
process where a porous drum dried or spray dried starch

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EXAMPLE 8

Starch sample A containing a 50/50 by weight ratio of a puffed, spray dried waxy maize and Atlox MBA 13/15 (C12-C15 monobranched ethoxylated alcohol) and starch sample B
5 containing a 50/50 by weight ratio of tapioca dextrin and Atlox MBA 13/15 (C12-C15 monobranched ethoxylated alcohol) were prepared. The starch samples were prepared in a similar manner to samples D and E of Example 7. The prepared starch powders (A and B) were tested for the effect on azoxystrobin
10 fungicide activity against *Septoria tritici* fungus on winter wheat (vagabond). Additional treatments were carried out using comparative samples which contained the azoxystrobin fungicide (250 g/l) with Atlox MBA 13/15 alone (C-1), Amistar, a commercial formulation which contained azoxystrobin (250 g/l)
15 plus an adjuvant (C-2), and Quadris, a commercial formulation which contained azoxystrobin (250 g/l) alone (C-3). Samples A, B, C-1 and C-3 were prepared to deliver 187.5 g of the azoxystrobin per hectare and 300 ml of the adjuvant when applied to the winter wheat (vagabond) with a spray volume of
20 300 l/ha. Sample C-2 was prepared to deliver 250 g/l of the azoxystrobin per hectare when applied to winter wheat

(vagalbond) with a spray volume of 300 l/ha; concentration of the built-in adjuvant is unknown. The % infection was determined on the treated plants 1, 2 and 3 weeks after treatment (WAT) and the results are shown in Table 12.

5

Table 12
Effect of Starch/Surfactant/Adjuvant
with Fungicide on Winter Wheat

10	Sample (1)	% Infection		
		1 WAT	2 WAT	3 WAT
	A	22.5	23.1	21.7
	B	25	25	25
15	C-1	20	25	35
	C-2	27.5	22.5	30
	C-3	32.5	30	35
20	(1) A - 50/50 waxy maize/Atlox MBA 13/15 and azoxystrobin B - 50/50 taploca dextrin/Atlox MBA 13/15 and azoxystrobin C-1 - Atlox MBA 13/15 and azoxystrobin C-2 - adjuvant and azoxystrobin C-3 - azoxystrobin			

25 The results in Table 12 show that the addition of the starch to surfactant/adjuvant (Samples A and B) extends the effectiveness of the fungicide in maintaining a lower % infection.

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EXAMPLE 9

This example illustrates the production of a solid formulation containing high loading of two (2) dissimilar active materials.

5 A cooked octenyl succinic anhydride (OSA) waxy maize starch/corn syrup was blended with aqueous glyphosate-IPA solution and then 2,4-D-2-ethylhexyl (liquid oil) was added (formulations given in Table 13 below). The formulations were subjected to high shear mixing until the particle size stabilized
10 (i.e. reduced particle size to low level) and an emulsion formed. Water was added to reduce the viscosity to a level acceptable for atomization. The solution was spray dried in a Mobile Minor spray dryer to get a solid powder product. The powder was collected and then redispersed by mixing with water (3 g
15 powder/100 ml water) with gentle agitation. The dispersion was then checked for emulsion stability, compatibility and emulsion/oil droplet size with the results given in Table 14.

20

Table 13
Multiactive/Starch Formulations

5	Components	Formulations (w/w %)			
		F1	F2	F3	F4
	Glyphosate - IPA	20	25	27.5	20
	2,4-D-2-ethylhexyl	20	25	27.5	20
	Waxy maize, OSA/	80	50	45	
10	corn syrup				
	Waxy maize, OSA/				60
	corn syrup				

Table 14

Multiactive/Starch Formulation Evaluations

20		Formulations			
		F1	F2	F3	F4
	Feedstock-PSD(1)	0.488	0.699	0.55	0.431
	(40% solids)				
	Redlayers. powder-PSD	0.852	0.411	0.488	0.414
	(3% w/v)				
25	Emulsion stability				
	(after 24 hrs) (2)				
	water hardness				
	50 ppm	TS	TS	TS	TS
	342 ppm	TS	TS	TS	TS
30	1000 ppm	TS	TS	TS	TS

(1) PSD - particle size distribution d(0.5) in micron
(2) TS- trace of sediment

The emulsion/solutions evaluated were functionally homogenous, showed no creaming, phasing or separation (after 4 hours) and minimal sedimentation (TS - trace of sediment after 24 hours). The particle size of the redispersed powders were comparable to the corresponding feedstock. Neither the glyphosate nor the 2,4-D-2-ethylhexyl separated in the redispersed powder/granule.

The above describes the preparation of a stable solid product which contains two (2) dissimilar active materials, i.e. the water soluble glyphosphate-IPA and the non-water soluble 2,4-D-2-ethylhexyl material. The stable powder exhibited good emulsion properties.

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WHAT IS CLAIMED IS:

1. A stable, solid formulation which is water dispersible and compatible when dispersed in water and comprises:
 - a.) a chemically modified starch,
 - b.) a biologically active agricultural material, and
 - c.) a surfactant and/or adjuvant.
2. The composition of Claim 1 wherein the modified starch is a starch ester or starch ether.
3. The composition of Claim 2 wherein the starch is a starch ester prepared from an organic acid anhydride having a hydrophobic hydrocarbon group of 2 to 22 carbon atoms.
4. The composition of Claim 3 wherein the hydrocarbon group is selected from alkyl, alkenyl, aralkyl and aralkenyl groups.
5. The composition of Claim 4 wherein the hydrocarbon group has 5 to 18 carbon atoms.

6. The composition of Claim 2 wherein the starch is a starch
ether prepared by modifying the starch with alkylene oxide
having 2 to 6 carbon atoms.

5 7. The composition of Claim 6 wherein the starch is modified
with up to 25% by weight of alkylene oxide which has 2 to 4
carbon atoms.

8. The composition of Claim 1 wherein the biologically active
10 material is selected from the group consisting of herbicides,
insecticides and fungicides.

9. The composition of Claim 8 wherein the surfactant is
selected from the group consisting of alcohol alkoxylates
15 having C8 to C18 alcohols, alkylamine alkoxylates having C8
to C18 alkylamines, sorbitol, sorbitan fatty acid esters having
C8 to C18 fatty acid esters and their ethoxylated derivatives
and chemically modified low molecular weight alkyl
polysaccharides having C8 to C14 alkyl groups.

20

10. The composition of Claim 9 wherein the modified starch is a starch ester or starch ether.

11. The composition of Claim 10 wherein from about 15 to 85%
5 by weight, dry basis, of load which comprises the total amount of active material, surfactant, adjuvant and other ingredients and from about 15 to 85% by weight, dry basis, of starch are used.

10 12. The composition of Claim 10 wherein from about 30 to 70% by weight, dry basis, of load which comprises the total amount of active material, surfactant, adjuvant and other ingredients and from about 30 to 70% by weight, dry basis, of starch are used.

15

13. The composition of Claim 10 wherein the starch is starch ester modified with an organic acid anhydride having a hydrocarbon group of 2 to 22 carbon atoms and is selected from alkyl, alkenyl, aralkyl or aralkenyl groups.

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14. The composition of Claim 13 wherein the hydrocarbon group has 5 to 18 carbon atoms.

15. The composition of Claim 10 wherein the starch is a starch
5 ether prepared by modifying the starch with alkylene oxide having 2 to 6 carbon atoms.

16. The composition of Claim 13 wherein the biologically active material is a glyphosate.
10

17. The composition of Claim 16 wherein the surfactant is a C8-C14 alkyl polyglycoside.

18. The composition of Claim 1 wherein more than one of the
15 biologically active materials are used.

19. The composition of Claim 18 wherein the modified starch is a starch ester or starch ether.
20

20. The composition of Claim 19 wherein the starch is a starch ester prepared from an organic acid anhydride having a hydrophobic hydrocarbon group of 2 to 22 carbon atoms.

5 21. The composition of Claim 1 wherein more than one of the chemically modified starch and/or more than one of the surfactant/adjuvants are used.

10 22. The composition of Claim 21 wherein more than one of the biologically active materials are used.

23. A stable, solid formulation which is water dispersible and compatible when dispersed and comprises:

- 15 a.) a chemically modified starch, and
b.) a biologically active agricultural material.

24. The composition of Claim 23 wherein the biologically active material is selected from the group consisting of herbicides, insecticides and fungicides.

20

25. The composition of Claim 24 wherein the modified starch is
a starch ester or starch ether.

26. The composition of Claim 25 wherein the biologically active
5 agricultural material is a glyphosate.

27. The composition of Claim 25 wherein from about 15 to 85%
by weight, dry basis, of the load which comprises the total
amount of active material and other ingredients and from
10 about 15 to 85% by weight, dry basis, of starch are used.

28. The composition of Claim 25 wherein from about 30 to 70%
by weight, dry basis, of the load which comprises the total
amount of active material and other ingredients and from
15 about 30 to 70% by weight, dry basis, of starch are used.

29. The composition of Claim 23 wherein more than of the
biologically active materials are used.

20 30. The composition of Claim 29 wherein the modified starch is
a starch ester or starch ether.

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31. A stable, solid formulation which is water dispersible and compatible when dispersed and comprises:

- a.) a chemically modified starch and
- b.) a surfactant or non-oil adjuvant.

5

32. The composition of Claim 31 wherein the modified starch is a starch ester or starch ether.

33. The composition of Claim 32 wherein the starch is a starch ester modified with an organic acid anhydride having a hydrophobic hydrocarbon group of 2 to 22 carbon atoms.

10

34. The composition of Claim 32 wherein the surfactant is a C8-C14 alkyl polyglycoside.

15

35. The composition of Claim 32 wherein from 15 to 85 by weight, dry basis, of the load which comprises the total amount of the surfactant, adjuvant and other ingredients and from about 15 to 85% by weight, dry basis of the starch are used.

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36. The composition of Claim 32 wherein from about 30 to 70%
by weight, dry basis, of the load which comprises the total
amount of the surfactant, adjuvant and other ingredients and
from about 30 to 70% by weight, dry basis, of the starch are
5 used.

37. The composition of Claim 31 wherein more than one of the
chemically modified starch and /or surfactant or adjuvants
are used.
10

38. The composition of Claim 37 wherein the modified starch is
a starch ester or starch ether.

39. An aqueous dispersion containing a biologically active
15 agricultural material and having increased biological
efficacy comprising:

- a.) a chemically modified starch,
 - b.) a biologically active agricultural material, and optionally
 - c.) a surfactant/ and/or adjuvant.
- 20

40. The composition of Claim 39 wherein the modified starch is
a starch ester or starch ether.

41. The composition of Claim 40 wherein the biologically active
5 material is selected from the group consisting of herbicides,
insecticides and fungicides.

42. The composition of Claim 40 wherein the biologically active
material is a glyphosate or strobilurin.

10

43. The composition of Claim 40 wherein the biologically active
material is glyphosate - Isopropyl amine or azoxystrobin.

44. The composition of Claim 42 wherein a non-ionic surfactant
15 is used.

45. The composition of Claim 44 wherein the surfactant is an
ethoxylated C8 to C18 alcohol.

20

46. A method of applying a biologically active agricultural material to agricultural crops, vegetation, weeds, plants, insects, pests and soil comprising applying an aqueous dispersion of:

- 5 a.) a chemically modified starch,
- b.) a biologically active agricultural material, and optionally
- c.) a surfactant and/or adjuvant,
- characterized in that an increased effect of biological efficacy
- 10 of the active material is provided.

47. The method of Claim 46 wherein the modified starch is a starch ester or starch ether.

- 15 48. The method of Claim 47 wherein the biologically active material is selected from the group consisting of herbicides, insecticides and fungicides.

- 20 49. The method of Claim 47 wherein the biologically active material is a glyphosate or strobilurin.

50. The method of Claim 47 wherein the biologically active material is glyphosate-isopropyl amine or azoxystrobin.

51. The method of Claim 49 wherein a non-ionic surfactant is
5 used.

52. The method of Claim 51 wherein the surfactant is an ethoxylated C8 to C18 alcohol.

10 53. The method of Claim 51 wherein the surfactant is a C8 to C14 alkyl polyglycoside.

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Abstract of the Disclosure

**A stable, solid product of selected starches, active
agricultural agents and optionally surfactants and or adjuvants
which is readily dispersible in aqueous medium and compatible
6 when dispersed.**

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WHAT IS CLAIMED IS:

1. A stable, solid formulation which is water dispersible and compatible when dispersed in water and comprises:
 - 5 a.) a chemically modified starch,
 - b.) a biologically active agricultural material, and
 - c.) a surfactant and/or adjuvant.
2. The composition of Claim 1 wherein the modified starch is a
10 starch ester or starch ether.
3. The composition of Claim 2 wherein the starch is a starch ester prepared from an organic acid anhydride having a hydrophobic hydrocarbon group of 2 to 22 carbon atoms.
15
4. The composition of Claim 3 wherein the hydrocarbon group is selected from alkyl, alkenyl, aralkyl and aralkenyl groups.
5. The composition of Claim 4 wherein the hydrocarbon group
20 has 5 to 18 carbon atoms.

6. The composition of Claim 2 wherein the starch is a starch
ether prepared by modifying the starch with alkylene oxide
having 2 to 6 carbon atoms.
- 5 7. The composition of Claim 8 wherein the starch is modified
with up to 25% by weight of alkylene oxide which has 2 to 4
carbon atoms.
8. The composition of Claim 1 wherein the biologically active
10 material is selected from the group consisting of herbicides,
insecticides and fungicides.
9. The composition of Claim 8 wherein the surfactant is
selected from the group consisting of alcohol alkoxylates
15 having C8 to C18 alcohols, alkylamine alkoxylates having C8
to C18 alkylamines, sorbitol, sorbitan fatty acid esters having
C8 to C18 fatty acid esters and their ethoxylated derivatives
and chemically modified low molecular weight alkyl
polysaccharides having C8 to C14 alkyl groups.

20

10. The composition of Claim 9 wherein the modified starch is a starch ester or starch ether.

11. The composition of Claim 10 wherein from about 15 to 85%
5 by weight, dry basis, of load which comprises the total amount of active material, surfactant, adjuvant and other ingredients and from about 15 to 85% by weight, dry basis, of starch are used.

10 12. The composition of Claim 10 wherein from about 30 to 70% by weight, dry basis, of load which comprises the total amount of active material, surfactant, adjuvant and other ingredients and from about 30 to 70% by weight, dry basis, of starch are used.

5

13. The composition of Claim 10 wherein the starch is starch ester modified with an organic acid anhydride having a hydrocarbon group of 2 to 22 carbon atoms and is selected from alkyl, alkenyl, aralkyl or aralkenyl groups.

1

14. The composition of Claim 13 wherein the hydrocarbon group has 5 to 18 carbon atoms.

15. The composition of Claim 10 wherein the starch is a starch
5 ether prepared by modifying the starch with alkylene oxide having 2 to 6 carbon atoms.

16. The composition of Claim 13 wherein the biologically active material is a glyphosate.
10

17. The composition of Claim 16 wherein the surfactant is a C6-C14 alkyl polyglycoside.

18. The composition of Claim 1 wherein more than one of the
15 biologically active materials are used.

19. The composition of Claim 18 wherein the modified starch is a starch ester or starch ether.
20

20. The composition of Claim 19 wherein the starch is a starch ester prepared from an organic acid anhydride having a hydrophobic hydrocarbon group of 2 to 22 carbon atoms.
- 5 21. The composition of Claim 1 wherein more than one of the chemically modified starch and/or more than one of the surfactant/adjuvants are used.
22. The composition of Claim 21 wherein more than one of the
- 10 biologically active materials are used.
23. A stable, solid formulation which is water dispersible and compatible when dispersed and comprises:
- a.) a chemically modified starch, and
- 15 b.) a biologically active agricultural material.
24. The composition of Claim 23 wherein the biologically active material is selected from the group consisting of herbicides, insecticides and fungicides.
- 20

25. The composition of Claim 24 wherein the modified starch is
a starch ester or starch ether.

26. The composition of Claim 25 wherein the biologically active
5 agricultural material is a glyphosate.

27. The composition of Claim 25 wherein from about 15 to 85%
by weight, dry basis, of the load which comprises the total
amount of active material and other ingredients and from
10 about 15 to 85% by weight, dry basis, of starch are used.

28. The composition of Claim 25 wherein from about 30 to 70%
by weight, dry basis, of the load which comprises the total
amount of active material and other ingredients and from
15 about 30 to 70% by weight, dry basis, of starch are used.

29. The composition of Claim 23 wherein more than of the
biologically active materials are used.

20 30. The composition of Claim 29 wherein the modified starch is
a starch ester or starch ether.

31. A stable, solid formulation which is water dispersible and compatible when dispersed and comprises:

- a.) a chemically modified starch and
- b.) a surfactant or non-oil adjuvant.

5

32. The composition of Claim 31 wherein the modified starch is a starch ester or starch ether.

33. The composition of Claim 32 wherein the starch is a starch ester modified with an organic acid anhydride having a hydrophobic hydrocarbon group of 2 to 22 carbon atoms.

10

34. The composition of Claim 32 wherein the surfactant is a C6-C14 alkyl polyglycoside.

15

35. The composition of Claim 32 wherein from 15 to 85 by weight, dry basis, of the load which comprises the total amount of the surfactant, adjuvant and other ingredients and from about 15 to 85% by weight, dry basis of the starch are used.

20

36. The composition of Claim 32 wherein from about 30 to 70%
by weight, dry basis, of the load which comprises the total
amount of the surfactant, adjuvant and other ingredients and
from about 30 to 70% by weight, dry basis, of the starch are
5 used.

37. The composition of Claim 31 wherein more than one of the
chemically modified starch and /or surfactant or adjuvants
are used.

10 38. The composition of Claim 37 wherein the modified starch is
a starch ester or starch ether.

39. An aqueous dispersion containing a biologically active
15 agricultural material and having increased biological
efficacy comprising:
a.) a chemically modified starch,
b.) a biologically active agricultural material, and optionally
c.) a surfactant/ and/or adjuvant.

20

40. The composition of Claim 39 wherein the modified starch is a starch ester or starch ether.

41. The composition of Claim 40 wherein the biologically active material is selected from the group consisting of herbicides, insecticides and fungicides.

42. The composition of Claim 40 wherein the biologically active material is a glyphosate or strobilurin.

43. The composition of Claim 40 wherein the biologically active material is glyphosate - isopropyl amine or azoxystrobin.

44. The composition of Claim 42 wherein a non-ionic surfactant is used.

45. The composition of Claim 44 wherein the surfactant is an ethoxylated C8 to C18 alcohol.

46. A method of applying a biologically active agricultural material to agricultural crops, vegetation, weeds, plants, insects, pests and soil comprising applying an aqueous dispersion of:

- 5 a.) a chemically modified starch,
 b.) a biologically active agricultural material, and
 optionally
 c.) a surfactant and/or adjuvant,
 characterized in that an increased effect of biological efficacy
10 of the active material is provided.

47. The method of Claim 46 wherein the modified starch is a starch ester or starch ether.

- 15 48. The method of Claim 47 wherein the biologically active material is selected from the group consisting of herbicides, insecticides and fungicides.

49. The method of Claim 47 wherein the biologically active
20 material is a glyphosate or strobilurin.

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50. The method of Claim 47 wherein the biologically active material is glyphosate-isopropyl amine or azoxystrobin.

51. The method of Claim 49 wherein a non-ionic surfactant is
5 used.

52. The method of Claim 51 wherein the surfactant is an ethoxylated C8 to C18 alcohol.

10 53. The method of Claim 51 wherein the surfactant is a C8 to C14 alkyl polyglycoside.

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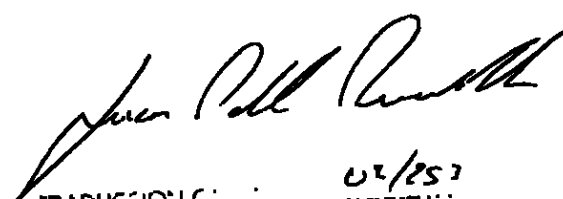
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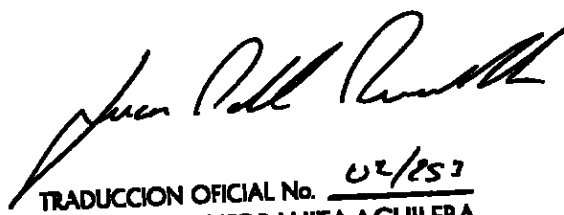
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Santafé de Bogotá, 28 de Agosto, 2001.



TRADUCCION OFICIAL No. 02/253
JUAN PABLO PIEDRAHITA AGUILERA
TRADUCTOR E INTERPRETE OFICIAL
C. IDONEIDAD 045
UNIVERSIDAD NACIONAL DE COLOMBIA

REIVINDICACIONES

1. Una formulación estable, sólida que es dispersable en agua y compatible cuando se dispersa en agua y comprende:

- a) Un almidón químicamente modificado,
- b) Un material agrícola biológicamente activo, y
- c) Un tensoactivo y/o adyuvante.

2. La composición de la reivindicación 1 en donde el almidón modificado es un ester de almidón o un éter de almidón.

3. La composición de la reivindicación 2 en donde el almidón es un ester de almidón preparado de un anhídrido de ácido orgánico que tiene un grupo hidrocarburo hidrófobo de 2 a 22 átomos de carbono.

4. La composición de la reivindicación 3 en donde el grupo hidrocarburo se selecciona de los grupos alquilo, alquenilo, aralquilo y aralquenilo.

5. La composición de la reivindicación 4 en donde el grupo de hidrocarburo tiene de 5 a 18 átomos de carbono.

6. La composición de la reivindicación 2 en donde el almidón es un éter de almidón preparado al modificar el almidón con óxido de alquileo que tiene de 2 a 6 átomos de carbono.

7. La composición de la reivindicación 6 en donde el almidón se modifica con hasta 25% en peso de óxido de alquileo que tiene de 2 a 4 átomos de carbono.

8. La composición de la reivindicación 1 en donde el material biológicamente activo se selecciona del grupo que consiste de herbicidas, insecticidas y fungicidas.

9. La composición de la reivindicación 8 en donde el tensoactivo se selecciona del grupo que consiste de alcoxilatos de alcohol que tienen alcoholes C8 a C18, alquilamina alcoxilatos que tienen alquilaminas C8 a C18, sorbitol, ésteres de ácidos grasos de sorbital que tienen ésteres de ácidos grasos C8 a C18 y sus derivados etoxilados y polisacáridos de alquilo de bajo peso molecular químicamente modificados que tienen grupos alquilo C6 a C14.

10. La composición de la reivindicación 9 en donde el almidón modificado es un éster de almidón o un éter de almidón.

11. La composición de la reivindicación 10 en donde desde aproximadamente 15 a 85% en peso, de base seca de la carga que comprende la cantidad total del material activo, tensoactivo, adyuvante y otros ingredientes y desde aproximadamente 15 a 85% en peso, base seca, de almidón se utiliza.

12. La composición de la reivindicación 10 en donde se utiliza desde aproximadamente 30 a 70% en peso, base seca, de carga que comprende la cantidad total de material activo, tensoactivo, adyuvante y otros ingredientes y desde aproximadamente 30 a 70% en peso, base seca, de almidón.

13. La composición de la reivindicación 10 en donde el almidón es éster de almidón modificado con un anhídrido de ácido orgánico que tiene un grupo de hidrocarburo de 2 a 22 átomos de carbono y se selecciona de los grupos alquilo, alquenilo, aralquilo, o aralquenilo.

14. La composición de la reivindicación 13 en donde el grupo hidrocarburo tiene de 5 a 18 átomos de carbono.

15. La composición de la reivindicación 10 en donde el almidón es un éter de almidón preparado al modificar el almidón con óxido de alquileo que tiene de 2 a 6 átomos de carbono,

16. La composición de la reivindicación 13 en donde el material biológicamente activo es un glifosato.

17. La composición de la reivindicación 16 en donde el tensoactivo es un alquil poliglicosido C6-C14.

18. La composición de la reivindicación 1 en donde se utilizan más de uno de los materiales biológicamente activos.

19. La composición de la reivindicación 18 en donde el almidón modificado es éster de almidón o éter de almidón.

20. La composición de la reivindicación 19 en donde el almidón es un éster de almidón preparado de un anhídrido de ácido orgánico que tiene un grupo hidrocarburo hidrófobo de 2 a 22 átomos de carbono.

21. La composición de la reivindicación 1 en donde se utilizan mas de uno de los almidones químicamente modificados y/o mas de uno de los tensoactivos/adyuvantes.

22. La composición de la reivindicación 21 en donde se utiliza más de uno de los materiales biológicamente activos.

23. Una formulación estable, sólida que es dispersable en agua y compatible cuando se dispersa y comprende:

- a) Un almidón químicamente modificado, y
- b) Un material agrícola biológicamente activo.

24. La composición de la reivindicación 23 en donde el material biológicamente activo se selecciona del grupo que consiste de herbicidas, insecticidas y fungicidas.

25. La composición de la reivindicación 24 en donde el almidón químicamente modificado es éster de almidón o éter de almidón.

26. La composición de la reivindicación 25 en donde el material agrícola biológicamente activo es un glifosato.

27. La composición de la reivindicación 25 en donde se utilizan desde aproximadamente 15 a 85% en peso, base seca, de la carga que comprende la cantidad total de material activo y otros ingredientes y desde aproximadamente 15 a 85% en peso, base seca, de almidón.

28. La composición de la reivindicación 25 en donde se utilizan desde aproximadamente 30 a 70% en peso, base seca, de la carga que comprende la cantidad total de material activo y otros ingredientes y desde aproximadamente 30 a 70% en peso, base seca, de almidón.

29. La composición de la reivindicación 23 en donde se utilizan más de los materiales biológicamente activos.

30. La composición de la reivindicación 29 en donde el almidón modificado es un éster de almidón o un éter de almidón.

31. Una formulación estable, sólida que es dispersable en agua, y compatible cuando se dispersa y comprende:

a) Un almidón químicamente modificado

b) Un tensoactivo o adyuvante no aceitoso.

32. La composición de la reivindicación 31 en donde el almidón modificado es éster de almidón o éter de almidón.

33. La composición de la reivindicación 32 en donde el almidón es un éster de almidón modificado con un anhídrido de ácido orgánico que tiene un grupo de hidrocarburo hidrófobo de 2 a 22 átomos de carbono.

34. La composición de la reivindicación 32 en donde el tensoactivo es un alquil poliglicosido C6-C14.

35. La composición de la reivindicación 32 en donde se utilizan de 15 a 85% en peso, base seca, de la carga que comprende la cantidad total de tensoactivo, adyuvante y otros ingredientes y desde aproximadamente 15 a 85% en peso, base seca del almidón.

36. La composición de la reivindicación 32 en donde se utilizan desde aproximadamente 30 a 60% en peso, base seca, de la carga que comprende la cantidad total de tensoactivo, adyuvante y otros ingredientes y desde aproximadamente 30 a 70% en peso, base seca, del almidón.

37. La composición de la reivindicación 31 en donde más de uno de los almidones químicamente modificados y/o tensoactivos o adyuvantes se utiliza.

38. La composición de la reivindicación 37 en donde el almidón modificado es un éster de almidón o un éter de almidón.

39. Una dispersión acuosa que contiene un material agrícola biológicamente activo y que tiene una eficacia biológica creciente que comprende:

- a) Un almidón químicamente modificado,
- b) Un material agrícola biológicamente activo, y opcionalmente
- c) Un tensoactivo y/o adyuvante.

40. La composición de la reivindicación 39 en donde el almidón modificado es éster de almidón o éter de almidón.

41. La composición de la reivindicación 40 en donde el material biológicamente activo se selecciona del grupo que consiste de herbicidas, insecticidas y funguicidas.

42. La composición de la reivindicación 40 en donde el material biológicamente activo es un glifosato o estrobilurina.

43. La composición de la reivindicación 40 en donde el material biológicamente activo es glifosato-isopropil amina o azoxistrobina.

44. La composición de la reivindicación 42 en donde se utiliza un tensoactivo no iónico.

45. La composición de la reivindicación 44 en donde el tensoactivo es un alcohol etoxilado C8 a C18.

46. Un método de aplicar un material agrícola biológicamente activo a cultivos, vegetación, malezas, plantas, insectos, plagas y suelo que comprende aplicar una dispersión acuosa de:

- a) Un almidón químicamente modificado,
- b) Un material agrícola biológicamente activo, y opcionalmente
- c) Un tensoactivo y/o adyuvante,

caracterizado por que se suministra un efecto que sienta de eficacia biológica del material activo.

47. El método de la reivindicación 46 en donde el almidón modificado es un éster de almidón o un éter de almidón.

48. El método de la reivindicación 47 en donde el material biológicamente activo se selecciona del grupo que consiste de herbicidas, insecticidas y funguicidas.

49. El método de la reivindicación 47 en donde el material biológicamente activo es un glifosato o estrobilurina.

50. El método de la reivindicación 47 en donde el material biológicamente activo es glifosato-isopropil amina o azoxistrobina.

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51. El método de la reivindicación 49 en donde se utiliza un tensoactivo no iónico.

52. El método de la reivindicación 51 en donde el tensoactivo es un alcohol etoxilado C8 a C18.

53. El método de la reivindicación 51 en donde el tensoactivo es un alquil políglicosido C6 a C14.