

CAVELIER

ABOGADOS

www.cavelier.com
cavelier@cavelier.com

EDIFICIO SISKI
CARRERA 4 No. 72 - 35
BOGOTÁ 8

Teléfono: (57-1) 347 3611
Telefax: (57-1) 211 8650
(57-1) 700 4814
Fax in ILSA (1-305) 675 7743

Señor Director
DIRECCION DE NUEVAS CREACIONES
Superintendencia de Industria y Comercio
E. S. D.

SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO



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Trámite : 011
Evento : 379
Actuación : 329

Referencia : Expediente No. 11.178.638
Asunto : Solicitud de patente para **DESHIDROHALOGENACION
SELECTIVA DE HIDROCARBUROS TERCARIOS
HALOGENADOS Y REMOCION DE IMPUREZAS DE
HIDROCARBUROS TERCARIOS HALOGENADOS**
Solicitante : **DOW AGROSCIENCES LLC**
Clase : C07C 001/030
Fecha de solicitud : 26 de diciembre de 2011

1. Yo, Luz Clemencia de PAEZ, en mi condición de apoderada de la sociedad solicitante, **DOW AGROSCIENCES LLC**, atentamente presento el siguiente documento:

1.1. **Informe Preliminar Internacional sobre patentabilidad (IPRP)**: Presento con este escrito copia del Informe Preliminar Internacional sobre patentabilidad junto con sus anexos expedido en el trámite de la solicitud internacional No. PCT/US2010/01841 correspondiente a la presente fase nacional, junto con la correspondiente traducción al español de las reivindicaciones presentadas.

Solicito a ese Despacho realizar el examen de patentabilidad sobre el nuevo capítulo reivindicatorio anexo al mencionado IPRP.

Atentamente solicito que se continúe con la tramitación de la solicitud.

Señor Director,

Luz Clemencia de Paéz
LUZ CLEMENCIA DE PAEZ
C.C. 35.456.344 de Usaquén
T.P.A. No. 23.555

COLO-10975-841-073-1
SDC\SCTID-218833\WPC10975
No. M-2012-218833\SDC

NIT. 860.041.367-3

PATENT COOPERATION TREATY

LSP/6AL

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:
GREGORY B. COY
KRIEG DEVAULT LLP
ONE INDIANA SQUARE, SUITE 2800
INDIANAPOLIS, IN 46204

PCT

NOTIFICATION OF TRANSMITTAL OF
INTERNATIONAL PRELIMINARY
REPORT ON PATENTABILITY
(Chapter II of the Patent Cooperation Treaty)

(PCT Rule 71.1)

Date of mailing
(day/month/year)

17 MAY 2012

Applicant's or agent's file reference

DOWA-166/674

IMPORTANT NOTIFICATION

International application No.

PCT/US10/01841

International filing date (day/month/year)

24 June 2010 (24.06.2010)

Priority date (day/month/year)

26 June 2009 (26.06.2009)

Applicant

DOW AGROSCIENCES, LLC ET AL.

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary report on patentability and its annexes, if any, established on the international application.

2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.

3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

4. REMINDER

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices)(Article 39(1))(see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary report on patentability. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the *PCT Applicant's Guide*.

The applicant's attention is drawn to Article 33(5), which provides that the criteria of novelty, inventive step and industrial applicability described in Article 33(2) to (4) merely serve the purposes of international preliminary examination and that "any Contracting State may apply additional or different criteria for the purposes of deciding whether, in that State, the claimed invention is patentable or not" (see also Article 27(5)). Such additional criteria may relate, for example, to exemptions from patentability, requirements for enabling disclosure, clarity and support for the claims.

Name and mailing address of the IPEA/ US

Mail Stop PCT, Attn: IPEA/US
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

Authorized officer

/Tam M. Nguyen/
Insuk Bullock

Facsimile No.

Telephone No. (571)-272-1719

Form PCT/IPEA/416 (January 2004)

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PATENT COOPERATION TREATY

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

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INDIANAPOLIS, IN 46204

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P.O. Box 1450
Alexandria, Virginia 22313-1450

Facsimile No.

Authorized officer

/Tam M. Nguyen/
Insuk Bullock

Telephone No. (571)-272-1700

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PATENT COOPERATION TREATY
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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY
(Chapter II of the Patent Cooperation Treaty)
(PCT Article 36 and Rule 70)

Applicant's or agent's file reference DOWA-166/674	FOR FURTHER ACTION	See Form PCT/IPEA/416																								
International application No. PCT/US10/01841	International filing date (day/month/year) 24 June 2010 (24.06.2010)	Priority date (day/month/year) 26 June 2009 (26.06.2009)																								
International Patent Classification (IPC) or national classification and IPC IPC: C10G 21/00(2006.01);C10L 3/00(2006.01) USPC: 423/242.2;208/208R,237,238																										
Applicant DOW AGROSCIENCES, LLC ET AL.																										
1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36. 2. This REPORT consists of a total of <u>8</u> sheets, including this cover sheet. 3. This report is also accompanied by ANNEXES, comprising: a. ☒ (sent to the applicant and to the International Bureau) a total of <u>22</u> sheets, as follows: ☒ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions). ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box. b. ☐ (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) _____, containing a sequence listing and/or tables related thereto, in electronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).																										
4. This report contains indications relating to the following items: <table style="width: 100%; border: none;"><tr><td style="width: 10%;">☒</td><td style="width: 20%;">Box No. I</td><td>Basis of the report</td></tr><tr><td>☐</td><td>Box No. II</td><td>Priority</td></tr><tr><td>☐</td><td>Box No. III</td><td>Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</td></tr><tr><td>☐</td><td>Box No. IV</td><td>Lack of unity of invention</td></tr><tr><td>☒</td><td>Box No. V</td><td>Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</td></tr><tr><td>☐</td><td>Box No. VI</td><td>Certain documents cited</td></tr><tr><td>☐</td><td>Box No. VII</td><td>Certain defects in the international application</td></tr><tr><td>☐</td><td>Box No. VIII</td><td>Certain observations on the international application</td></tr></table>			☒	Box No. I	Basis of the report	☐	Box No. II	Priority	☐	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability	☐	Box No. IV	Lack of unity of invention	☒	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement	☐	Box No. VI	Certain documents cited	☐	Box No. VII	Certain defects in the international application	☐	Box No. VIII	Certain observations on the international application
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Date of submission of the demand 23 March 2011 (23.03.2011)	Date of completion of this report 26 January 2012 (26.01.2012)																									
Name and mailing address of the IPEA/ US Mail Stop PCT, Attn: IPEA/US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450 Facsimile No.	Authorized officer /Tam M. Nguyen/ Insuk Bullock Telephone No. (571)-272-1700																									

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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY	International application No. PCT/US10/01841
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Box No. I Basis of the report

1. With regard to the language, this report is based on:
 - ☒ the international application in the language in which it was filed.
 - ☐ a translation of the international application into English, which is the language of a translation furnished for the purposes of:
 - ☐ international search (under Rules 12.3(a) and 23.1(b))
 - ☐ publication of the international application (under Rule 12.4(a))
 - ☐ international preliminary examination (under Rules 55.2(a) and/or 55.3(a))

2. With regard to the elements of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:
 - ☐ the international application as originally filed/furnished
 - ☒ the description:
 - pages 1-14 as originally filed/furnished
 - pages* NONE received by this Authority on _____
 - pages* NONE received by this Authority on _____
 - ☒ the claims:
 - pages NONE as originally filed/furnished
 - pages* NONE as amended (together with any statement) under Article 19
 - pages* 41-45 received by this Authority on 23 MARCH 2011 (23.03.2011)
 - pages* NONE received by this Authority on _____
 - ☒ the drawings:
 - pages 1/1 as originally filed/furnished
 - pages* NONE received by this Authority on _____
 - pages* NONE received by this Authority on _____
 - ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:
 - ☐ the description, pages _____
 - ☐ the claims, Nos. _____
 - ☐ the drawings, sheets/figs _____
 - ☐ the sequence listing (*specify*): _____
 - ☐ any table(s) related to the sequence listing (*specify*): _____

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
 - ☐ the description, pages _____
 - ☐ the claims, Nos. _____
 - ☐ the drawings, sheets/figs _____
 - ☐ the sequence listing (*specify*): _____
 - ☐ any table(s) related to the sequence listing (*specify*): _____

5. ☐ This report has been established taking into account the rectification of an obvious mistake authorized by or notified to this Authority under Rule 91 (Rule 70.2(e)).

* If item 4 applies, some or all of those sheets may be marked "superseded."

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY		International application No. PCT/US10/01841
Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement		
1. Statement		
Novelty (N)	Claims <u>6, 8-10, 12, 13, 15-21</u>	YES
	Claims <u>1-5, 7, 11, 14</u>	NO
Inventive Step (IS)	Claims <u>NONE</u>	YES
	Claims <u>1-21</u>	NO
Industrial Applicability (IA)	Claims <u>1-21</u>	YES
	Claims <u>NONE</u>	NO
2. Citations and Explanations (Rule 70.7) Please See Continuation Sheet		

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY	International application No. PCT/US10/01841
Supplemental Box	
a clay (col 2, ln 64-66). Regarding claim 7, Haynal discloses the method of claim 1, further comprising: pretreating the at least one sorbent before the contacting step (washing, adjusting pH, col 2, ln 54-57 and heating, col 3, ln 10-15); wherein the pretreating step comprises making the at least one sorbent operable (useful) for adsorbing the impurities (col 2, ln 54-57). Regarding claim 11, Haynal discloses the method of claim 7, wherein two sorbents are contacted with the hydrocarbon stream (two or more clays, col 2, ln 65-67). Regarding claim 14, Haynal discloses the method of claim 7, further comprising: performing an additional purification process to remove the impurities from the hydrocarbon stream (hydrocarbon stream is also contacted with a molecular sieve, col 2, ln 13-15). Claims 6, 8-10, 12, 15-19, and 21 lack an inventive step under PCT Article 33(3) as being obvious over Haynal in view of US 200610173225 A1 to Das et al. (hereinafter Das). Regarding claim 6, Haynal discloses the method of claim 5 but fails to teach wherein the clay is selected from the group consisting of Bentonite, Fuller's Earth and combinations thereof. However, Das does teach a method of removing hydrocarbons from a hydrocarbon stream comprising aromatic compounds (para [0001]) by contacting the hydrocarbon stream with a clay sorbent (para [0031]) wherein the clay comprises Bentonite or attapulgite (para [0060]). It would not have involved an inventive step to employ the Bentonite of Das as a second clay in Haynal (col 2, ln 65-67) used in combination with attapulgite to facilitate the separation process and ultimately provide a high purity hydrocarbon in a cost-effective manner. Regarding claim 8, Haynal discloses the method of claim 7, wherein the pretreating step comprises: a) washing the at least one sorbent with a solvent (water, col 2, ln 53-55); - shaking the sorbent in solution (col 2, ln 53-55) b) adjusting the pH of the at least one sorbent while in the solvent (col 2, ln 56-57); and - drying the sorbent (by heating, col 3, ln 10-15) but fails to teach c) degassing the at least one sorbent while in the solvent; d) removing the solvent from the at least one sorbent; and e) drying the at least one sorbent after degassing. However Das does teach heating the sorbent/clay in a vacuum under heat for activation (para [0060]) which would typically remove any gases present in the clay. It would not have involved an inventive step to degas the sorbent under vacuum as in Das while still in the Haynal solvent to facilitate removal of any contaminants in the clay as well as to activate the clay (Das, para [0060]) by providing more adsorption sites. It would further be obvious to remove the solvent and dry the sorbent by heating as in Haynal to enhance the effectiveness of the clay (Haynal, col 3, ln 10-15) and ultimately control the amount of processing necessary to purify the stream (Haynal, col 3, ln 5-7). Regarding claim 9, Haynal/Das discloses the method of claim 8 but fails to teach wherein the removing step comprises filtering the sorbent. It would not have involved an inventive step to filter the sorbent as an obvious variation of drying the sorbent. It would further be obvious to filter the sorbent to remove any unwanted moisture in a manner which will not fuse or clog the clay particles (Haynal, col 3, ln 10-15). Regarding claim 10, Haynal/Das discloses the method of claim 8. Haynal further discloses wherein the pH is adjusted to about 10 (col 2, ln 57, 9 overlaps about 10). Regarding claim 12, Haynal discloses the method of claim 11, wherein the two sorbents are different (two or more clays such as attapulgite and a hydrated silicate, col 2, ln 65 - col 2, ln 2) and	

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY	International application No. PCT/US10/01841
Supplemental Box	
the sorbents are treated (col 2, ln 54-57) but fails to teach wherein the two sorbents are pretreated separately and then placed in a bed prior to the contacting step. However Das does teach placing pretreated sorbents in a bed (para [0061]). It would not have involved an inventive step to pretreat each sorbent separately when using sorbents with different chemistries such as attapulgite and hydrated silicates (Haynal, col 2, ln 65 - col 3, ln 2) to optimize activation ; of each sorbent and ultimately enhance the purity of the resulting hydrocarbon stream. It would further be obvious to place the treated sorbents in a bed prior to contacting as set forth in Das to provide a simple batch procedure by which the hydrocarbon stream can be forced through the adsorbent (Haynal, col 4, ln 35-37). Regarding claim 15, Haynal discloses a method for removing impurities from a hydrocarbon stream comprising at least one vinyl aromatic compound (abstract and col 2, ln 19-43), said method comprising: pretreating at least one sorbent to form at least one treated sorbent (col 2, ln 53-57 and col 3, ln 10-15); ! a) washing the at least one sorbent with a solvent (water, col 2, ln 53-55); shaking the sorbent in solution (col 2, ln 53-55) b) adjusting the pH of the at least one sorbent while in the solvent (col 2, ln 56-57); drying the sorbent (by heating, col 3, ln 10-15); contacting the hydrocarbon stream with the at least one treated sorbent (clay) to adsorb at least a portion of the impurities from the hydrocarbon stream (col 2, ln 44-45); wherein the impurities are selected from the group consisting of colored impurities, sulfur-containing impurities and combinations thereof (col 3, ln 41-50); but fails to teach c) degassing the at least one sorbent while in the solvent; d) removing the solvent from the at least one sorbent; and e) drying the at least one sorbent after degassing. However Das does teach heating the sorbent/clay in a vacuum under heat for activation (para [0060]) which would typically remove any gases present in the clay. It would not have involved an inventive step to degas the sorbent under vacuum as in Das while still in the Haynal solvent to facilitate removal of any contaminants in the clay as well as to activate the clay (Das, para [0060]) by providing more adsorption sites. It would further be obvious to remove the solvent and dry the sorbent by heating as in Haynal to enhance the effectiveness of the clay (Haynal, col 3, ln 10-15) and ultimately control the amount of processing necessary to purify the stream (Haynal, col 3, ln 5-7). Regarding claim 16, Haynal/Das discloses the method of claim 15. Haynal further discloses wherein the at least one vinyl aromatic compound comprises styrene (col 2, ln 40-43 and col 4, ln 19). Regarding claim 17, Haynal/Das discloses the method of claim 16. Haynal further teaches further comprising: isolating (collecting) the purified stream (col 4, ln 38-41 but fails to expressly disclose isolating the styrene from the hydrocarbon stream after the contacting step. However it would not have involved an inventive step to isolate the styrene from the hydrocarbon stream to facilitate use of the styrene in a variety of applications including packaging materials (Haynal, col 1, ln 25-31). Regarding claim 18, Haynal/Das discloses the method of claim 15. Haynal further discloses wherein two sorbents (col 2, ln 65-66) are contacted with the hydrocarbon stream (col 2, ln 7-13). Regarding claim 19, Haynal/Das discloses the method of claim 18 but fails to teach wherein the two sorbents are pretreated separately and then placed in a bed prior to the contacting step. However Das does teach placing pretreated sorbents in a bed (para [0061]). It would have been obvious to one of ordinary skill in the art to pretreat each sorbent separately when using sorbents with different chemistries such as attapulgite and hydrated silicates (Haynal, col 2, ln 65 - col 3, ln 2) to optimize activation of each sorbent and ultimately enhance the purity of the resulting hydrocarbon stream. It would further be obvious to place the treated sorbents in a bed prior to contacting as set forth in Das to provide a simple batch procedure by which the hydrocarbon stream can be forced through the	

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY	International application No. PCT/US10/01841
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adsorbent (Haynal, col 4, ln 35-37). Regarding claim 21, Haynal/Das discloses the method of claim 15, further comprising: performing an additional purification process to remove the impurities from the hydrocarbon stream (hydrocarbon stream is also contacted with a molecular sieve, col 2, ln 13-15). Claims 13 lacks an inventive step under PCT Article 33(3) as being obvious over Haynal in view of US 3,697,226 A (Doherty). Regarding claim 13, Haynal discloses the method of claim 11 but fails to teach wherein the two sorbents are pretreated separately and then placed in separate beds prior to the contacting step; wherein the separate beds are arranged in series. However Doherty does teach a method for removing impurities (abstract) from a hydrocarbon stream (col 5, ln 30-36) by contacting the stream with sorbents (adsorbent materials) in separate beds arranged in series (col 2, ln 60-67). It would have been obvious to one of ordinary skill in the art to pretreat each sorbent separately when using sorbents with different chemistries such as attapulgite and hydrated silicates (Haynal, col 2, ln 65 - col 3, ln 2) to optimize activation of each sorbent and ultimately enhance the purity of the resulting hydrocarbon stream. It would further be obvious to place the two sorbents in separate beds and arrange the beds in series to facilitate selective removal of multiple impurities which may be present in fluctuating amounts (Doherty, col 2, ln 55-67). Claim 20 lacks an inventive step under PCT Article 33(3) as being obvious over Haynal in view of Das and further in view of Doherty. Regarding claim 20, Haynal/Das discloses the method of claim 18 but fails to teach wherein the two sorbents are pretreated separately and then placed in separate beds prior to the contacting step; wherein the separate beds are arranged in series. However Doherty does teach a method for removing impurities (abstract) from a hydrocarbon stream (col 5, ln 30-36) by contacting the stream with sorbents (adsorbent materials) in separate beds arranged in series (col 2, ln 60-67). It would not have involved an inventive step to pretreat each sorbent separately when using sorbents with different chemistries such as attapulgite and hydrated silicates (Haynal, col 2, ln 65 - col 3, ln 2) to optimize activation of each sorbent and ultimately enhance the purity of the resulting hydrocarbon stream. It would further be obvious to place the two sorbents in separate beds and arrange the beds in series to facilitate selective removal of multiple impurities which may be present in fluctuating amounts (Doherty, col 2, ln 55-67). Claims 1-21 have industrial applicability as defined by PCT Article 33(4) because the subject matter can be made or used in industry. <u>Response to Arguments</u> The argument that since Haynal does not teach each and every element of the invention, the invention processes novelty over Haynal is not persuasive. Haynal teaches every limitation of claims 1-5, 7, 11, and 14; therefore, these claims do not meet the novelty. The argument that neither Das nor Doherty teaches a method for removing impurities from a hydrocarbon stream comprising at least one vinyl aromatic compound, said method comprising: contacting the hydrocarbon stream with at least one sorbent that adsorbs at least a portion of the impurities from the hydrocarbon stream to provide a purified hydrocarbon stream; and separating the purified hydrocarbon stream from the at least one sorbent is not persuasive. Haynal discloses a method for removing impurities from a hydrocarbon stream comprising at least one vinyl aromatic compound (abstract and col 2, ln 19-43), said method comprising: contacting the hydrocarbon stream with at least one sorbent (clay) that adsorbs at least a portion of the impurities from the hydrocarbon stream to provide a purified hydrocarbon stream (col 2, ln 44-45); and separating the purified hydrocarbon	

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stream from the at least one sorbent (purified stream is collected and transferred, col 4, ln 35-41). ----- NEW CITATIONS -----	

What is claimed is:

1. A method for removing a tertiary chlorinated hydrocarbon impurity from 1,3-dichloro-1-propene, comprising:
 - providing a first mixture comprising 1,3-dichloro-1-propene and a tertiary chlorinated hydrocarbon impurity selected from the group consisting of 2-chloro-2-methylpentane, 2-chloro-2,3-dimethylbutane, 4-chloro-4-methyl-1-pentene and mixtures thereof;
 - contacting the first mixture containing the tertiary chlorinated hydrocarbon impurity with a dehydrochlorination catalyst effective to catalyze a conversion of the tertiary chlorinated hydrocarbon impurity to a corresponding unchlorinated or less-chlorinated unsaturated hydrocarbon and hydrogen chloride, the dehydrochlorination catalyst comprising a sorbent that includes silicon oxide, aluminum oxide or both silicon oxide and aluminum oxide; and
 - distilling the 1,3-dichloro-1-propene to separate and recover a purified cis-1,3-dichloro-1-propene fraction and a purified trans-1,3-dichloro-1-propene fraction.
2. A method for removing a tertiary chlorinated hydrocarbon impurity from 1,3-dichloro-1-propene, comprising:
 - providing a first mixture comprising 1,3-dichloro-1-propene and a tertiary chlorinated hydrocarbon impurity;
 - contacting the first mixture containing the tertiary chlorinated hydrocarbon impurity with a dehydrochlorination catalyst effective to catalyze a conversion of the tertiary chlorinated hydrocarbon impurity to a corresponding unchlorinated or less-chlorinated unsaturated hydrocarbon and hydrogen chloride; and
 - distilling the 1,3-dichloro-1-propene to separate and recover a purified cis-1,3-dichloro-1-propene fraction and a purified trans-1,3-dichloro-1-propene fraction.
3. The method in accordance with claim 1 or claim 2 wherein said contacting comprises feeding the first mixture containing the tertiary chlorinated hydrocarbon impurity into a reactor defining a reaction zone containing the catalyst.

4. The method in accordance with claim 1 or claim 2 wherein the conversion is conducted at a temperature of from about 20 to about 200°C and a pressure of from about 5 to about 50 psia.

5. The method in accordance with claim 3 wherein the first mixture containing the tertiary chlorinated hydrocarbon impurity is fed into the reactor as a feed stream, and wherein the feed stream comprises a liquid mixture having a flow rate of from 0 to about 4000 hr⁻¹ gas hourly space velocity (GHSV) or a gaseous mixture having a flow rate of from 0 to about 4000 weight hourly space velocity (WHSV).

6. The method in accordance with claim 1 or claim 2 wherein the dehydrochlorination catalyst comprises a sorbent-type dehydrohalogenation catalyst selected from the group consisting of activated alumina, sintered alumina, activated clay, fumed silica, silica gel, magnesium silicate, TiO₂, Al₂O₃, ZrO₂, AlPO₄, Al_xSi_yO₂ and mixtures thereof.

7. The method in accordance with claim 1 or claim 2 wherein the dehydrochlorination catalyst is doped with a metal.

8. The method in accordance with claim 1 or claim 2 wherein said method comprises:

contacting the first mixture containing the tertiary chlorinated hydrocarbon impurity with the dehydrochlorination catalyst to produce a second mixture comprising 1,3-dichloro-1-propene and the corresponding unchlorinated or less-chlorinated unsaturated hydrocarbon; and

distilling the second mixture to produce a purified cis-1,3-dichloro-1-propene fraction and a purified trans-1,3-dichloro-1-propene fraction.

9. The method in accordance with wherein said method comprises:

distilling the first mixture containing the tertiary chlorinated hydrocarbon impurity to produce a purified trans-1,3-dichloro-1-propene fraction and a cis-1,3-dichloro-1-propene fraction, the cis-1,3-dichloro-1-propene fraction including the tertiary chlorinated hydrocarbon impurity;

contacting the cis-1,3-dichloro-1-propene fraction with the dehydrochlorination catalyst to produce a second mixture comprising cis-1,3-dichloro-1-propene and the corresponding unchlorinated or less-chlorinated unsaturated hydrocarbon; and
distilling the second mixture to produce a purified cis-1,3-dichloro-1-propene fraction.

10. The method in accordance with claim 3, further comprising passing a stripping gas stream through the reaction zone;

11. The method in accordance with claim 10 wherein the stripping gas is selected from the group consisting of nitrogen gas, helium gas, argon gas, light hydrocarbon.

12. The method in accordance with claim 1 or claim 2 wherein said method comprises:

distilling the first mixture containing the tertiary chlorinated hydrocarbon impurity to produce a purified trans-1,3-dichloro-1-propene fraction and a cis-1,3-dichloro-1-propene fraction, the cis-1,3-dichloro-1-propene fraction including at least one impurity; and

distilling the cis-1,3-dichloro-1-propene fraction to produce a purified cis-1,3-dichloro-1-propene fraction;

wherein said distilling the first mixture containing the tertiary chlorinated hydrocarbon impurity comprises feeding the first mixture into a distillation separator defining a distillation chamber, said distillation chamber having the dehydrochlorination catalyst positioned therein.

13. The method in accordance with claim 1 or claim 2 wherein said method comprises:

distilling the first mixture containing the tertiary chlorinated hydrocarbon impurity to produce a purified trans-1,3-dichloro-1-propene fraction and a rough cis-1,3-dichloro-1-propene fraction, the rough cis-1,3-dichloro-1-propene fraction including at least one impurity; and

distilling the rough cis-1,3-dichloro-1-propene fraction to produce a purified cis-1,3-dichloro-1-propene fraction;

wherein said distilling the rough cis-1,3-dichloro-1-propene fraction comprises feeding the first mixture into a distillation separator defining a distillation chamber, said distillation chamber having the dehydrochlorination catalyst positioned therein.

14. The method in accordance with claim 12 wherein the distillation separator further comprises a recirculation loop configured to extract a fluid from the distillation chamber at a position below the dehydrochlorination catalyst and to return the fluid to the distillation chamber at a position above the dehydrochlorination catalyst.

15. The method in accordance with claim 1 or claim 2 wherein said method comprises:

distilling the first mixture containing the tertiary chlorinated hydrocarbon impurity in a first distillation separator to produce a purified trans-1,3-dichloro-1-propene fraction and a rough cis-1,3-dichloro-1-propene fraction, the rough cis-1,3-dichloro-1-propene fraction including at least one impurity;

distilling the rough cis-1,3-dichloro-1-propene fraction in a second distillation separator to produce a purified cis-1,3-dichloro-1-propene fraction;

extracting a portion of a distilling mixture from the first distillation separator or the second distillation separator, the distilling mixture including at least a portion of the tertiary chlorinated hydrocarbon impurity;

contacting the distilling mixture with a dehydrochlorination catalyst effective to catalyze a conversion of the tertiary chlorinated hydrocarbon impurity in the distilling mixture to a corresponding unchlorinated or less-chlorinated unsaturated hydrocarbon and hydrogen chloride, thereby producing a dehydrochlorination-treated distilling mixture; and

returning the dehydrochlorination-treated distilling mixture to the first distillation separator or the second distillation separator from which it was extracted.

16. A method for removing a tertiary halogenated hydrocarbon impurity from a target hydrocarbon compound, comprising:

providing a first mixture comprising a target hydrocarbon compound and a tertiary halogenated hydrocarbon impurity;

contacting the first mixture containing the tertiary halogenated hydrocarbon impurity with a dehydrohalogenation catalyst effective to catalyze a conversion of the tertiary halogenated hydrocarbon impurity to a corresponding unhalogenated or less-halogenated unsaturated hydrocarbon and hydrogen halide, thereby providing a modified mixture, the dehydrohalogenation catalyst comprising a sorbent that includes silicon oxide, aluminum oxide or both silicon oxide and aluminum oxide; and

distilling the modified mixture to separate and recover a purified target hydrocarbon compound.

17. The method in accordance with claim 16 wherein said contacting the first mixture comprises feeding the first mixture into a distillation separator defining a distillation chamber, said distillation chamber having the dehydrohalogenation catalyst positioned therein; and wherein the distillation separator further comprises a recirculation loop configured to extract a fluid from the distillation chamber at a position below the dehydrohalogenation catalyst and to return the fluid to the distillation chamber at a position above the dehydrohalogenation catalyst.

IN THE UNITED STATES PATENT OFFICE
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

In re PCT application of:
Dow AgroSciences, LLC

International Application
No. PCT/US2010/001841

International Filing Date:
24 June 2010

Title of Invention:
SELECTIVE DEHYDROHALOGENATION
OF TERTIARY HALOGENATED
HYDROCARBONS AND REMOVAL OF
TERTIARY HALOGENATED
HYDROCARBON IMPURITIES

File Ref. DOWA-166

Certificate Under 37 CFR 1.8

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On 23 March 2011

Gregory B. Coy

(Signature)

Gregory B. Coy

(Printed Name)

AMENDMENT UNDER PCT ARTICLE 34

Mail Stop PCT
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir/Madam:

Pursuant to Article 34 and without prejudice to their reintroduction, we wish to replace claim pages 41-45 with the Replacement Pages 41-45. A marked-up copy of the claim set is enclosed to make clearer the claim amendments.

Kindly examine the application in view of these amendments and Applicant's remarks, which are submitted herewith.

Respectfully submitted,

Gregory B. Coy
Gregory B. Coy
KRIEG DEVAULT LLP
One Indiana Square, Suite 2800
Indianapolis, IN 46204-2079
United States of America
Tel.: (317) 238-6323
Fax: (317) 636-1507
Email: gcoy@kdlegal.com

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Gregory B. Coy
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REMARKS IN RESPONSE TO WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY MAILED 1 SEPTEMBER 2010

Mail Stop PCT
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir/Madam:

The Written Opinion of the International Searching Authority (hereafter "WO/ISA") dated 1 September 2010 acknowledges that claims 1-3 and 16 satisfy the industrial applicability requirement and that claims 1-3 satisfy the novelty requirement. However, the WO/ISA asserts that claim 16 does not satisfy the novelty requirement and that claims 1-3 and 16 do not satisfy the inventive step requirement.

The International Search Report ("ISR") dated 1 September 2010 was not established in respect of claims 4-15 on the grounds that these dependent claims were not drafted in accordance with the second and third sentences of Rule 6.4(a). Claims 4-15 were subsequently amended under Article 19 by way of an amendment received by the International Bureau on 15 October 2010, and new claim 17 was added under Article 19 by way of the same amendment. Applicant believes that claims 4-15 and 17 satisfy the second and third sentences of Rule 6.4(a).

Submitted herewith is an Amendment Under PCT Article 34, by which Applicant has amended claims 1, 16 and 17. Applicant respectfully requests that examination of this application proceed on the basis of claims 1-17, as previously amended under Article 19, and as further amended herewith under Article 34, and in view of the remarks herein. Applicant submits that claims 1-17, as amended, satisfy the novelty, inventive step and industrial applicability requirements, and respectfully requests an International Preliminary Report on Patentability indicating same. If the International Preliminary Examining Authority (IPEA) determines that any grounds remain for asserting that any claim lacks novelty or inventive step, Applicant respectfully requests that the IPEA provide a Written Opinion in due time for Applicant to respond thereto before preparation of an International Preliminary Report on Patentability.

Of the claims pending in this application after entry of the Article 34 amendment, the independent claims are claims 1, 2, and 16. These claims, along with the associated dependent claims, are discussed individually below.

Independent Claim 1 and Dependent Claims 3-15

Independent claim 1, as amended, is directed to a method for removing a tertiary chlorinated hydrocarbon impurity from 1,3-dichloro-1-propene. In addition to other features, the method includes contacting a mixture of 1,3-dichloro-1-propene and a tertiary chlorinated hydrocarbon impurity with a dehydrochlorination catalyst effective to catalyze a conversion of the tertiary chlorinated hydrocarbon impurity to a corresponding unchlorinated or less-chlorinated unsaturated hydrocarbon and hydrogen chloride, and distilling the 1,3-dichloro-1-propene to separate and recover a purified cis-1,3-dichloro-1-propene fraction and a purified trans-1,3-dichloro-1-propene fraction. Claim 1, as amended, also specifies that the dehydrochlorination catalyst comprises a sorbent that includes silicon oxide, aluminum oxide or both silicon oxide and aluminum oxide.

The WO/ISA asserts that independent claim 1 lacks inventive step under PCT Article 33(3) as being obvious over U.S. Patent No. 3,257,472 to Kruse (hereafter "Kruse") in view of US 2003/0164284 to Matsumoto et al. (hereinafter "Matsumoto"). For the reasons discussed below, the Kruse and Matsumoto references cited in the WO/ISA lack sufficient teachings to negate the inventive step of the subject matter of claim 1, as amended.

Matsumoto describes a process for producing trans-1,3-dichloropropene that is less colored. In particular, Matsumoto states at paragraphs [0005] and [0006] that, "[I]n order for the trans-isomer to be used as a material for e.g. an intermediate for pharmaceuticals, an intermediate for agricultural chemicals or an intermediate for functional materials, it is required to have a Hazen color number (APHA) of at most 20. Whereas, the trans-isomer obtainable by the conventional process has had a problem that it is substantially densely colored with its APHA being about 500. Namely, it is an object of the present invention to solve the above problem and to effectively obtain a less colored trans-isomer of high purity." The manner of lowering the coloration of the trans-isomer disclosed in Matsumoto is to react chlorine or bromine with one of the compositions being distilled.

Kruse discloses the use of an acid-type sulfonated polystyrene resin, which is cross-linked with divinyl-benzene or a similar divinyl compound, as a catalyst for the dehydrohalogenation of a tertiary alkyl halide, a tertiary cycloalkyl halide or a mixture thereof. Kruse describes using sulfonated polystyrene resin catalyst in the production of olefins from tertiary-halogenated hydrocarbon starting materials. In Example I, set forth at column 3, lines 10-43 of Kruse, 2-chloro-2,3-dimethylbutane was contacted with the sulfonated resin catalyst (Amberlyst-15) in the pot of a fractionation column to measure the yield of olefins achieved by way of the dehydrochlorination reaction. Kruse reports that, including the 2,3-dimethylbutenes "found in the column hold-up and residue," the total "per pass yield" of olefins achieved using the sulfonated polystyrene resin catalyst was "51 percent at 62 percent conversion of the 2-chloro-2,3-dimethylbutane." It appears that the discrepancy between conversion (reported to be 62%) and yield (reported to be 51%) is explained in Kruse by the statement that the 2-chloro-2,3-dimethylbutane in the distillate "was probably formed in the overhead condenser by the recombination of olefin with the HCl which was passed overhead through the column." (Kruse, column 3, lines 33-36). Whether or not this is correct, a person skilled in the art would recognize that Example I provides no support for the contention in Kruse that the sulfonated polystyrene catalyst is effective to selectively dehydrochlorinate tertiary chlorinated alkanes because the only starting material contacted with the catalyst in Example I was a tertiary chlorinated alkane—no other compound was present in the pot.

Example, II of Kruse also fails to support a contention that the sulfonated polystyrene catalyst is effective to selectively catalyze the dehydrochlorination of tertiary alkyl chlorides...

Moreover, upon careful consideration of Example II of Kruse, a person skilled in the art would consider Example II to contradict the statement at column 2, lines 11-14 of Kruse that the sulfonated polystyrene resin catalyst selectively catalyzes the dehydrochlorination of tertiary alkyl halides and tertiary cycloalkyl halides in the presence of primary and/or secondary halides. In Example II of Kruse, a mixture containing 1-methyl-1-chlorocyclohexane (a tertiary chlorinated cycloalkane) and secondary chlorides of methylcyclohexane (secondary chlorinated cycloalkanes) were charged to the kettle of a fractionation column in roughly a 2:1 ratio and contacted with the Amberlyst-15 catalyst. Kruse reports that three overhead cuts collected from the apparatus during the first three hours of reaction, in the amounts of 20.8 grams, 3.7 grams and 1.3 grams, respectively had the contents (in weight percent) set forth in the table at column 3, lines 62-74 of Kruse. In addition, the remaining pot residue, totaling 13.5 grams, had the content set forth in the same table. A person skilled in the art would infer, based upon the data reported in this table and the associated explanations at column 3, line 45 to column 4, line 17, that:

- (i) of the 1-methyl-1-chlorocyclohexane charged to the pot (about 32.67 grams, or about 0.25 mol), some remained unchanged (or, according to Kruse, may have reformed by recombination of tertiary olefin and hydrogen chloride in the overhead condenser);
- (ii) of the 1-methyl-1-chlorocyclohexane charged to the pot, some was converted to either 1-methylcyclohexene or 1-methylenecyclohexane via a dehydrochlorination reaction;
- (iii) of the secondary chlorides of methylcyclohexane charged to the pot (about 16.73 grams, or about 0.13 mol), some remained unchanged; and
- (iv) of the secondary chlorides of methylcyclohexane charged to the pot, some was converted to secondary olefins via a dehydrochlorination reaction.

More particularly, based upon the data provided in Kruse, it appears that at least about 12 mol% of the secondary chlorides of methylcyclohexane was converted to secondary olefins in the presence of the sulfonated polystyrene resin. Because dehydrochlorination of the secondary chlorides in the starting material would not account for all of the secondary olefin products, it appears that some degree of isomerization of 1-methylcyclohexene products also occurred in the Example II process.

In view of the above, Kruse teaches a person skilled in the art that the sulfonated polystyrene resin catalyst described in Kruse promotes dehydrochlorination of secondary chlorinated alkanes, and possibly other reactions, in addition to the dehydrochlorination of tertiary chlorinated alkanes, when contacted with a mixture of secondary and tertiary chlorinated

alkanes. As a result, a person skilled in the art would understand based upon these data that the sulfonated polystyrene resin therefore does not selectively catalyze the dehydrochlorination of tertiary chlorinated alkanes, or at best that the sulfonated polystyrene is only partially selective, given that at least 12 mol% of the secondary chlorinated alkanes in the starting material were dehydrochlorinated in the Example II process.

In support of its assertion that claim 1 lacks an inventive step under PCT Article 33(3), the WO/ISA misinterprets the teachings of Kruse (See Box No. V.2. of the WO/ISA). For example, in the discussion of the inventive step of claims 1-3, the WO/ISA cites column 1, lines 8-12, of Kruse as supporting the statement that "Kruse discloses a method for removing a tertiary chlorinated hydrocarbon impurity." (emphasis added). The WO/ISA also cites column 1, lines 48-55, of Kruse as disclosing "providing a first mixture comprising a tertiary chlorinated hydrocarbon impurity." (emphasis added). Kruse, however, does not disclose a method for removing an impurity, and the cited portions of Kruse make no reference to the removal of a tertiary chlorinated hydrocarbon impurity from a mixture, as set forth in claim 1, but rather only describes dehydrochlorination of bulk tertiary chlorinated compounds. Column 1, lines 8-12, of Kruse (cited in the WO/ISA) states: "This invention relates to a process for dehydrohalogenation of organic halogen compounds. In one of its aspects, the invention relates to a process for dehydrohalogenation of tertiary-halogenated hydrocarbons using a sulfonated resin catalyst." Column 1, lines 48-55, of Kruse (cited in the WO/ISA) states: "According to this invention, there is provided a process for dehydrohalogenation of tertiary halides which comprises contacting a fluid comprising one of a tertiary alkyl halide, a tertiary cycloalkyl halide, and mixtures thereof with a catalyst comprising a porous acid-type sulfonated resin for a time sufficient to effect dehydrohalogenation, and recovering from the contacting an olefinic product." There is no teaching or suggestion in these passages of removing a tertiary chlorinated impurity from a mixture. As discussed above, Kruse describes the use of a sulfonated polystyrene resin catalyst for producing olefinic products in a bulk reaction using tertiary-halogenated hydrocarbon starting materials.

Not only does Kruse fail to teach the removal of a tertiary chlorinated hydrocarbon impurity from a mixture, Kruse is devoid of any working example of a process for removing an impurity. With reference to Example I of Kruse, the only starting material contacted with the sulfonated polystyrene resin catalyst in this Example was 2-chloro-2,3-dimethylbutane, a tertiary chlorinated alkane. While Example II does describe contacting the sulfonated polystyrene resin

with a mixture, the primary component of the mixture (in a 2:1 ratio, by weight) was a tertiary chlorinated alkane. The major component of a mixture to be used in the production of olefins would not be considered by a person skilled in the art to be an impurity.

Therefore, the statements in the WO/ISA suggesting that Kruse discloses a method for removing a tertiary chlorinated hydrocarbon *impurity* from a mixture misinterprets the actual teachings of Kruse, which is devoid of any teaching or suggestion of using the sulfonated polystyrene resin catalyst, or any other catalyst, for the dehydrohalogenation of an impurity as a means for removing the impurity from the mixture or reducing the concentration of the impurity to a more acceptable level.

Moreover, the functionality requirements for a catalyst to be used in the bulk manufacture of olefin products is different than the functionality requirements for a catalyst to be used for the selective dehydrochlorination of an impurity from a mixture that includes a tertiary chlorinated hydrocarbon impurity and also other chlorinated hydrocarbons, such as 1,3-dichloro-1-propene, as recited in claim 1. For example, one objective of a method for removing an impurity from a target compound is to avoid conditions that would cause reaction of the target compound (i.e., the compound being purified) or otherwise detrimentally impact yield of the target compound. Based on the disclosure of Kruse, particularly the data provided in Example II, a person skilled in the art would be led away from selecting the sulfonated polystyrene resin catalyst disclosed therein for use in a process for selectively dehydrochlorinating a tertiary chlorinated alkane impurity when present in admixture with other hydrocarbons, particularly other chlorinated hydrocarbon species. The very teachings of Kruse reveal that the sulfonated polystyrene resin catalyst disclosed therein would promote the dehydrochlorination of other chlorinated species in the mixture, and therefore would not be suitable for removal of a tertiary chlorinated alkane impurity from a mixture that includes the impurity in admixture with other chlorinated hydrocarbons such as 1,3-dichloro-1-propene. As discussed above, Example II of Kruse describes an experiment in which the sulfonated polystyrene catalyst was contacted with a mixture of a tertiary chlorinated cycloalkane and secondary chlorinated cycloalkanes. A person skilled in the art would understand the results reported in Kruse to show that the sulfonated polystyrene catalyst promoted conversion of a significant portion of the secondary chlorinated cycloalkanes to corresponding secondary olefins. A person skilled in the art would therefore find the teachings of Kruse to lead away from the use of the sulfonated polystyrene resin catalyst

disclosed therein in the method set forth in claim 1, wherein it is desired to react the impurity, which is present in a small concentration, while leaving the 1,3-dichloro-1-propene unreacted. A person skilled in the art would expect the sulfonated polystyrene resin of Kruse to promote the dehydrochlorination of other chlorinated species in the mixture, such as the 1,3-dichloro-1-propene, which would unacceptably reduce the yield of the 1,3-dichloro-1-propene that the method is intended to purify. Moreover, the Kruse catalyst is shown to promote isomerization, which would also lead a person skilled in the art away from selecting this catalyst for use in a method for purifying 1,3-dichloro-1-propene.

The WO/ISA acknowledges that Kruse does not disclose the use of dehydrohalogenation for removing a tertiary chlorinated hydrocarbon impurity from 1,3-dichloro-1-propene, but asserts that, "it would have been obvious to one skilled in the art to combine the hydrodechlorination [sic] process of Kruse with the dichloropropene process [of Matsumoto] because, the hydrodechlorination [sic] catalyst would selectively act on the tertiary chlorinated compounds...allowing the more effective distillation of the dichloropropene." The WO/ISA cites column 1, lines 38-40, of Kruse in support of this assertion, presumably due to the use of the word "selective" in this passage, which states that, "It is an object of this invention to provide a new dehydrohalogenation catalyst for the selective dehydrohalogenation of tertiary halides." The term "selective" is presumably used in this passage of Kruse to mean that the sulfonated resin catalyst dehydrochlorinates tertiary alkyl halides and tertiary cycloalkyl halides but not primary and/or secondary halides (see column 2, lines 11-14, of Kruse); however, this statement is contradicted by the data set forth in Example II of Kruse, as discussed above, which shows that secondary chlorides of methylcyclohexane were also converted to secondary olefins in the presence of the sulfonated resin catalyst. At the very least, Kruse shows that the sulfonated polystyrene resin is not completely selective, but rather dehydrochlorinates a substantial portion of secondary chlorides in the mixture to olefinic products. A person skilled in the art, upon reading the full disclosure of Kruse, would understand that the sulfonated polystyrene resin does not selectively catalyze the dehydrochlorination of tertiary chlorinated alkanes to the exclusion of secondary chlorinated hydrocarbons, but that the sulfonated polystyrene resin also promotes the dehydrochlorination of secondary chlorinated hydrocarbons. A person skilled in the art therefore would have found no suggestion or motivation in Kruse to combine the dehydrochlorination process of Kruse with a dichloropropene process as described in ...

Matsumoto, but rather would have been led away from making this combination due to the expectation that the use of the catalyst would cause the dehydrochlorination of other chlorinated hydrocarbons in the mixture, specifically, 1,3-dichloro-1-propene, which would result in the loss of the product that the method is intended to purify.

The WO/ISA also acknowledges that Kruse does not disclose "distilling the 1,3-dichloro-1-propene to separate and recover a purified cis-1,3-dichloro-1-propene fraction and a purified trans-1,3-dichloro-1-propene fraction," but asserts that, "It would have been obvious to one skilled in the art to combine the distillation process of Matsumoto with the dehydrochlorination process of Kruse, because it purified the dichloropropene stream allowing for better clarity and fewer impurities." The Applicant also traverses this assertion, however, for the same reasons as discussed above. A person skilled in the art would have found no suggestion or motivation in Kruse to combine the dehydrochlorination process of Kruse with a dichloropropene process as described in Matsumoto, but rather would have been led away from making this combination due to the expectation that the use of the catalyst would cause the dehydrochlorination of other chlorinated hydrocarbons in the mixture, particularly, dehydrochlorination of the 1,3-dichloro-1-propene.

Moreover, there is no disclosure in Matsumoto, or any other art of record, suggesting the desirability of removing tertiary chlorinated alkane impurities from the distillation compositions of Matsumoto (or whether such impurities are even present in the distillation compositions), and there is no disclosure in Kruse, or any other art of record, suggesting that use of the sulfonated polystyrene resin catalyst disclosed in Kruse would have any bearing on the color of the trans-isomer of 1,3-dichloropropene. Therefore, the cited art is devoid of any teaching that would motivate a person skilled in the art to make this combination; and the asserted combination appears to result solely from impermissible hindsight reconstruction based upon the claims of the present application. Furthermore, as discussed above, a person skilled in the art would find no teaching in Kruse indicating that the sulfonated polystyrene resin catalyst disclosed therein would be effective to selectively catalyze the dehydrohalogenation of 2-chloro-2-methylpentane, 2-chloro-2,3-dimethylbutane, 4-chloro-4-methyl-1-pentene or mixtures thereof, without adversely affecting the cis-1,3-dichloropropene and trans-1,3-dichloropropene present in the distillation compositions described in Matsumoto. Rather, a person skilled in the art would have expected, based upon the disclosure of Kruse that the sulfonated polystyrene resin catalyst would

cause side reactions and produce side products, and the skilled person would have no expectation that the combination suggested in the WO/ISA would have any desired effect. Thus, a person skilled in the art would find no motivation to combine the teachings of the Kruse and Matsumoto references.

In addition, even if a person skilled in the art were to make the combination asserted in the WO/ISA, such a combination still would not have included all of the subject matter of claim 1, as amended. Upon entry of the Article 34 amendment submitted herewith, claim 1 recites that the dehydrochlorination catalyst comprises "a sorbent that includes silicon oxide, aluminum oxide or both silicon oxide and aluminum oxide." While Kruse discloses a specific catalyst for catalyzing dehydrohalogenation of tertiary-halogenated hydrocarbons, namely, an acid-type sulfonated polystyrene resin, which is cross-linked with divinyl-benzene or a similar divinyl compound, a person skilled in the art would not derive any suggestion or motivation from Kruse to select or use any catalyst of the type identified in claim 1, as amended. Because the sulfonated resin catalyst of Kruse is not "a sorbent that includes silicon oxide, aluminum oxide or both silicon oxide and aluminum oxide," as recited in claim 1, and because there is no teaching, suggestion or motivation in the art of record to use any different catalyst to achieve dehydrohalogenation of tertiary chlorinated alkanes, even the combination asserted in the WO/ISA would not include all elements of claim 1.

In view of the above, a person skilled in the art would not have considered the invention of claim 1 to be obvious in view of the disclosures of Kruse and Matsumoto at least for the following reasons: (1) the cited references contain no disclosure, teaching or suggestion of using the catalysts set forth in claim 1, as amended, i.e., a sorbent that includes silicon oxide, aluminum oxide or both silicon oxide and aluminum oxide, to catalyze a dehydrochlorination reaction, or any teaching that would provide any expectation that such catalysts would catalyze such a reaction; and (2) the cited references contain no disclosure, teaching or suggestion that any catalyst, much less the catalysts set forth in claim 1, as amended, would catalyze the dehydrochlorination of tertiary chlorinated alkane impurities without having unacceptable adverse effects on other hydrocarbon species with which the impurities are mixed. While Kruse discloses a catalyst for dehydrochlorination of a tertiary chlorinated alkane, the data provided in Example II of Kruse shows that the catalyst is not selective, and thus Kruse would not motivate a person skilled in the art to use the catalyst to remove a tertiary chlorinated hydrocarbon impurity

from a mixture that includes other hydrocarbons, especially other chlorinated hydrocarbon species.

The Applicant therefore respectfully submits that claim 1, as amended, satisfies the inventive step requirement of PCT Article 33(3), and respectfully requests an indication of the same. Claims 3-15 depend either directly or indirectly from independent claim 1 and are submitted to satisfy the inventive step requirement for at least the reasons set forth above in connection with independent base claim 1, and for additional reasons. While further explanations of the novelty and inventive step of the subject matter recited in the dependent claims is not believed to be necessary, the Applicant would note that the dependent claims include multiple features that are believed to be novel and nonobvious over the prior art, and the Applicant reserves the right to present further arguments in support of the dependent claims if such becomes necessary or desirable at a later time.

Independent Claim 2 and Dependent Claims 3-15

Independent claim 2 is also directed to a method for removing a tertiary chlorinated hydrocarbon impurity from 1,3-dichloro-1-propene. In addition to other features, the method includes contacting a mixture of 1,3-dichloro-1-propene and a tertiary chlorinated hydrocarbon impurity with a dehydrochlorination catalyst effective to catalyze a conversion of the tertiary chlorinated hydrocarbon impurity to a corresponding unchlorinated or less-chlorinated unsaturated hydrocarbon and hydrogen chloride, and distilling the 1,3-dichloro-1-propene to separate and recover a purified cis-1,3-dichloro-1-propene fraction and a purified trans-1,3-dichloro-1-propene fraction.

The WO/ISA asserts that independent claim 2 lacks inventive step under PCT Article 33(3) as being obvious over Kruse in view of Matsumoto. For the reasons discussed below, the Kruse and Matsumoto references cited in the WO/ISA lack sufficient teachings to negate the inventive step of the subject matter of claim 2. The disclosures of Kruse and Matsumoto are discussed above in connection with claim 1.

In support of its assertion that claim 2 lacks an inventive step under PCT Article 33(3), the WO/ISA misinterprets the teachings of Kruse, as discussed above in connection with claim 1 (See Box No. V.2. of the WO/ISA). The cited portions of Kruse, however, make no reference to the removal of a chlorinated hydrocarbon impurity from a mixture, as discussed above in connection with claim 1. Rather, Kruse describes the use of a sulfonated polystyrene resin catalyst for

producing olefinic products in a bulk reaction using tertiary-halogenated hydrocarbon starting materials. There is no teaching or suggestion in the cited passages in Kruse of removing a tertiary chlorinated impurity from a mixture. Moreover, the only starting material contacted with the sulfonated polystyrene resin catalyst in Example I of Kruse was 2-chloro-2,3-dimethylbutane. The starting material contacted with the sulfonated polystyrene resin catalyst in Example II of Kruse was a mixture, the primary component of which was a tertiary chlorinated alkane (in a 2:1 ratio, by weight). The major component of a starting material mixture to be used in the production of olefins would not be considered by a person skilled in the art to be an impurity. Therefore, the statements in the WO/ISA suggesting that Kruse discloses a method for removing a tertiary chlorinated hydrocarbon *impurity* from a mixture misinterprets the actual teachings of Kruse, which is devoid of any teaching or suggestion of the use of the sulfonated polystyrene resin catalyst, or any other catalyst, for the dehydrochlorination of an impurity as a means for removing the impurity from the mixture or reducing the concentration of the impurity to a more acceptable level, as set forth in claim 2.

Moreover, the functionality requirements for a catalyst to be used in the bulk manufacture of olefin products is different than the functionality requirements for a catalyst to be used for the selective dehydrochlorination of an impurity from a mixture that includes a tertiary chlorinated hydrocarbon impurity and also other chlorinated hydrocarbons, such as 1,3-dichloro-1-propene, as recited in claim 2. Based on the disclosure of Kruse, particularly the data provided in Example II, a person skilled in the art would be led away from selecting the sulfonated polystyrene resin catalyst disclosed therein for selectively dehydrochlorinating a tertiary chlorinated alkane impurity when present in admixture with other chlorinated hydrocarbons. The very teachings of Kruse reveal that the sulfonated polystyrene resin catalyst disclosed therein would not be suitable for removal of a tertiary chlorinated alkane impurity from a mixture that includes the impurity in admixture with other hydrocarbons, particularly other chlorinated hydrocarbons such as 1,3-dichloro-1-propene, and a person skilled in the art would find no motivation in Kruse to try to use the sulfonated polystyrene resin for such a purpose. As discussed above, Example II of Kruse describes an experiment in which the sulfonated polystyrene catalyst was contacted with a mixture of a tertiary chlorinated cycloalkane and secondary chlorinated cycloalkanes. A person skilled in the art would have understood the results reported in Kruse to show that the sulfonated polystyrene catalyst also converted a ...

significant portion of the secondary chlorinated cycloalkanes to corresponding secondary olefins. A person skilled in the art would therefore find the teachings of Kruse to lead away from the use of the sulfonated polystyrene resin catalyst disclosed therein in the method set forth in claim 2, in which other chlorinated hydrocarbons to be isolated are present in the mixture, and a person skilled in the art would find no teachings or suggestions in Kruse that would motivate or guide him or her to any expectation that any catalyst would achieve the selective dehydrochlorination of a tertiary halogenated hydrocarbon impurity that is present in small relative amounts in admixture with one or more other hydrocarbons to be recovered, especially other chlorinated species such as 1,3-dichloro-1-propene, as set forth in Claim 2.

The WO/ISA acknowledges that Kruse does not disclose the use of dehydrohalogenation for removing a tertiary chlorinated hydrocarbon impurity from 1,3-dichloro-1-propene, but asserts that, "it would have been obvious to one skilled in the art to combine the hydrodechlorination [sic] process of Kruse with the dichloropropene process [of Matsumoto] because, the hydrodechlorination [sic] catalyst would selectively act on the tertiary chlorinated compounds...allowing the more effective distillation of the dichloropropene." The WO/ISA cites column 1, lines 38-40, of Kruse in support of this assertion, presumably due to the use of the word "selective" in this passage; however, the usage of the term "selective" in this statement is contradicted by the data set forth in Example II of Kruse, as discussed above, which shows that secondary chlorides of methylcyclohexane were also converted to secondary olefins in the presence of the sulfonated polystyrene resin catalyst. At the very least, Kruse shows that the sulfonated polystyrene resin is not completely selective, but rather dehydrochlorinates a substantial portion of secondary chlorides to olefinic products. A person skilled in the art, upon reading the full disclosure of Kruse, would understand that the sulfonated polystyrene resin does not selectively catalyze the dehydrochlorination of tertiary chlorinated alkanes to the exclusion of secondary chlorinated hydrocarbons, but that the sulfonated polystyrene resin also promotes the dehydrochlorination of secondary chlorinated hydrocarbons. A person skilled in the art therefore would have found no suggestion or motivation in Kruse to combine the dehydrochlorination process of Kruse with a dichloropropene process as described in Matsumoto, but rather would have been led away from making this combination due to the expectation that the use of the catalyst would cause the dehydrochlorination of other chlorinated hydrocarbons in the mixture, specifically, 1,3-dichloro-1-propene, which would result in the loss

of the product that the method is intended to purify. Moreover, the Kruse catalyst is shown to promote isomerization, which would also lead a person skilled in the art away from selecting this catalyst for use in a method for purifying 1,3-dichloro-1-propene.

The WO/ISA also acknowledges that Kruse does not disclose "distilling the 1,3-dichloro-1-propene to separate and recover a purified cis-1,3-dichloro-1-propene fraction and a purified trans-1,3-dichloro-1-propene fraction," but asserts that, "It would have been obvious to one skilled in the art to combine the distillation process of Matsumoto with the dehydrochlorination process of Kruse, because it purified the dichloropropene stream allowing for better clarity and fewer impurities." The Applicant also traverses this assertion, however, for the same reasons as discussed above. A person skilled in the art would have found no suggestion or motivation in Kruse to combine the sulfonated polystyrene resin catalyzed dehydrochlorination reaction of Kruse with a dichloropropene process as described in Matsumoto, but rather would have been led away from making this combination due to the expectation that the use of the catalyst would cause the dehydrochlorination of other chlorinated hydrocarbons in the mixture, particularly, dehydrochlorination of the 1,3-dichloro-1-propene.

Moreover, there is no disclosure in Matsumoto, or any other art of record, suggesting the desirability of removing tertiary chlorinated alkane impurities from the distillation compositions of Matsumoto (or whether such impurities are even present in the distillation compositions), and there is no disclosure in Kruse, or any other art of record, suggesting that use of the sulfonated polystyrene resin catalyst disclosed in Kruse would have any bearing on the color or the trans-isomer of 1,3-dichloropropene. Therefore, the cited art is devoid of any teaching that would motivate a person skilled in the art to make this combination, and the asserted combination appears to result solely from impermissible hindsight reconstruction based upon the claims of the present application. Furthermore, as discussed above, a person skilled in the art would find no teaching in Kruse indicating that the sulfonated polystyrene resin catalyst disclosed therein would be effective to selectively catalyze the dehydrohalogenation of a tertiary chlorinated impurity without adversely affecting the cis-1,3-dichloropropene and trans-1,3-dichloropropene present in the distillation composition described in Matsumoto. Rather, a person skilled in the art would have expected, based upon the disclosure of Kruse that the sulfonated polystyrene resin catalyst would cause side reactions and produce side products, and the skilled person would have no expectation that the combination suggested in the WO/ISA would have any desired ...

effect. Thus, a person skilled in the art would find no motivation to combine the teachings of the Kruse and Matsumoto references.

In view of the above, a person skilled in the art would not have considered the invention of claim 2 to be obvious in view of the disclosures of Kruse and Matsumoto at least because the cited references contain no disclosure, teaching or suggestion that any catalyst would catalyze the dehydrochlorination of tertiary chlorinated alkanes when such tertiary chlorinated alkanes are present as an impurity in a mixture that includes 1,3-dichloro-propene, or any other chlorinated hydrocarbon, without having unacceptable adverse effects on the other chlorinated hydrocarbon species in the mixture. While Kruse discloses a catalyst for dehydrochlorination of a tertiary chlorinated alkane, the data provided in Example II of Kruse shows that the catalyst is not selective, and thus Kruse would not motivate a person skilled in the art to use the catalyst to remove a tertiary chlorinated hydrocarbon impurity from a mixture that includes other hydrocarbons, especially other chlorinated hydrocarbon species.

The Applicant therefore respectfully submits that claim 2 satisfies the inventive step requirement of PCT Article 33(3), and respectfully requests an indication of the same. Claims 3-15 depend either directly or indirectly from independent claim 2 and are submitted to satisfy the inventive step requirement for at least the reasons set forth above in connection with independent base claim 2, and for additional reasons. While further explanations of the novelty and inventive step of the subject matter recited in the dependent claims is not believed to be necessary, the Applicant would note that the dependent claims include multiple features that are believed to be novel and nonobvious over the prior art, and the Applicant reserves the right to present further arguments in support of the dependent claims if such becomes necessary or desirable at a later time.

Independent Claim 16 and Dependent Claim 17

Independent claim 16 is directed to a method for removing a tertiary halogenated hydrocarbon impurity from a target hydrocarbon compound. In addition to other features, the method includes contacting a mixture of a target hydrocarbon compound and a tertiary halogenated hydrocarbon impurity with a dehydrohalogenation catalyst effective to catalyze a conversion of the tertiary halogenated hydrocarbon impurity to a corresponding unhalogenated or less-halogenated unsaturated hydrocarbon and hydrogen halide, thereby providing a modified mixture, and distilling the modified mixture to separate and recover a purified target hydrocarbon

compound. Claim 16, as amended, specifies that the dehydrohalogenation catalyst comprises a sorbent that includes silicon oxide, aluminum oxide or both silicon oxide and aluminum oxide.

The WO/ISA asserts that independent claim 16 lacks novelty under PCT Article 33(2) as being anticipated by Kruse. For the reasons discussed below, Kruse does not negate the novelty of the subject matter of claim 16, as amended. The disclosure of Kruse is discussed above in connection with claim 1.

In addition to other features, claim 16 specifies that the first mixture that is contacted with a dehydrohalogenation catalyst comprises a tertiary halogenated hydrocarbon impurity. Kruse, however, makes no reference to the removal of a chlorinated hydrocarbon impurity from a mixture as asserted in the WO/ISA, as discussed above in connection with claim 1. Rather, as discussed above, Kruse discloses the use of a sulfonated polystyrene resin catalyst for producing olefinic products in a bulk reaction using tertiary-halogenated hydrocarbon starting materials. There is no disclosure in Kruse of any mixture that includes a tertiary halogenated impurity or of any process that is directed to removing a tertiary halogenated impurity from a mixture, as recited in claim 16. In both Example I and Example II of Kruse, the tertiary halogenated compound is present in the starting material as either the sole material (as in Example I) or as the major component (i.e., 65.2 weight percent of the reaction mixture in Example II). Thus, Kruse is devoid of any disclosure of any process in which a tertiary halogenated compound is present in a starting material as an impurity. Therefore, the statements in the WO/ISA suggesting that Kruse discloses a method for removing a tertiary chlorinated hydrocarbon *impurity* from a mixture mischaracterizes the actual teachings of Kruse, which is devoid of any disclosure involving the use of the sulfonated polystyrene resin catalyst, or any other catalyst, for dehydrochlorinating an impurity as a means for removing the impurity from the mixture or reducing the concentration of the impurity to a more acceptable level, as set forth in claim 16.

In addition, upon entry of the Article 34 amendment submitted herewith, claim 16 recites that the dehydrohalogenation catalyst comprises "a sorbent that includes silicon oxide, aluminum oxide or both silicon oxide and aluminum oxide." Kruse fails to disclose any catalyst comprising a sorbent that includes silicon oxide, aluminum oxide or both silicon oxide and aluminum oxide as recited in claim 16, as amended, but rather discloses a catalyst comprising an acid-type sulfonated polystyrene resin, which is cross-linked with divinyl-benzene or a similar divinyl compound. Because the sulfonated polystyrene resin catalyst of Kruse is not "a sorbent that

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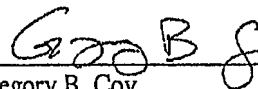
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includes silicon oxide, aluminum oxide or both silicon oxide and aluminum oxide," as recited in claim 16, Kruse does not negate the novelty or inventive step of claim 16, as amended.

In view of the above, the Applicant respectfully submits that claim 16, as amended, satisfies the novelty and inventive step requirements of PCT Articles 33(2) and 33(3), and respectfully requests an indication of the same. Claim 17 depends from independent claim 16 and is submitted to satisfy the novelty and inventive step requirements for at least the reasons set forth above in connection with independent base claim 16, and for additional reasons. While further explanations of the novelty and inventive step of the subject matter recited in dependent claim 17 is not believed to be necessary, the Applicant would note that the dependent claim includes additional features that are believed to be novel and nonobvious over the prior art, and the Applicant reserves the right to present further arguments in support of the dependent claim if such becomes necessary or desirable at a later time.

In view of the foregoing remarks, Applicant respectfully requests examination of the present application, and an indication that all of the pending claims of the present application, as amended, satisfy the novelty, inventive step and industrial applicability requirements of PCT Article 33. Should the Examiner believe any grounds remain for a negative indication with regard to any pending claim, Applicant respectfully requests issuance of a Written Opinion by the IPEA in sufficient time to provide Applicant an opportunity to consider and respond to same.

Respectfully submitted,



Gregory B. Coy
KRIEG DEVAULT LLP
One Indiana Square, Suite 2800
Indianapolis, IN 46204-2079
United States of America
Tel.: (317) 238-6323
Fax: (317) 636-1507

REIVINDICACIONES MODIFICADAS

- PARA REALIZAR EL EXAMEN DE
PATENTABILIDAD

REIVINDICACIONES

Lo que se reivindica es:

1. Un método para eliminar de 1,3-dicloro-1-propeno una impureza de hidrocarburo clorado terciario, método que comprende:

proporcionar una primera mezcla, que contiene 1,3-dicloro-1-propeno y una impureza de hidrocarburo clorado terciario, seleccionado del grupo conformado por 2-cloro-2-metilpentano, 2-cloro-2,3-dimetilbutano, 4-cloro-4-metil-1-penteno y mezclas de los anteriores;

contactar la primera mezcla, que contiene la impureza de hidrocarburo clorado terciario, con un catalizador de deshidrocloración, efectivo para catalizar una conversión de la impureza de hidrocarburo clorado terciario en un hidrocarburo insaturado menos clorado o no clorado correspondiente y cloruro de hidrógeno, conteniendo el catalizador de deshidrocloración un absorbente que incluye dióxido de silicio, óxido de aluminio o ambos, dióxido de silicio y óxido de aluminio; y

destilar el 1,3-dicloro-1-propeno para separar y recuperar una fracción de cis-1,3-dicloro-1-propeno purificado y una fracción de trans-1,3-dicloro-1-propeno purificado.

2. Un método para eliminar de 1,3-dicloro-1-propeno una impureza de hidrocarburo clorado terciario, método que comprende:

proporcionar una primera mezcla que contiene 1,3-dicloro-1-propeno y una impureza de hidrocarburo clorado terciario;

contactar la primera mezcla, que contiene la impureza de hidrocarburo clorado terciario, con un catalizador de deshidrocloración, efectivo para catalizar una conversión de la impureza de hidrocarburo clorado terciario en un

hidrocarburo insaturado menos clorado o no clorado correspondiente y cloruro de hidrógeno; y

destilar el 1,3-dicloro-1-propeno para separar y recuperar una fracción de cis-1,3-dicloro-1-propeno purificado y una fracción de trans-1,3-dicloro-1-propeno purificado.

3. El método de acuerdo con la reivindicación 1 o la reivindicación 2 en donde el citado contactar comprende cargar la primera mezcla, que contiene la impureza de hidrocarburo clorado terciario, en un reactor que define una zona de reacción que contiene el catalizador.

4. El método de acuerdo con la reivindicación 1 o la reivindicación 2 en donde la conversión se conduce a una temperatura de desde aproximadamente 20 a aproximadamente 200° C y una presión de desde aproximadamente 5 a aproximadamente 50 psia.

5. El método de acuerdo con la reivindicación 3 en donde la primera mezcla, que contiene la impureza de hidrocarburo clorado terciario, se carga en el reactor como una corriente de carga, y en donde la corriente de carga comprende una mezcla líquida que tiene un caudal de desde 0 a aproximadamente 4000 hr⁻¹ velocidad espacial horaria de la fase gaseosa (GHSV – *gas hourly space velocity*) o una mezcla gaseosa que tiene un caudal de desde 0 a aproximadamente 4000 velocidad espacial horaria y másica (WHSV – *weight hourly space velocity*).

6. El método de acuerdo con la reivindicación 1 o la reivindicación 2 en donde el catalizador de deshidrocloración comprende un catalizador de deshidrohalogenación tipo absorbente, seleccionado del grupo conformado por alúmina activada, alúmina sinterizada, arcilla activada, sílice pirogénica, gel de

silíce, silicato de magnesio, TiO_2 , Al_2O_3 , ZrO_2 , $\text{Al}_x\text{Si}_y\text{O}_z$ y mezclas de los anteriores.

7. El método de acuerdo con la reivindicación 1 o la reivindicación 2 en donde el catalizador de deshidrocloración se dopa con un metal.

8. El método de acuerdo con la reivindicación 1 o la reivindicación 2 en donde el citado método comprende:

contactar la primera mezcla, que contiene la impureza de hidrocarburo clorado terciario, con el catalizador de deshidrocloración para producir una segunda mezcla, que contiene 1,3-dicloro-1-propeno y el hidrocarburo insaturado menos clorado o no clorado correspondiente; y

destilar la segunda mezcla para producir una fracción de cis-1,3-dicloro-1-propeno purificado y una fracción de trans-1,3-dicloro-1-propeno purificado.

9. El método de acuerdo con la reivindicación 1 o la reivindicación 2 en donde el citado método comprende:

destilar la primera mezcla, que contiene la impureza de hidrocarburo clorado terciario, para producir una fracción de trans-1,3-dicloro-1-propeno purificado y una fracción de cis-1,3-dicloro-1-propeno, incluyendo la fracción de cis-1,3-dicloro-1-propeno la impureza de hidrocarburo clorado terciario;

contactar la fracción de cis-1,3-dicloro-1-propeno con el catalizador de deshidrocloración para producir una segunda mezcla, que comprende cis-1,3-dicloro-1-propeno y el hidrocarburo insaturado menos clorado o no clorado correspondiente; y

destilar la segunda mezcla para producir una fracción de cis-1,3-dicloro-1-propeno purificado.

10. El método de acuerdo con la reivindicación 3, que comprende además pasar una corriente de gas de destilación a través de la zona de reacción.

11. El método de acuerdo con la reivindicación 10 en donde el gas de destilación se selecciona del grupo conformado por gas de nitrógeno, gas de helio, gas de argón, hidrocarburo liviano.

12. El método de acuerdo con la reivindicación 1 o la reivindicación 2 en donde el citado método comprende:

destilar la primera mezcla, que contiene la impureza de hidrocarburo clorado terciario, para producir una fracción de trans-1,3-dicloro-1-propeno purificado y una fracción de cis-1,3-dicloro-1-propeno, incluyendo la fracción de cis-1,3-dicloro-1-propeno por lo menos una impureza; y

destilar la fracción de cis-1,3-dicloro-1-propeno para producir una fracción de cis-1,3-dicloro-1-propeno purificado;

en donde el citado destilar la primera mezcla, que contiene la impureza de hidrocarburo clorado terciario, comprende cargar la primera mezcla en un separador de destilación que define una cámara de destilación, teniendo la citada cámara de destilación el catalizador de deshidrocloración alojado en ella.

13. El método de acuerdo con la reivindicación 1 o la reivindicación 2 en donde el citado método comprende:

destilar la primera mezcla, que contiene la impureza de hidrocarburo clorado terciario, para producir una fracción de trans-1,3-dicloro-1-propeno purificado y una fracción de cis-1,3-dicloro-1-propeno en bruto, incluyendo la fracción de cis-1,3-dicloro-1-propeno en bruto por lo menos una impureza; y

destilar la fracción de cis-1,3-dicloro-1-propeno en bruto para producir una fracción de cis-1,3-dicloro-1-propeno purificado;

en donde el citado destilar la fracción de cis-1,3-dicloro-propeno en bruto comprende cargar la primera mezcla en un separador de destilación que define una cámara de destilación, teniendo la citada cámara de destilación el catalizador de deshidrocloración alojado en ella.

14. El método de acuerdo con la reivindicación 12 en donde el separador de destilación comprende adicionalmente un circuito de recirculación configurado para extraer un fluido de la cámara de destilación en una posición por debajo del catalizador de deshidrocloración y para regresar el fluido a la cámara de destilación en una posición por encima del catalizador de deshidrocloración.

15. El método de acuerdo con la reivindicación 1 o la reivindicación 2 en donde el citado método comprende:

destilar la primera mezcla, que contiene la impureza de hidrocarburo clorado terciario, en un primer separador de destilación para producir una fracción de trans-1,3-dicloro-1-propeno purificado y una fracción de cis-1,3-dicloro-1-propeno en bruto, incluyendo la fracción de cis-1,3-dicloro-1-propeno en bruto por lo menos una impureza;

destilar la fracción de cis-1,3-dicloro-1-propeno en bruto en un segundo separador de destilación para producir una fracción de cis-1,3-dicloro-1-propeno purificado;

extraer una porción de una mezcla de destilación del primer separador de destilación o el segundo separador de destilación, incluyendo la mezcla de destilación por lo menos una porción de la impureza de hidrocarburo clorado terciario;

contactar la mezcla de destilación con un catalizador de deshidrocloración, efectivo para catalizar una conversión de la impureza de hidrocarburo clorado terciario en la mezcla de destilación en un hidrocarburo insaturado menos clorado

o no clorado correspondiente y cloruro de hidrógeno, produciendo en esa forma una mezcla de destilación tratada por deshidrocloración; y

regresar la mezcla de destilación tratada por deshidrocloración al primer separador de destilación o al segundo separador de destilación del cual se extrae.

16. Un método para eliminar de un compuesto de hidrocarburo objetivo una impureza de hidrocarburo halogenado terciario, método que comprende:

proporcionar una primera mezcla, que comprende un compuesto de hidrocarburo objetivo y una impureza de hidrocarburo halogenado terciario;

contactar la primera mezcla, que contiene la impureza de hidrocarburo halogenado terciario, con un catalizador de deshidrohalogenación, efectivo para catalizar una conversión de la impureza de hidrocarburo halogenado terciario en un hidrocarburo insaturado menos halogenado o no halogenado y haluro de hidrógeno, proporcionando en esa forma una mezcla modificada, conteniendo el catalizador de deshidrohalogenación un absorbente que incluye dióxido de silicio, óxido de aluminio o ambos, dióxido de silicio y óxido de aluminio; y

destilar la mezcla modificada para separar y recuperar un compuesto de hidrocarburo objetivo purificado.

17. El método de acuerdo con la reivindicación 16 en donde el citado contactar la primera mezcla comprende cargar la primera mezcla en un separador de destilación que define una cámara de destilación, teniendo la citada cámara de destilación el catalizador de deshidrohalogenación alojado en ella; y en donde el separador de destilación comprende además un circuito de recirculación configurado para extraer un fluido de la cámara de destilación, en una posición por debajo del catalizador de deshidrohalogenación y para regresar el fluido a la cámara de destilación en una posición por encima del catalizador de deshidrohalogenación.