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Agents: BABYCH, Eric, D, et al; Brinks Gilson & Lione, P.O. Box 10087, Chicago, IL 60610 (US).

Abstract: Methods are provided for refining natural oil feedstocks and partially hydrogenating polyunsaturated olefins and polyunsaturated esters. The methods comprise reacting the feedstock in the presence of a metathesis catalyst under conditions sufficient to form a metathesized product comprising olefins and esters. In certain embodiments, the methods further comprise separating the polyunsaturated olefins from the polyunsaturated esters in the metathesized product. In certain embodiments, the methods further comprise partially hydrogenating the polyunsaturated olefins in the presence of a hydrogenation catalyst, wherein at least a portion of the polyunsaturated olefins are converted to monounsaturated olefins. In other embodiments, the methods further comprise partially hydrogenating the polyunsaturated esters in the presence of a hydrogenation catalyst, wherein at least a portion of the polyunsaturated esters are converted to monounsaturated esters.
**INTERNATIONAL SEARCH REPORT**

**A. CLASSIFICATION OF SUBJECT MATTER**

INV. C11B3/02
C11B11/00
C11C1/00
C11C3/12
C11C3/14

ADD.

According to International Patent Classification (IPC) and to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

C11B
C11C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data, FSTA, COMPENDEX

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

<table>
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<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
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<td>wo 2008/008420 AI (CARGILL INC [US]; BRAKSMAYER DIZA PEARL [US]; BOND RISHA [US]; BUNNELL) 17 January 2008 (2008-01-17) page 16, paragraph 3</td>
<td>1-21</td>
</tr>
</tbody>
</table>

Further documents are listed in the continuation of Box C. See patent family annex.

* Special categories of cited documents:
  - "A" document defining the general state of the art which is not considered to be of particular relevance
  - "E" earlier application or patent published and cited after the international filing date
  - "L" document from which may throw doubts on priority claim(s) or which is cited as such with a special reason (as specified)
  - "O" document referring to an oral disclosure, use, exhibition or other means
  - "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is taken in combination with one or more other such documents, such combination being obvious to a person skilled in the art

"A" document member of the same patent family

**Date of the actual completion of the international search**

9 July 2014

**Date of mailing of the international search report**

20/03/2015

**Name and mailing address of the ISA/Authorized officer**

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Rooney, Kevin
INTERNATIONAL SEARCH REPORT

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. □ Claims Nos.: because they relate to subject matter not required to be searched by this Authority, namely:

2. □ Claims Nos.: because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. □ Claims Nos.: because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. □ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. □ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.

3. □ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. □ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-21

Remark on Protest

□ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

□ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

□ No protest accompanied the payment of additional search fees.

Form PCT/ISA/21 0 (continuation of first sheet (2)) (April 2005)
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This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-21

    Method of refining a natural oil by providing a feedstock comprising a natural oil, producing a metathesed feedstock in the presence of a metathesis catalyst, partially hydrogenating the metathesized product in the presence of a hydrogenation catalyst to produce monounsaturated oils.

2. claims: 22-27

    A method of forming monounsaturated oils by providing a feedstock comprising polyunsaturated oils, partially hydrogenating the polyunsaturated oils in the presence of a hydrogenation catalyst for 30-180 minutes at 150-250°C with H₂ gas at 50-500 psi, wherein the catalyst is provided in an amount between 0.01-1 wt% of the polyunsaturated oils and wherein the hydrogenation step has a conversion ratio of at least 85% and a selectivity of at least 90%.

3. claims: 28-33

    A method of forming monounsaturated esters by providing a feedstock comprising polyunsaturated esters, partially hydrogenating the polyunsaturated esters in the presence of a hydrogenation catalyst for 30-180 minutes at 150-250°C with H₂ gas at 50-500 psi, wherein the catalyst is provided in an amount between 0.01-1 wt% of the polyunsaturated esters and wherein the hydrogenation step has a conversion ratio of at least 85% and a selectivity of at least 90%.