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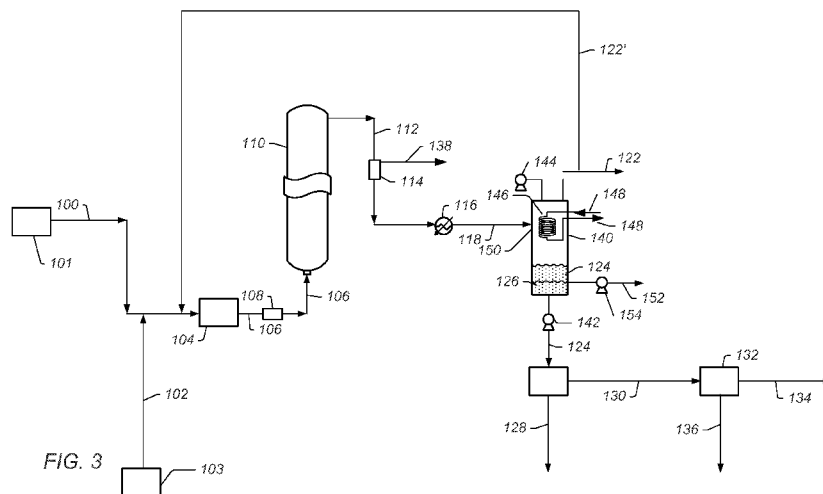
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- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))

[Continued on next page]

(54) Title: SYSTEMS AND METHODS FOR MAKING BIOPRODUCTS



(57) Abstract: Processes for continuous preparation of bioproducts are described herein. The processes include contacting fatty acid glycerides with alcohols in the presence of an acidic heterogeneous catalyst and separating the fatty acid alkyl esters from the reaction products.

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14 February 2013

## INTERNATIONAL SEARCH REPORT

International application No.  
**PCT/US2012/027941****A. CLASSIFICATION OF SUBJECT MATTER***C07C 69/003(2006.01)i, C07C 69/007(2006.01)i, C10L 1/19(2006.01)i*

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

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

C07C 69/003; C07C 67/02; C01B 33/00; C11C 3/00; C11C 1/02; C11B 3/00; C11C 1/00

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

Korean utility models and applications for utility models  
Japanese utility models and applications for utility models

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

eKOMPASS(KIPO internal) &amp; Keywords: continuous, fatty acid alkyl ester, FAME, fatty acid glyceride, alcohol, methanol, ethanol, heterogeneous, catalyst, acidic, glycerin, cooling, biodiesel.

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y A	US 2006-0014974 A1 (BOURNAY, LAURENT et al.) 19 January 2006 See abstract; paragraphs [0023] & [0028]-[0029]; example 2; Figures 6-7; claim 1.	26-31,33-38,40,119  32,39 1-12
X Y A	US 2009-0069586 A1 (OKU, TOMOCHARU et al.) 12 March 2009 See Figure 2; paragraphs [0033], [0088] & [0107]; example 1; claim 1.	119 32,39 1-12,26-31,33-38 ,40
X A	US 6262285 B1 (MCDONALD, WILLIAM M.) 17 July 2001 See claim 1.	119 1-12,26-40
A	US 7812187 B2 (KAWASHIMA, AYATO et al.) 12 October 2010 See claim 1.	1-12,26-40,119
A	US 6960672 B2 (NAKAYAMA, MASAHIDE et al.) 01 November 2005 See claims 1 & 4-5.	1-12,26-40,119

 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 but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of citation or other 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 combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&amp;" document member of the same patent family

Date of the actual completion of the international search

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**30 NOVEMBER 2012 (30.11.2012)**

Name and mailing address of the ISA/KR

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INTERNATIONAL SEARCH REPORT

International application No.  
**PCT/US2012/027941**

**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 an extra 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 fee, this Authority did not invite payment of any additional fee.
- 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.:  
1-12, 26-40 & 119

- 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.

## INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

**PCT/US2012/027941**

Patent document cited in search report	Publication date	Patent family member(s)	Publication date		
US 2006-0014974 A1	19.01.2006	BR P10504143 A	21.02.2006		
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		WO 02-081607 A1	17.10.2002		

(Box No. III)

Invention group I (Claims 1-12, 26-40 & 119): A method of continuous manufacture of fatty acid alkyl esters, comprising contacting a feedstock stream and an alcohol stream (or their mixture) with a catalyst to produce a reaction product comprising one or more fatty acid alkyl esters.

Invention group II (Claims 13-25, 50-59 & 118): A system of continuous manufacture of fatty acid alkyl esters, comprising a reactor, the reactor being capable of receiving a flow (of one or more alcohol compounds and/or one or more feedstocks).

Invention group III (Claims 41-49, 60-95): A method of making one or more bioproducts, wherein the feedstock comprise one or more fatty acid glycerides and/or one or more alcohols.

Invention group IV (Claims 96-108): A method of making biodiesel and biolubricants, comprising: contacting at least a portion of a feedstock with a heterogeneous acidic catalyst to produce a first mixture; separating a fatty acid methyl ester/glycerin stream from the reaction mixture; applying an electrostatic field to the fatty acid methyl ester/glycerin stream for separation; contacting the fatty acid methyl ester stream with an additional heterogeneous acidic catalyst to produce a second mixture; and separating one or more fatty acid alkyl esters from the second mixture.

Invention group V (Claims 109-117): A method of making omega 3 and omega 6 fatty acids, comprising: contacting a feedstock with a heterogeneous acidic catalyst in the presence of one or more alcohols to produce a reaction mixture; and separating at least one or more of the polyunsaturated fatty acids from the reaction mixture, wherein the one or more polyunsaturated fatty acids comprise an omega 3 and/or an omega 6 fatty acid.

The common technical feature linking groups I-V together is 'a process (or a system) related to manufacture of fatty acid alkyl esters (or bioproducts, biodiesel and biolubricants, or omega 3 and omega 6 fatty acids) from one or more fatty acid glycerides and/or one or more alcohols'. However, the feature is already disclosed in US 2006-0014974 A1 (19 January 2006), US 2009/0069586 A1 (12 March 2009) and US 6262285 B1 (17 July 2001). Thus, the invention groups I-V do not relate to a single general inventive concept under PCT Rule 13.1 because the above mentioned technical feature fails to contribute over the prior art within the meaning of PCT Rule 13.2.