



New connection on: : 01-11-2018 : 07:27:53 - Last disconnection on: : 01-11-2018 : 04:55:47

V 4.0.0.44358(LP,U,linux) (Rev:43856 2017-04-27 09:03:29 +0200#(D201802)) (RPM D201802)

Welcome to EPOQUE Rebuild under the Production Environment

[No database/cluster active] ..fi epodoc

 Database: EPODOC

[EPODOC: SS 1] C07C/C/LOW

Results in EPODOC 1.021.614

[SS 2] * and (biodiesel or bio-diesel)

Results in EPODOC 709

EPODOC: term 'BIO-DIESEL' not found in index 'BI'. WARNING(1)

[SS 3] * and biodiesel

Results in EPODOC 709

[SS 4] * and (glycerol or glycerin)

Results in EPODOC 278

[SS 5] * and (water 4d wash+)

Results in EPODOC 12

[SS 6] ..li



1/12 © EPODOC / EPO

PN - [WO2016098025](#) A1 20160623

PR - AR2014P104698 20141217

AP - WO2015IB59692 20151216

DT - *; Rep

CT - |EP| ISR (A1)

[WO8707632](#) A1 19871217 [XDI] (BIO ENERGY TECHNOLOGY LTD [GB])

[XD] 1,2,4,15,17

* example 1; claim 1 *

[I] 5-7,11,12,14,16,18;

[US2006096159](#) A1 20060511 [A] (BONSCH RUDOLF [DE], et al)

[A] 1-15

* the whole document *;

[WO2011033346](#) A1 20110324 [A] (COUNCIL SCIENT IND RES [IN], et al)

[A] 1-15

* the whole document *

CCI - [C07C67/58](#) ; [C10L1/026](#)

CLC - [C07C67/58](#), [C07C69/52](#) , INV

CCA - [Y02E50/13](#)

PA - INIS BIOTECH LLC [US]; CONSEJO NAC INVEST CIENT TEC [AR]; UNIV NAC DEL LITORAL [AR]

TI - PROCESS FOR THE PURIFICATION OF **BIODIESEL**

AB - The invention relates to a process for the purification of crude **biodiesel** obtained by reacting triacylglycerol with an alcohol in the presence of a catalyst, comprising a series of **water-washing** operations in order to reduce the total amount of contaminants and, in particular, sterol glucosides and monoacylglycerides. The invention is characterised by the addition of water to the system before the **glycerol** phase is separated from the **biodiesel** phase.

2/12 © EPODOC / EPO

PN - [TW201432045](#) A 20140816

PNFP - TWI498419B B 20150901

PR - US201313759644 20130205

AP - TW20130120027 20130606

DT - I

CCI - [C07C67/03](#) ; [C11C3/10](#)

CLC - [C07C67/03](#), [C07C69/52](#) , INV

CCA - [Y02E50/13](#)

PA - (A B)
CPC CORP TAIWAN [TW]

TI - (A B)
Process for producing **biodiesel**
through transesterification

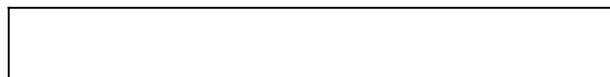
AB - (A)
Non-basic and non-acidic
homogeneous catalysts organo-
metallic compound of the
formula: M(OCH₃)_x wherein M is
B, Na, Mg, K, Ca, Sc, Ti, V, Cr, Mn,
Fe, Co, Ni, Cu, Zn, Ga, Ge, Al, Sn,
Sb, Mo, Ag, or Cd and x is an
integer from 2, 3 or 4 can



catalyze transesterification of oils and fats having high free fatty acid content and with an acid number from 0.5 to 20, into **biodiesel**. B(OCH₃)₃ and Ge(OCH₃)₄, having low boiling points, are easily recovered from the **biodiesel** and **glycerol** phases and recycled for reuse. Continuous **biodiesel** production with the novel homogenous catalysts is achieved without the complicated and troublesome steps attendant with conventional processes using base or acid homogeneous catalyst. The high purity **biodiesel** is produced without acid-base neutralization, **water wash**, filtration, and solid disposal steps for removing the spent catalyst from the product streams associated with prior techniques.

3/12 © EPODOC / EPO

PN - [WO2014123711](#) A1 20140814
 PR - US201313759644 20130205
 AP - WO2014US13166 20140127
 DT - **
 CT - |EP| ISR (A1)
[DE102007026654](#) A1 20100107
 [XI] (HOELTER HEINRICH [DE])
 [X] 1-10
 * paragraphs [0001] , [0005] -
 [0010] - [0029]; claims
 13,21,35,36 *
 [I] 11-22;
[WO2009107739](#) A1 20090903
 [X] (UBE MATERIAL IND LTD [JP],
 et al)
 [X] 1-22
 * paragraph [0021] -
 paragraph [0026]; claim - *;
[US2011035993](#) A1 20110217
 [XA] (LOESCHER MITCHELL E [US])
 [X] 1-10



* paragraph [0036] -
 paragraph [0043] *
 [A] 11-22;
[US2005080280](#) A1 20050414
 [X] (YOO JEONG-WOO [KR])
 [X] 1-22
 * paragraphs [0013] , [0030] -
 [0040]; example 4 *;
[US2012066965](#) A1 20120322
 [XA] (RUWWE JOHANNES [DE], et
 al)
 [X] 1-10
 * paragraphs [0003] - [0005] -
 [0031] , [0035] , [0036];
 examples 2-20; claim - *
 [A] 11-22;
[US2010130763](#) A1 20100527
 [A] (GAO YONG [US])
 [A] 1-22
 * paragraphs [0002] , [0003] ,
 [0015] - [0022] *;
[US8624073](#) B1 20140107
 [XP] (YANG SHIH-CHIEH [TW], et
 al)
 [XP] 1-22
 * the whole document *

CCI	- C07C67/03 ; C11C3/10
CLC	- C07C67/03 , C07C69/52 , INV
CCA	- Y02E50/13
PA	- CPC CORP TAIWAN; YANG SHIH-CHIEH; CHANG JEN-RAY; LEE MAW-TIEN; LIN TZONG-BIN; LEE FU-MING [US]; HONG CHENG-TSUNG; LEEJENG-CHENG
TI	- HOMOGENEOUS CATALYSTS FOR BIODIESEL PRODUCTION
AB	- Non-basic and non-acidic homogeneous catalysts organometallic compound of the formula: $M(OCH_3)_x$ wherein M is B, Na, Mg, K, Ca, Sc, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, Ga, Ge, Al, Sn, Sb, Mo, Ag, and Cd and x is an integer from 2, 3 or 4 can catalyze transesterification of oils and fats having high free fatty acid content and with an acid number from 0.5 to 20,

into **biodiesel**. B(QCt-3)₃ and GeB (QCt-3)₄, having low boiling points, are easily recovered from the **biodiesel** and **glycerol** phases and recycled for reuse. Continuous **biodiesel** production with the novel homogenous catalysts is achieved without the complicated and troublesome steps attendant with conventional processes using base or acid homogeneous catalyst. The high purity biodiesel is produced without acid-base neutralization, **water wash**, filtration, and solid disposal steps for removing the spent catalyst from the product streams associated with prior techniques.

4/12 © EPODOC / EPO

PN - [US8624073](#) B1 20140107

PR - US201313759644 20130205

AP - US201313759644 20130205

DT - *; Rep

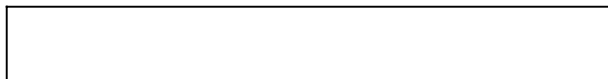
CT - || STSE (B1)
[US7906665](#) B2 20110315 [] (LIN VICTOR SHANG-YI [US], et al);
[US8063232](#) B2 20111122 [] (HAGADORN JOHN R [US], et al);
[US2007282118](#) A1 20071206 [] (GUPTA ASHOK K [IN], et al);
[US2009126262](#) A1 20090521 [] (ASTHANA NAVINCHANDRAS [US], et al);
[US2011035993](#) A1 20110217 [] (LOESCHER MITCHELL E [US]);
[US2011185625](#) A1 20110804 [] (SINGH INDER PAL [CA], et al)

CCI - [C07C67/03](#) ; [C11C3/10](#)

CLC - [C07C67/03](#) , [C07C69/52](#) , INV

CCA - [Y02E50/13](#)

PA - YANG SHIH-CHIEH [TW]; CHANG JEN-RAY [TW]; LEE MAW-TIEN [TW]; LIN TZONG-BIN [TW]; LEE FU-MING [US]; HONG CHENG-TSUNG



[TW]; LEE JENG-CHENG [TW]; CPC
CORP TAIWAN [TW]

- TI - Homogeneous catalysts
for **biodiesel** production
- AB - Non-basic and non-acidic
homogeneous catalysts organo-
metallic compound of the
formula: $M(OCH_3)_x$ wherein M is
B, Na, Mg, K, Ca, Sc, Ti, V, Cr, Mn,
Fe, Co, Ni, Cu, Zn, Ga, Ge, Al, Sn,
Sb, Mo, Ag, and Cd and x is an
integer from 2, 3 or 4 can
catalyze transesterification of
oils and fats having high free
fatty acid content and with an
acid number from 0.5 to 20,
into **biodiesel**. $B(OCH_3)_3$ and Ge
 $(OCH_3)_4$, having low boiling
points, are easily recovered from
the **biodiesel** and **glycerol** phases
and recycled for reuse.
Continuous **biodiesel** production
with the novel homogenous
catalysts is achieved without the
complicated and troublesome
steps attendant with
conventional processes using
base or acid homogeneous
catalyst. The high
purity **biodiesel** is produced
without acid-base
neutralization, **water wash**,
filtration, and solid disposal
steps for removing the spent
catalyst from the product
streams associated with prior
techniques.

5/12 © EPODOC / EPO

- PN - [US2011166378](#) A1 20110707
- PNFP - US8269028 B2 20120918
- PR - US201113032980 20110223; US20090409250 20090323; US20040547574
20040317; WO2004US08294 20040317; US20030456097P 20030320
- AP - US201113032980 20110223
- DT - **
- CT - || R141 (A1)
[US6015440](#) A [];

	US5399731 A [];
	US7507846 B2 [];
	US7906082 B2 [];
	US5514820 A [];
	US5424467 A [];
	US6262285 B1 [];
	US6440057 B1 [];
	US3474131 A [];
	US5972057 A [];
	US6127560 A [];
	US5468887 A [];
	US3927982 A []
CCI	- C07C67/03 ; C07C67/08 ; C10L1/026 ; C11C1/08 ; C11C3/003 ; C11C3/10
CLC	- C07C67/03 , C07C69/24 , INV
	- C07C67/03 , C07C69/52 , INV
	- C07C67/08 , C07C69/24 , INV
	- C07C67/08 , C07C69/52 , INV
CCA	- Y02E50/13 ; Y02P30/20 ; Y02P20/582
PA	- (B2) PELLEY MICHAEL F [US]
TI	- (A1 B2) METHOD AND APPARATUS FOR REFINING BIODIESEL
AB	- (A1 B2) Method and apparatus for producing biodiesel fuel, i.e., alkyl ester, from vegetable and/or animal oil. A transesterification catalyst is prepared in a base catalyst tank by spraying alkyl alcohol under pressure through jets at metal hydroxide pellets until the pellets have fully reacted with the alcohol. The oil is heated and transesterified in the presence of alkyl alcohol and the transesterification catalyst in a closed, recirculating transesterification flow system under slight cavitation to yield product alkyl ester and product glycerol . Cavitation is achieved by permitting air to enter the transesterification flow system through an adjustable air inlet valve. When permitted to stand, product alkyl ester forms an upper layer that is decanted and subjected to purification steps, to remove particulates and alkyl alcohol from the product alkyl ester, and a lower layer of product glycerol is drained away. Purification of the product alkyl ester preferably includes subjecting the product alkyl ester to an overhead water mist in a wash tank with simultaneous infusion of a stream of air bubbles. Alcohol vapor is reclaimed as liquid alcohol within an alcohol condenser and stored for reuse. If the oil contains free fatty acids, prior to transesterification, the oil is heated and the free fatty acids are esterified in the presence of an esterification catalyst and alkyl alcohol. For safety, baffles and explosion damper/flame arrestors are provided in locations where flammable vapors pose a risk.

PN - [JP2010037422](#) A 20100218

PR - JP20080201347 20080804

AP - JP20080201347 20080804

DT - I

CCI - [B01J23/06](#) ; [B01J37/0201](#) ;
[C07C67/03](#) ; [C10L1/026](#) ;
[C11C3/003](#)

CLC - [C07C67/03](#) , [C07C69/24](#) , INV
- [C07C67/03](#) , [C07C69/52](#) , INV

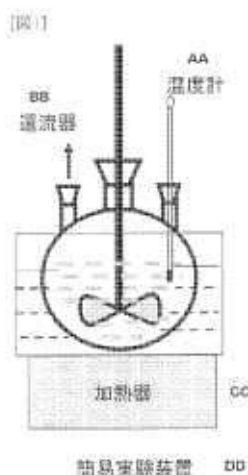
CCA - [Y02E50/13](#) ; [C10G2300/1011](#) ;
[Y02P30/20](#)

FT - 4G169/AA03; 4G169/AA08;
4G169/BC01A; 4G169/BC01B;
4G169/BC35A; 4G169/BC35B;
4G169/CB01; 4G169/EA01Y;
4G169/FB14; 4H006/AA02;
4H006/AC41; 4H006/AC48;
4H006/BA02; 4H006/BA07;
4H006/BA30; 4H006/BA55;
4H006/BA81; 4H006/BC31;
4H006/BC36; 4H013/BA02;
4H039/CA60; 4H039/CA66;
4H039/CD30; 4H059/AA02;
4H059/BA12; 4H059/BA13;
4H059/BA30; 4H059/BC13;
4H059/CA36; 4H059/CA94;
4H059/EA17

PA - SUD CHEMIE CATALYSTS INC

TI - METHOD FOR MANUFACTURING
FATTY ACID ESTER AND **GLYCERIN**,
AND **BIODIESEL** CONTAINING
FATTY ACID ESTER AS WELL AS
SOLID CATALYST TO BE USED
THEREFOR

AB - PROBLEM TO BE SOLVED: To
provide a method for
manufacturing a fatty acid ester
and **glycerol** by a reaction of oils
and fats with an alcohol, the
method being capable of
manufacturing them in the
productively relatively
advantageous system of low
temperatures and normal
pressures and being capable of
omitting the processes of the
catalyst separation, the product



AA THERMOMETER
BB REFLUXER
CC HEATER
DD SIMPLIFIED EXPERIMENTAL SYSTEM

neutralization and the **water washing**, which are drawbacks of a homogeneous phase alkali catalyst, and the processes of the product neutralization and washing, as well as to provide a **biodiesel** containing the fatty acid ester manufactured by the above manufacturing method and a solid catalyst which is usable for the above manufacturing method and has a high activity and no metal elution.

- SOLUTION: The method for manufacturing a fatty acid ester and **glycerol** from oils and fats and an alcohol, includes the reaction under the mild condition of normal pressures and temperatures of 50-70[deg.] C by means of at least one solid catalyst containing an activated zinc oxide and an alkali supported on the activated zinc oxide.
- COPYRIGHT: (C)2010,JPO&INPIT

7/12 © EPODOC / EPO

PN - [US2010015020](#) A1 20100121

PNFP - US7906082 B2 20110315

PR - US20090409250 20090323; US20040547574 20040317; WO2004US08294 20040317; US20030456097P 20030320

AP - US20090409250 20090323

DT - **

CT - || R141 (A1)
[US6015440](#) A [];
[US5399731](#) A [];
[US7507846](#) B2 [];
[US5514820](#) A [];
[US5424467](#) A [];
[US6262285](#) B1 [];
[US6440057](#) B1 [];
[US3474131](#) A [];
[US5972057](#) A [];
[US6127560](#) A [];
[US5468887](#) A [];

	US3927982 A []
CCI	- C07C67/03 ; C07C67/08 ; C10L1/026 ; C11C1/08 ; C11C3/003 ; C11C3/10
CLC	- C07C67/03 , C07C69/24 , INV - C07C67/03 , C07C69/52 , INV - C07C67/08 , C07C69/24 , INV - C07C67/08 , C07C69/52 , INV
CCA	- Y02E50/13 ; Y02P30/20 ; Y02P20/582
TI	- (A1 B2) METHOD AND APPARATUS FOR REFINING BIODIESEL
AB	- (A1 B2) Method and apparatus for producing biodiesel fuel, i.e., alkyl ester, from vegetable and/or animal oil. A transesterification catalyst is prepared in a base catalyst tank by spraying alkyl alcohol under pressure through jets at metal hydroxide pellets until the pellets have fully reacted with the alcohol. The oil is heated and transesterified in the presence of alkyl alcohol and the transesterification catalyst in a closed, recirculating transesterification flow system under slight cavitation to yield product alkyl ester and product glycerol . Cavitation is achieved by permitting air to enter the transesterification flow system through an adjustable air inlet valve. When permitted to stand, product alkyl ester forms an upper layer that is decanted and subjected to purification steps, to remove particulates and alkyl alcohol from the product alkyl ester, and a lower layer of product glycerol is drained away. Purification of the product alkyl ester preferably includes subjecting the product alkyl ester to an overhead water mist in a wash tank with simultaneous infusion of a stream of air bubbles. Alcohol vapor is reclaimed as liquid alcohol within an alcohol condenser and stored for reuse. If the oil contains free fatty acids, prior to transesterification, the oil is heated and the free fatty acids are esterified in the presence of an esterification catalyst and alkyl alcohol. For safety, baffles and explosion damper/flame arrestors are provided in locations where flammable vapors pose a risk.

8/12 © EPODOC / EPO

PN	- WO2004085579 A2 20041007
PNFP	- WO2004085579 A3 20041229
PR	- US20030456097P 20030320
AP	- WO2004US08294 20040317
DT	- *; Rep
CT	- [US] ISR (A3) US3927982 A 19751223 [A] (CHAPMAN RODNEY M, et al); US5514820 A 19960507 [A] (ASSMANN GEORG [DE], et al)
CCI	- C07C67/03 ; C07C67/08 ; C10L1/026 ; C11C1/08 ; C11C3/003 ; C11C3/10
CLC	- C07C67/03 , C07C69/24 , INV - C07C67/03 , C07C69/52 , INV - C07C67/08 , C07C69/24 , INV - C07C67/08 , C07C69/52 , INV
CCA	- Y02E50/13 ; Y02P30/20 ; Y02P20/582
PA	- (A2 A3)

PELLEY MICHAEL F [US]

- TI - (A2 A3)
METHOD AND APPARATUS FOR REFINING **BIODIESEL**
- AB - (A2)
Method and apparatus for producing **biodiesel** fuel, i.e., alkyl ester, from vegetable and/or animal oil. A transesterification catalyst is prepared in a base catalyst tank by spraying alkyl alcohol under pressure through jets at metal hydroxide pellets until the pellets have fully reacted with the alcohol. The oil is heated and transesterified in the presence of alkyl alcohol and the transesterification catalyst in a closed, recirculating transesterification flow system under slight cavitation to yield product alkyl ester and product **glycerol**. Cavitation is achieved by permitting air to enter the transesterification flow system through an adjustable air inlet valve. When permitted to stand, product alkyl ester forms an upper layer that is decanted and subjected to purification steps, to remove particulates and alkyl alcohol from the product alkyl ester, and a lower layer of product **glycerol** is drained away. Purification of the product alkyl ester preferably includes subjecting the product alkyl ester to an overhead **water** mist in a **wash** tank with simultaneous infusion of a stream of air bubbles. Alcohol vapor is reclaimed as liquid alcohol within an alcohol condenser and stored for reuse. If the oil contains free fatty acids, prior to transesterification, the oil is heated and the free fatty acids are esterified in the presence of an esterification catalyst and alkyl alcohol. For safety, baffles and explosion damper/flame arrestors are provided in locations where flammable vapors pose a risk.

9/12 © EPODOC / EPO

- PN - [US2007099278](#) A1 20070503
- PR - US20050732264P 20051101; US20060590262 20061031
- AP - US20060590262 20061031
- DT - *
- CCI - [C12P7/06](#) ; [C07C51/46](#)
- CLC - [C07C51/46](#) , [C07C57/12](#) , INV
- CCA - [Y02E50/13](#) ; [Y02E50/17](#)
- TI - Production of **biodiesel** from combination of corn (maize) and other feed stocks
- AB - A method and system to produce **biodiesel** from a combination of corn (maize) and other agro feedstock may be simarouba, mahua, rice, pongamia etc. Germ is separated (either by wet process or dry process) from corn, crude corn oil extracted from germ and corn starch milk/slurry is heated and cooked in jet cooker to about 105 degree Celsius, enzymes added to convert starch into fermentable sugars in liquification and saccharification process and rapidly cooled down to about 30 degree Celsius. Simarouba fruits syrup, mahua syrup is mixed with corn starch milk (after saccharification). When yeast is added the fermentation takes place for about 72 hours. Thereafter the fermented wash is distilled to produce ethanol. Water consumed in dry process is very less compared to traditional wet process system. Corn oil and mixture of other oils is fed into transesterification (reaction) vessels where ethanol with catalyst, usually sodium hydroxide is added and reaction takes place for about a period of 2-8 hours. Crude **biodiesel** and crude **glycerin** as by-products is produced. Excess ethanol removed by distillation process. Crude **biodiesel washed** with

warm **water** to remove residual soaps or unused catalyst, dried and **biodiesel** stored for commercial use. Oil extracted from spent bleach mud (used sodium bentonite), a waste product of edible oil refineries may also be utilized for economical production of **biodiesel** in combination of corn oil and ethanol.

10/12 © EPODOC / EPO

PN - [US2006224005](#) A1 20061005

PNFP - US7507846 B2 20090324

PR - US20040547574 20040317; US20030456097P 20030320; WO2004US08294 20040317

AP - US20040547574 20040317

DT - **

CT - || STSE (B2)

[US3474131](#) A 19691021 [] (SCHMERLING LOUIS)

[US6440057](#) B1 20020827 [] (ERGUEN NURHAN [AT], et al)

- || R141 (A1)

[US5399731](#) A [];

[US5514820](#) A [];

[US5424467](#) A [];

[US6262285](#) B1 [];

[US6440057](#) B1 [];

[US3474131](#) A [];

[US5972057](#) A [];

[US6127560](#) A [];

[US5468887](#) A [];

[US3927982](#) A []

CTNP - || STSE (B2)

[] Knothe, G. et al., Biodiesel: The use of Vegetable Oils and Their Derivatives as Alternative Diesel Fuels, 1997, American Chemical Society, Chapter 10, pp. 172-207

[] Konen, et al. Esterification of Unsaturated Fatty Acids, 1945, Oil & Soap, vol. 22, pp. 57-60

CCI - [C07C67/03](#) ; [C07C67/08](#) ; [C10L1/026](#) ; [C11C1/08](#) ; [C11C3/003](#) ; [C11C3/10](#)

CLC - [C07C67/03](#) , [C07C69/24](#) , INV

- [C07C67/03](#) , [C07C69/52](#) , INV

- [C07C67/08](#) , [C07C69/24](#) , INV

- [C07C67/08](#) , [C07C69/52](#) , INV

CCA - [Y02E50/13](#) ; [Y02P30/20](#) ; [Y02P20/582](#)

TI - (A1 B2)

Method and apparatus for refining **biodiesel**

AB - (A1 B2)

Method and apparatus for producing **biodiesel** fuel, i.e., alkyl ester, from vegetable and/or animal oil. A transesterification catalyst is prepared in a base catalyst tank by spraying alkyl alcohol under pressure through jets at metal hydroxide pellets until the pellets have fully reacted with the alcohol. The oil is heated and transesterified in the presence of alkyl alcohol and the transesterification catalyst in a closed, recirculating transesterification flow system under slight cavitation to yield product alkyl ester and

product **glycerol**. Cavitation is achieved by permitting air to enter the transesterification flow system through an adjustable air inlet valve. When permitted to stand, product alkyl ester forms an upper layer that is decanted and subjected to purification steps, to remove particulates and alkyl alcohol from the product alkyl ester, and a lower layer of product **glycerol** is drained away. Purification of the product alkyl ester preferably includes subjecting the product alkyl ester to an overhead **water** mist in a **wash** tank with simultaneous infusion of a stream of air bubbles. Alcohol vapor is reclaimed as liquid alcohol within an alcohol condenser and stored for reuse. If the oil contains free fatty acids, prior to transesterification, the oil is heated and the free fatty acids are esterified in the presence of an esterification catalyst and alkyl alcohol. For safety, baffles and explosion damper/flame arrestors are provided in locations where flammable vapors pose a risk.

11/12 © EPODOC / EPO

- PN - [US7126032](#) B1 20061024
- PR - US20060387654 20060323
- AP - US20060387654 20060323
- DT - *; Rep
- CCI - [C07C29/80](#) ; [C07C29/88](#)
- CLC - [C07C29/80](#) , [C07C31/225](#) , INV
- [C07C29/88](#) , [C07C31/225](#) , INV
- PA - SUNOCO INC R&M [US]
- TI - Purification of **glycerin**
- AB - A process for purifying **glycerin** recovered as a byproduct of **biodiesel** production comprises heating a **glycerin** effluent stream containing a low molecular weight alcohol, water and fatty acid esters of the low molecular weight alcohol to cause transesterification of the fatty acid esters to glycerides and additional low molecular weight alcohol. The reaction mixture is sparged with nitrogen to help remove water and low molecular weight alcohol, which drives the transesterification reaction towards glyceride formation. A **wash water** stream may also be added to the recovered **glycerin** stream from **biodiesel** production. Either before or following the transesterification reaction, an oil layer can be separated from the recovered **glycerin** stream by reducing the pH of the stream to below 7. Following separation of the oil layer and transesterification the **glycerin** stream is flash distilled to separate **glycerin** from water, salts, and glycerides.

12/12 © EPODOC / EPO

- PN - [DE10043644](#) A1 20020328
- PR - DE2000143644 20000905
- AP - DE2000143644 20000905
- DT - *
- CT - [DE3932514](#) A1 []; [DE3020612](#) A1 [];
[AT397966B](#) B []; [AT387399B](#) B []
- CTNP - [] JAOCS, Vol.61, no.10, 1638-1643
- CCI - [C11C3/003](#) ; [C07C29/1285](#) ; [C07C67/03](#) ; [C10L1/026](#)

CLC	- C07C29/1285 , C07C31/225 , INV - C07C67/03 , C07C69/52 , INV
CCA	- Y02E50/13
PA	- GOES GES FUER FORSCHUNG UND TE [DE]
TI	- Production of biomethanol and bioethanol diesel comprises continuous re-esterification, removing glycerin after dosing the catalyst-alkanol mixture with removal of methanol in the biodiesel , and washing with phosphoric acid and water
AB	- Biomethanol and bioethanol diesel are produced by continuous re-esterification in a multiple stage reactor cascade at Reynolds numbers of 1300-1500 and minimal dwell times; removing glycerin after dosing the catalyst-alkanol mixture with removal of methanol in the biodiesel in the last stage; and washing with phosphoric acid and water to give a final product containing 3 ppm potassium. Production of biomethanol and bioethanol diesel comprises continuous re-esterification in a multiple stage reactor cascade at Reynolds numbers of 1300-1500 and minimal dwell times; removing glycerin after dosing the catalyst-alkanol mixture with removal of methanol in the biodiesel in the last stage; and washing with phosphoric acid and water to give a final product containing 3 ppm potassium. The alkanol such as ethanol or methanol used in the re-esterification is pre-dried before the re-esterification e.g. using molecular sieves or by membrane separation to give a water content of less than 0.3%. The catalyst used is in the form of K- or Na-metholate and etholate after converting the starting compounds. The product volume can be adjusted in the region of 0.2 to more than t/d.

[SS 6] biodiesel and (process or method)

Results in EPODOC 4.969

[SS 7] * and (water 4d wash+)

Results in EPODOC 151

[SS 8] * and (glycerol or glycerin+)

Results in EPODOC 59

[SS 9] * and PD<20141217

Results in EPODOC 47

[SS 10] ..v

[EPODOC: SS 10] 9 and purification

Results in EPODOC 10

[SS 11] ..li



1/10 © EPODOC / EPO

PN - [TW201239079](#) A 20121001
PR - TW20110111178 20110331
AP - TW20110111178 20110331
DT - I
CCA - [Y02E50/13](#) ; [Y02P30/20](#)
PA - RESI CORP [TW]; CHANG RON-HSIN [TW]
TI - High temperature multistage continuous recycle **process** for the production of **biodiesel**
AB - This invention is a high temperature continuous recycle **process** for the production of **biodiesel**. Accordingly, one aspect of the present invention provides an integrated continuous **process** with acid catalyst and base catalyst for the esterification and transesterification of triglycerides and low carbon alkyl alcohol, respectively, in a series of oscillatory continuous flow reactors with recycle, operating at a temperature slightly lower than boiling point of the said low carbon alkyl alcohol. The reactions will be carried out in a series of oscillatory continuous flow reactors with recycle to produce **biodiesel** and **glycerin**. **Glycerin** and alcohol mixtures separated, by using mechanical separators, from the product streams of the first and the second reactors will be mixed, neutralized, and purified, by a **glycerin purification process**, to produce **glycerin** product. The low carbon alkyl alcohol and **glycerin** mixture produced from the third reactor will be pumped to the second reactor for further reaction. The **biodiesel** produced from the third reactor will be **washed**, by using pure **water**, and be purified by a **biodiesel purification process** to produce **biodiesel** product. The solution of low carbon alkyl alcohol and catalyst, generated from the **biodiesel purification process** and **glycerin purification process**, will be concentrated and recycled for **process** utilization by using a low carbon alkyl alcohol **purification process**.

2/10 © EPODOC / EPO

PN - [TW201226550](#) A 20120701
PNFP - TWI422674B B 20140111
PR - TW20100144548 20101217
AP - TW20100144548 20101217
DT - I
CCA - [Y02E50/13](#) ; [Y02P30/20](#)
PA - (A B)
NAT TAICHUNG UNIVERSITY OF EDUCATION [TW]
TI - (A B)
Method of calcium carbide residue as a low-cost solid catalyst for **biodiesel** production
AB - (A)
The **method** of calcium carbide residue as a low-cost solid catalyst for **biodiesel** production of the present invention includes: Step1: Preparation of the solid catalyst: The product of the reaction is obtained from hydrolyzing the calcium carbide. After drying the product, we will get the solid calcium oxide. Step2: Transesterification: Mix triacylglycerol with alcohol. Boil the said mixture (some vaporizing mixture return back from the cool down system). And then add the said solid calcium oxide as a

catalyst into a reaction container with said mixture, whereby getting fatty acid methyl ester and **glycerol**. Step3: Separation and **purification**: The mixtures comprise fatty acid methyl ester, **glycerol** and solid calcium oxide. Standing the reaction container for a period of time. The mixtures will separate into three layers. Suck out these layers in order. The fatty acid methyl ester is used for **biodiesel** which is a kind of fuel. Boiling and sucking out the remaining methanol and water of the fatty acid methyl ester, after **washing** it by pure **water** several times. Whereby the **method** can enhance the rate of the transesterification reaction.

3/10 © EPODOC / EPO

- PN - [TW201226549](#) A 20120701
- PNFP - TWI422673B B 20140111
- PR - TW20100144546 20101217
- AP - TW20100144546 20101217
- DT - I
- CCA - [Y02E50/13](#) ; [Y02P30/20](#)
- PA - (A B)
NAT TAICHUNG UNIVERSITY OF EDUCATION [TW]
- TI - (A)
Method of waste concrete as a low-cost solid catalyst for **biodiesel** production
- (B)
Method of waste concrete as a low-cost solid catalyst for **biodiesel** production
- AB - (A)
The **method** of waste concrete as a low-cost solid catalyst for **biodiesel** production of the present invention includes: Step1: Preparation of the solid catalyst: Grind the waste concrete into powder. The catalyst is obtained from burning the powder under the condition of a calcination temperature. Step2: Transesterification: Mix triacylglycerol with alcohol. Boil the said mixture (some vaporizing mixture return back from the cool down system). And then add the said solid calcium oxide as a catalyst into a reaction container with said mixture, whereby getting fatty acid methyl ester and **glycerol**. Step3: Separation and **purification**: The mixtures comprise fatty acid methyl ester, **glycerol** and solid calcium oxide. Standing the reaction container for a period of time. The mixtures will separate into three layers. Suck out these layers in order. The fatty acid methyl ester is used for **biodiesel** which is a kind of fuel. Boiling and sucking out the remaining methanol and water of the fatty acid methyl ester, after **washing** it by pure **water** several times. Whereby the **method** can enhance the rate of the transesterification reaction.

4/10 © EPODOC / EPO

- PN - [US2011166378](#) A1 20110707
- PNFP - US8269028 B2 20120918
- PR - US201113032980 20110223; US20090409250 20090323; US20040547574 20040317; WO2004US08294 20040317; US20030456097P 20030320
- AP - US201113032980 20110223
- DT - **

CT	- R141 (A1) US6015440 A []; US5399731 A []; US7507846 B2 []; US7906082 B2 []; US5514820 A []; US5424467 A []; US6262285 B1 []; US6440057 B1 []; US3474131 A []; US5972057 A []; US6127560 A []; US5468887 A []; US3927982 A []
CCI	- C07C67/03 ; C07C67/08 ; C10L1/026 ; C11C1/08 ; C11C3/003 ; C11C3/10
CLC	- C07C67/03 , C07C69/24 , INV - C07C67/03 , C07C69/52 , INV - C07C67/08 , C07C69/24 , INV - C07C67/08 , C07C69/52 , INV
CCA	- Y02E50/13 ; Y02P30/20 ; Y02P20/582
PA	- (B2) - PELLY MICHAEL F [US]
TI	- (A1 B2) METHOD AND APPARATUS FOR REFINING BIODIESEL
AB	- (A1 B2) Method and apparatus for producing biodiesel fuel, i.e., alkyl ester, from vegetable and/or animal oil. A transesterification catalyst is prepared in a base catalyst tank by spraying alkyl alcohol under pressure through jets at metal hydroxide pellets until the pellets have fully reacted with the alcohol. The oil is heated and transesterified in the presence of alkyl alcohol and the transesterification catalyst in a closed, recirculating transesterification flow system under slight cavitation to yield product alkyl ester and product glycerol. Cavitation is achieved by permitting air to enter the transesterification flow system through an adjustable air inlet valve. When permitted to stand, product alkyl ester forms an upper layer that is decanted and subjected to purification steps, to remove particulates and alkyl alcohol from the product alkyl ester, and a lower layer of product glycerol is drained away. Purification of the product alkyl ester preferably includes subjecting the product alkyl ester to an overhead water mist in a wash tank with simultaneous infusion of a stream of air bubbles. Alcohol vapor is reclaimed as liquid alcohol within an alcohol condenser and stored for reuse. If the oil contains free fatty acids, prior to transesterification, the oil is heated and the free fatty acids are esterified in the presence of an esterification catalyst and alkyl alcohol. For safety, baffles and explosion damper/flame arrestors are provided in locations where flammable vapors pose a risk.

PR	- US20090409250 20090323; US20040547574 20040317; WO2004US08294 20040317; US20030456097P 20030320
AP	- US20090409250 20090323
DT	- **
CT	- R141 (A1) US6015440 A []; US5399731 A []; US7507846 B2 []; US5514820 A []; US5424467 A []; US6262285 B1 []; US6440057 B1 []; US3474131 A []; US5972057 A []; US6127560 A []; US5468887 A []; US3927982 A []
CCI	- C07C67/03 ; C07C67/08 ; C10L1/026 ; C11C1/08 ; C11C3/003 ; C11C3/10
CLC	- C07C67/03 , C07C69/24 , INV - C07C67/03 , C07C69/52 , INV - C07C67/08 , C07C69/24 , INV - C07C67/08 , C07C69/52 , INV
CCA	- Y02E50/13 ; Y02P30/20 ; Y02P20/582
TI	- (A1 B2) METHOD AND APPARATUS FOR REFINING BIODIESEL
AB	- (A1 B2) Method and apparatus for producing biodiesel fuel, i.e., alkyl ester, from vegetable and/or animal oil. A transesterification catalyst is prepared in a base catalyst tank by spraying alkyl alcohol under pressure through jets at metal hydroxide pellets until the pellets have fully reacted with the alcohol. The oil is heated and transesterified in the presence of alkyl alcohol and the transesterification catalyst in a closed, recirculating transesterification flow system under slight cavitation to yield product alkyl ester and product glycerol . Cavitation is achieved by permitting air to enter the transesterification flow system through an adjustable air inlet valve. When permitted to stand, product alkyl ester forms an upper layer that is decanted and subjected to purification steps, to remove particulates and alkyl alcohol from the product alkyl ester, and a lower layer of product glycerol is drained away. Purification of the product alkyl ester preferably includes subjecting the product alkyl ester to an overhead water mist in a wash tank with simultaneous infusion of a stream of air bubbles. Alcohol vapor is reclaimed as liquid alcohol within an alcohol condenser and stored for reuse. If the oil contains free fatty acids, prior to transesterification, the oil is heated and the free fatty acids are esterified in the presence of an esterification catalyst and alkyl alcohol. For safety, baffles and explosion damper/flame arrestors are provided in locations where flammable vapors pose a risk.

PN - [US2009099380](#) A1 20090416

PNFP - US8022236 B2 20110920

PR - US20080287779
20081014; US20070998842P
20071012

AP - US20080287779 20081014

DT - *; Rep

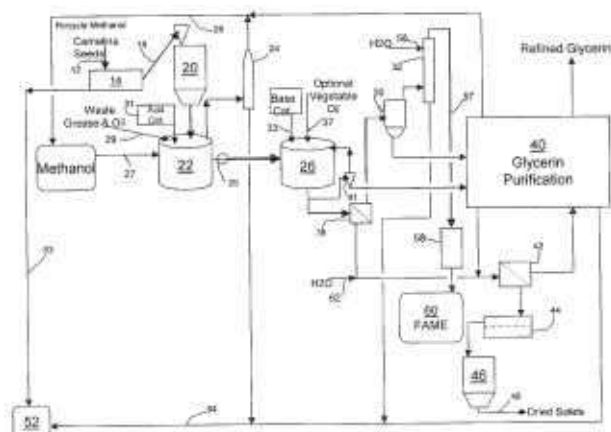
CT - || R141 (A1)
[US2494366](#) A [];
[US5434279](#) A [];
[US2383601](#) A [];
[US4164506](#) A [];
[US4695411](#) A [];
[US7109363](#) B2 [];
[US7112229](#) B2 [];
[US4698186](#) A [];
[US2007261294](#) A1 [];
[US2007277432](#) A1 []

CCI - [C11C3/003](#)

CCA - [Y02E50/13](#) ; [C10G2300/1011](#) ;
[Y02P30/20](#)

TI - (A1 B2)
Fatty acid alkyl ester production
from oleaginous seeds

AB - (A1 B2)
A **process** is described for
producing fatty acid alkyl esters
for both diesel fuel and non-fuel
uses. The feed material includes
whole oleaginous seeds slurried
in a liquid triglyceride oil
containing at least two weight
percent free fatty acid, wherein
oil from inside the seeds is first
extracted with concurrent
esterification of free fatty acids
from all sources in an acidic
environment. Following
sufficient free fatty acid
reaction, the intermediate
product is subjected to base-
catalyzed concurrent extraction
and transesterification.
Decanting of the
byproduct **glycerin** is followed
by **water washing**. Subsequently,
the fatty acid ester product is



concurrently purified and fractionated into a **biodiesel** fuel stream and a non-fuel fraction, each of which undergoes post treatment as needed. The **process** is optionally integrated with **glycerin purification** and/or methanol recovery.

7/10 © EPODOC / EPO

PN - [RO121991](#) B1 20081030
 PR - RO20060000773 20061011
 AP - RO20060000773 20061011
 DT - I
 CCA - [Y02E50/13](#)
 PA - ARTEGO S A [RO]
 TI - **PROCESS** AND INSTALLATION FOR PRODUCING **BIODIESEL**FUEL
 AB - The invention relates to a **process** and an installation for producing **biodiesel** fuel. According to the invention, the **process** consists in heating the raw oils up to the temperature of 38...42A C, admixing an alcoholic catalyst solution, in a ratio of 18...22% as compared with the oil, followed by the trans-esterification reaction at the temperature of 45...50A C, gravimetric separation of raw **glycerol**, correction of the excess alcohol and technical **glycerol**, **purification** of **biodiesel** fuel by serially treating the same with an aqueous solution of phosphoric acid, aqueous solution of ammonia and a final **washing** with twice demineralized **water**, admixture of N-isopropyl-N-phenyl-p-phenylene diamine oxidation preventive agent into the liquid mass and subjecting the final product obtained thereby to cold filtration, at temperatures below 20...25A C.

8/10 © EPODOC / EPO

PN - [WO2004085579](#) A2 20041007
 PNFP - WO2004085579 A3 20041229
 PR - US20030456097P 20030320
 AP - WO2004US08294 20040317
 DT - *; Rep
 CT - |US| ISR (A3)
[US3927982](#) A 19751223 [A] (CHAPMAN RODNEY M, et al);
[US5514820](#) A 19960507 [A] (ASSMANN GEORG [DE], et al)
 CCI - [C07C67/03](#) ; [C07C67/08](#) ; [C10L1/026](#) ; [C11C1/08](#) ; [C11C3/003](#) ; [C11C3/10](#)
 CLC - [C07C67/03](#) , [C07C69/24](#) , INV
 - [C07C67/03](#) , [C07C69/52](#) , INV
 - [C07C67/08](#) , [C07C69/24](#) , INV
 - [C07C67/08](#) , [C07C69/52](#) , INV
 CCA - [Y02E50/13](#) ; [Y02P30/20](#) ; [Y02P20/582](#)
 PA - (A2 A3)

PELLEY MICHAEL F [US]

TI - (A2 A3)

METHOD AND APPARATUS FOR REFINING BIODIESEL

AB - (A2)

Method and apparatus for producing **biodiesel** fuel, i.e., alkyl ester, from vegetable and/or animal oil. A transesterification catalyst is prepared in a base catalyst tank by spraying alkyl alcohol under pressure through jets at metal hydroxide pellets until the pellets have fully reacted with the alcohol. The oil is heated and transesterified in the presence of alkyl alcohol and the transesterification catalyst in a closed, recirculating transesterification flow system under slight cavitation to yield product alkyl ester and product **glycerol**. Cavitation is achieved by permitting air to enter the transesterification flow system through an adjustable air inlet valve. When permitted to stand, product alkyl ester forms an upper layer that is decanted and subjected to **purification** steps, to remove particulates and alkyl alcohol from the product alkyl ester, and a lower layer of product **glycerol** is drained away. **Purification** of the product alkyl ester preferably includes subjecting the product alkyl ester to an overhead **water** mist in a **wash** tank with simultaneous infusion of a stream of air bubbles. Alcohol vapor is reclaimed as liquid alcohol within an alcohol condenser and stored for reuse. If the oil contains free fatty acids, prior to transesterification, the oil is heated and the free fatty acids are esterified in the presence of an esterification catalyst and alkyl alcohol. For safety, baffles and explosion damper/flame arrestors are provided in locations where flammable vapors pose a risk.

9/10 © EPODOC / EPO

PN - [US2006224005](#) A1 20061005

PNFP - US7507846 B2 20090324

PR - US20040547574 20040317; US20030456097P 20030320; WO2004US08294 20040317

AP - US20040547574 20040317

DT - **

CT - || STSE (B2)

[US3474131](#) A 19691021 [] (SCHMERLING LOUIS)

[US6440057](#) B1 20020827 [] (ERGUEN NURHAN [AT], et al)

- || R141 (A1)

[US5399731](#) A [];

[US5514820](#) A [];

[US5424467](#) A [];

[US6262285](#) B1 [];

[US6440057](#) B1 [];

[US3474131](#) A [];

[US5972057](#) A [];

[US6127560](#) A [];

[US5468887](#) A [];

[US3927982](#) A []

CTNP - || STSE (B2)

[] Knothe, G. et al., Biodiesel: The use of Vegetable Oils and Their Derivatives as Alternative Diesel Fuels, 1997, American Chemical Society, Chapter 10, pp. 172-207

[] Konen, et al. Esterification of Unsaturated Fatty Acids,
1945, Oil & Soap, vol. 22, pp. 57-60

- CCI - [C07C67/03](#) ; [C07C67/08](#) ; [C10L1/026](#) ; [C11C1/08](#) ; [C11C3/003](#) ; [C11C3/10](#)
- CLC - [C07C67/03](#) , [C07C69/24](#) , INV
- [C07C67/03](#) , [C07C69/52](#) , INV
- [C07C67/08](#) , [C07C69/24](#) , INV
- [C07C67/08](#) , [C07C69/52](#) , INV
- CCA - [Y02E50/13](#) ; [Y02P30/20](#) ; [Y02P20/582](#)
- TI - (A1 B2)
Method and apparatus for refining **biodiesel**
- AB - (A1 B2)
Method and apparatus for producing **biodiesel** fuel, i.e., alkyl ester, from vegetable and/or animal oil. A transesterification catalyst is prepared in a base catalyst tank by spraying alkyl alcohol under pressure through jets at metal hydroxide pellets until the pellets have fully reacted with the alcohol. The oil is heated and transesterified in the presence of alkyl alcohol and the transesterification catalyst in a closed, recirculating transesterification flow system under slight cavitation to yield product alkyl ester and product **glycerol**. Cavitation is achieved by permitting air to enter the transesterification flow system through an adjustable air inlet valve. When permitted to stand, product alkyl ester forms an upper layer that is decanted and subjected to **purification** steps, to remove particulates and alkyl alcohol from the product alkyl ester, and a lower layer of product **glycerol** is drained away. **Purification** of the product alkyl ester preferably includes subjecting the product alkyl ester to an overhead **water** mist in a **wash** tank with simultaneous infusion of a stream of air bubbles. Alcohol vapor is reclaimed as liquid alcohol within an alcohol condenser and stored for reuse. If the oil contains free fatty acids, prior to transesterification, the oil is heated and the free fatty acids are esterified in the presence of an esterification catalyst and alkyl alcohol. For safety, baffles and explosion damper/flame arrestors are provided in locations where flammable vapors pose a risk.

10/10 © EPODOC / EPO

- PN - [US7126032](#) B1 20061024
- PR - US20060387654 20060323
- AP - US20060387654 20060323
- DT - *; Rep
- CCI - [C07C29/80](#) ; [C07C29/88](#)
- CLC - [C07C29/80](#) , [C07C31/225](#) , INV
- [C07C29/88](#) , [C07C31/225](#) , INV
- PA - SUNOCO INC R&M [US]
- TI - **Purification** of **glycerin**
- AB - A **process** for purifying **glycerin** recovered as a byproduct of **biodiesel** production comprises heating a **glycerin** effluent stream containing a low molecular weight alcohol, water and fatty acid esters of the low molecular weight alcohol to cause transesterification of the fatty acid esters to glycerides and additional low molecular weight alcohol. The reaction mixture is sparged with nitrogen to help remove water and

low molecular weight alcohol, which drives the transesterification reaction towards glyceride formation. A **wash water** stream may also be added to the recovered **glycerin** stream from **biodiesel** production. Either before or following the transesterification reaction, an oil layer can be separated from the recovered **glycerin** stream by reducing the pH of the stream to below 7. Following separation of the oil layer and transesterification the **glycerin** stream is flash distilled to separate **glycerin** from water, salts, and glycerides.

[SS 11]