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(54) **Title:** METHOD FOR MANUFACTURING BIODIESEL FUEL FROM VEGETABLE OIL

(57) **Abstract:** Disclosed is a method of manufacturing biodiesel fuel by using vegetable oil, wherein the method comprises the steps of: a) carrying out esterification of 25 to 33 wt% of diesel, 36 to 55 wt% of glycerin, 7 to 13 wt% of solvent oil, 8 to 13 wt% of Il-sun oil, and other additives in the presence of an acidic or basic catalyst; b) separating the esterification reaction product into layers by specific gravity difference in a settling tank through reaction at a driving pressure of 3 to 4 atm, at 70 to 8O0C, and removing a glycerin layer; c) filtering out non-esterified materials by a centrifugation process; and d) carrying out a reaction by using a vacuum evaporator in a batch reactor.

Description

METHOD FOR MANUFACTURING BIODIESEL FUEL FROM VEGETABLE OIL

Technical Field

[1] The present invention relates to environmentally friendly internal combustion engine biodiesel fuel by using vegetable oil, and a method of manufacturing the same.

Background Art

[2] As the manufacture of industrial machines and vehicles including diesel engines has rapidly increased worldwide with the development of industry, the consumption of diesel oil used as an energy source has been increased. As compared to various fuels obtained from crude oil, diesel oil is inexpensive, and thus is advantageous in the view of cost reduction, but has a problem of generating a large amount of air pollution after its combustion.

[3] In order to solve such a problem, research on alternative fuel having physical properties similar to diesel oil and being capable of preventing air pollution has been variously conducted. As a result of the research, research on biodiesel oil having physical properties similar to diesel oil and being capable of significantly reducing the occurrence of air pollution is being actively conducted.

[4] Biodiesel is fatty acid ester obtained from vegetable oil or waste oil, which is manufactured by a reaction for generating a low molecular alcohol through the action of an acidic or basic catalyst. Also, since the biodiesel has physical properties similar to light oil (energy source of a diesel engine), the biodiesel may be used in combination with the light oil or may be used in a diesel engine as a substitute for the light oil.

[5] In the present invention, an acidic or basic catalyst is used to carry out an esterification reaction, and centrifugal separation is carried out to separate glycerin (glycerol) from the reacted product, and to filter out additionally generated non-esterified materials, such as alkalies (hydroxyl group). Thus, it is possible to increase the yield of the manufacturing process, and to solve all problems with the fuel.

[6] In this manner, a method of manufacturing environmentally friendly biodiesel by using residual products (such as, alkalies (hydroxyl group)) and ethanol acids (glycolic acid) was completed.

Disclosure of Invention

Technical Problem

[7] Therefore, the present invention has been made in view of the above-mentioned problems. The present invention provides environmentally friendly internal combustion engine biodiesel fuel by using vegetable oil, which can reduce envi-

ronmental pollution, and a method of manufacturing the same.

Technical Solution

[8] The above mentioned biodiesel is fatty acid ester obtained from vegetable oil or waste oil, which is manufactured by a reaction for generating a low molecular alcohol through the action of an acidic or basic catalyst.

[9] Preferably, raw materials for the biodiesel may require pretreatment because the manufacture of the biodiesel requires the esterification of waste oil and the use of moisture, which may affect an esterification reaction.

[10] Preferably, pure vegetable oil is a raw material, not concerned with the purity, moisture, and acid value (rancidity) in the manufacture, and thus may be fed through direct esterification.

[11] Preferably, as a catalyst, an acidic or basic additive, such as KOH, K_2CO_3, NaOH, and $NaOCH_3$, may be used. In particular, it is the most preferable to use a basic catalyst.

[12] Preferably, a low molecular weight alcohol includes methanol and ethanol, and the raw materials generate recycling energy through a manufacturing process by using residual products of refined fermentation/fossil fuel.

Advantageous Effects

[13] According to the present invention, it is possible to reduce the import rate of fossil fuel on which the rate of import dependence is the highest at the present time, to decrease the amount of exhaust gas from air pollution materials to a minimum, and to improve process efficiency of biodiesel (alternative fuel of recycle energy) through the best yield, and a separation refining process. Also, since vegetable oil, a recycle energy source, is used, its residual products may be re-used.

Mode for the Invention

[14] Hereinafter, reference will now be made in detail to the preferred embodiments of the present invention. However, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope and spirit of the invention as disclosed in the accompanying claims.

[15] **Example**

[16] **Example 1: Manufacture of biodiesel fuel**

[17] The fuel according to the present invention was manufactured through esterification of materials noted in Table 1 by a catalyst (KOH or NaOH). The materials were reacted at a driving pressure of 3 to 4 atm, at 70 to 80°C and were separated into layers by the specific gravity difference in a settling tank. Then, a separated glycerin (glycerol) layer was removed. A centrifugation process was carried out to filter out residual non-esterified materials, such as alkalies (hydroxyl group), and a purification

process was performed.

[18] In manufacturing the fuel, a vacuum evaporator was used to carry out the reaction at 60℃ for 3 hours in a batch reactor.

[19] Table 1

[Table 1]

[Table]

Name of Reaction materials	**wt%**	**Specific gravity**
Diesel	25 ~ 33	0.82
Glycerin	36 ~ 55	0.91
Solvent oil	7 ~ 13	0.78
Il-sun oil(refined oil, such as gasoline, that can be used as fuel)	8 ~ 13	0.78
Other additives	5	

[20] In Table 1, the other additives include a flash point increasing agent, 16 octane booster, an ash preventing agent, and an anti-freezing agent.

[21] **Example 2: Composition test**

[22] Table 2 shows the composition test results of the fuel obtained from Example 1.

[23] Table 2

[Table 2]

[Table]

Test Item	**Diesel**	**Biodiesel fuel**
Cetane Index	51	48 ~ 60
Density Ib/gal at 15℃	7.079	7.328
Content of moisture (wt%)	0.01 or less	0.005
Kinematic viscosity (cst/40℃)	2.7	5.0
Oxygen content (wt %)	0	10<
Sulfur content (wt%)	0.03	0.01
Boiling point (℃)	188 ~ 343	182 ~ 338
Cloud point (℃)	(-15) ~ 5	(-3) ~ 12
Pour point (℃)	(-35) ~ (-15)	(-15) ~ 16
flash point (℃)	57	140
ignition point (℃)	316	-

[24] **Example 3: Test on exhaust gas**

[25] Exhaust gas from a Korean vehicle in which the fuel obtained from Example 1 was injected was analyzed (see Table. 3).

[26] Table 3

[Table 3]

[Table]

Test Item	Diesel	Biodiesel fuel
Benzen-based carcinogenic polymer [mg/mm3]	5.0	0.1
Sulfur content [%]	<0.36	0.01
Biodegradability in air[%/day]	-	70<

Industrial Applicability

[27] Although several exemplary embodiments of the present invention have been described for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope and spirit of the invention as disclosed in the accompanying claims.

Claims

[1] A method of manufacturing environmentally friendly biodiesel fuel, wherein the method comprises the steps of:

a) carrying out esterification of 25 to 33 wt% of diesel, 36 to 55 wt% of glycerin, 7 to 13 wt% of solvent oil, 8 to 13 wt% of Il-sun oil, and other additives in presence of an acidic or basic catalyst;

b) separating the esterification reaction product into layers by specific gravity difference in a settling tank through a reaction at a driving pressure of 3 to 4 atm, at 70 to 80℃, and removing a glycerin layer from the product;

c) filtering out non-esterified materials by a centrifugation process; and

d) carrying out a reaction by using a vacuum evaporator in a batch reactor.

[2] The method as claimed in claim 1, wherein the acidic or basic catalyst is one material selected from the group consisting of KOH, K_2CO_3, NaOH, and $NaOCH_3$.

[3] The method as claimed in claim 2, wherein the catalyst is KOH or NaOH.

[4] The method as claimed in claim 1, wherein step d) is carried out at 60℃ for 3 hours.

[5] Biodiesel fuel manufactured by the method as claimed in any one of claims 1 to 4.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2008/003565

A. CLASSIFICATION OF SUBJECT MATTER

C10L 1/02(2006.01)i, C11C 3/00(2006.01)i, C07C 51/43(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)

IPC 8: C10L

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)

eKIPASS(KIPO internal), keyword: biodiesel, diesel, glycerin

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 2005-60587 A (O YOSHIO) 10 March 2005 See abstract and paragraph <17> - <35>	1-5
A	KR 2006-108141 A (KIM JAE JONG) 17 October 2006 See the whole document, in particular abstract and figures	1-5
A	JP 9-235573 A (SOMEYA) 9 September 1997 See claims	1-5
A	JP 2004-307608 A (SEKIKUCHI ET AL.) November 2004 See the whole document	1-5
A	JP 2001-226694 A (TATENTO ET AL.) 21 August 2001 See the whole document	1-5

☐ 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
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"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
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Information on patent family members

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