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(54) METHOD FOR PRODUCING LOW-VISCOUS MARINE FUEL

(57) The invention relates to petroleum processing, more precisely to a method for producing a low-viscous marine fuel used for ship or boiler plants. The inventive method involves oil atmospheric vacuum distillation associated with separation of straight-run and vacuum fractions, catalytic cracking of a wide fraction associated with separation of a catalytic cracking distillate. The vacuum fraction boiling at a temperature ranging from 360 to 490 °C is cleaned by selective solvent. Afterwards, the thus obtained highly aromatised extract is compounded with the straight-run fractions and catalytic cracking distillate at a ratio of 1:69:30-20:25:55 respectively, the target product being obtained. In addition, the straight-run fractions whose boiling point ranges from 160 to 380 °C are separated, and the wide fraction whose boiling point ranges from 330 to 540 °C is exposed to catalytic cracking associated wit separation of a catalytic cracking distillate boiling at a temperature ranging from 160 to 420 °C. Up to 50 mass % coking fraction boiling at a temperature of 160 - 420 °C could also be added to the target product.

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Description

Field of the Invention

[0001] The invention relates to petroleum processing, more particularly to a method for producing a low- viscous marine fuel used for ship or boiler plants.

Prior Art

[0002] A low-viscous marine fuel may be produced by straight-run petroleum refming and by processing of secondary products (e.g., distillates produced by processes of catalytic, thermal cracking and carbonization). Rigid operational demands are made to such fuels in respect of their performance, namely improvement in their lubricity and reduction in corrosiveness.

[0003] A method of producing a low-viscous marine fuel is known in the art, which comprises fuel oil processing by using vacuum distillation, thermal cracking of distillate fractions, viscosity breaking of the residue, rectification separation of the thermal cracking and viscosity breaking products in an atmospheric column for producing kerosene-gas oil fraction and the residue in the atmospheric column. The kerosene-gas oil fraction is then used as a low-viscous marine fuel, the atmospheric column residue as a high-viscous marine fuel, and a mixture of the kerosene-gas oil fraction and the residue as a heavy marine fuel or high-viscous marine fuel (RU 2176263, C 10 G 9/00, 2001).

[0004] A disadvantage of the above method is a low yield of a low-viscous marine fuel, since it intended, mainly, for producing heavy fuels.

[0005] Also a method for producing a low-viscous marine fuel is known, which comprises petroleum refining at a atmospheric vacuum pipe heaters (AVPH-plants), separation the fractions 160 - 360°C, 160 - 420°C and 300 - 480°C; afterwards these fractions are mixed in the weight ratio 40:40:20 - 60:30:10 for producing a straight-run distillate, catalytic cracking of the wide vacuum fraction 250 - 550°C with separation of the catalytic cracking distillate of 160 - 400°C, and then this distillate is compounded with a straight-run distillate in the ratio of 20:80 - 60:40 (RU 2074232, C 10 G 57/00, 1997).

[0006] However, the said method does not enable to produce a low-viscous marine fuel with the required specifications in respect of calorific value, cetane number and lubricity.

[0007] The closest to the inventive solution is a method producing low-viscous marine fuel method, which comprises oil atmospheric and vacuum refining with separation of straight-rub and vacuum fractions, catalytic cracking of a wide fraction with separation of catalytic cracking distillate and the separated fractions are compounded for producing the target product (RU 2149888, C 10 L 1/04, 2000).The separated fractions, namely: 155 - 360°C, 155 - 435 °C and 220 - 550°C are mixed in the weight ratio 45:55:5 - 55:53:10, thus obtaining straight-run distillate. The wide vacuum fraction, which is boiled out in the temperature range from 240 to 560°C, is subjected to hydro refining and then to catalytic cracking, thus separating catalytic cracking distillate boiling out in the temperature range from 155 to 420°C? which is then compounded with straight-run distillate in the ratio 15:85 - 65:35. A disadvantage of this known method is a low oil-to fuel yield as well as a low cetane number of the fuel produced and its insufficient lubricity.

Summary of the invention

[0008] The objective of this invention is to develop a method for producing a low-viscous marine fuel enabling to increase the oil-to-fuel yield, expand raw materials and improve physical and chemical properties of the fuel.

[0009] In order to achieve the stated objective, in a method of producing a low-viscous marine fuel, comprising atmospheric vacuum distillation of oil with selection of straight-run and vacuum fractions, catalytic cracking of a wide vacuum fraction associated with separation of a catalytic cracking distillate and compounding of the selected fractions for the purpose of obtaining the target product the vacuum fraction is selected boiling out in the temperature range from 360 to 490°C, which fraction than is purified by a selective solvent, and thus obtained highly aromatized extract is compounded with the straight-run fractions and the catalytic cracking distillate in the ratio of 1:69:30 - 20:25:25, respectively.

[0010] The distinctive features under this invention consist in that atmospheric and vacuum distillation the vacuum fraction is selected, which boil out in the temperature range from 360 to 490°C; then this fractions purified with a selective solvent, and thus obtained highly aromatized extract is compounded with straight-run fractions and the catalytic cracking distillate in the ratio of 1:69:30 - 20:25:55, respectively.

[0011] The analysis of known technical solutions in respect of methods for producing a low-viscous marine fuel shows that the totality of the essential features in accordance with this invention is new, and the known solutions do not contain features similar to the distinctive features of the inventive method.

[0012] The said distinctive features enable, when using this method at refmeries, to increase the oil target product, expand raw materials due to qualified use of the residual components at petroleum refineries.

[0013] It is preferred to separate straight-run fractions, boiling out in the temperature range from 160 to 380°C, and subject the wide vacuum fraction, boiling out in the temperature range from 330 to 540°C, selecting catalytic cracking distillate, boiling out in the temperature.

[0014] It is also expedient to introduce to the target product up to 50 per cent by weight the cocking process fraction, boiling out in the temperature range from 160 to 420°C.

[0015] The essence of the inventive method is illustrated by examples given below.

Example 1

[0016] Oil at an AVPH-plant (atmospheric vacuum pipe heaters) is distilled for obtaining the straight-run fractions in the temperature ranges from 180 to 360°C and from 270 to 380°C and the vacuum fractions in the temperature range from 360 to 490°C and from 330 to 540°C. The fraction of 330 - 540°C is sent to fluidized-bed catalytic cracking plant in the presence of a zeolite catalyst containing a promoter with serum-lowering functions. Distillate is separated from the cracking products, which boils out in the temperature range from 160 to 420°C The vacuum fraction 360 - 490 °C is purified a selective solvent, e.g., N-methylpirrolidone, for obtaining base oils and a highly aromatized extract. The obtained components, namely the highly aromatized extract, straight-run fractions 180 n- 360 °C and 270 - 380 °C as well as catalytic cracking distillate are compounded in the ratios of 1:50:19:30, respectively.

Example 2

[0017] The method is carried out mainly at an AVPH-plant according to the conditions of Example 1, but the straight-run fraction 169 - 380°C, the narrow vacuum fractions 360 - 420°C and 420 - 490°C, the wide vacuum fraction 330 - 540 °C, the catalytic cracking distillate 200 - 370°C being separated from the latter. The narrow Vacuum fractions are subjected to joint selective purification for the purpose of obtaining the highly aromatized extract. The obtained components, namely: the highly aromatized extract, the straight-run fraction and the catalytic cracking distillate are compounded in the ratios 20:25:55< respectively.

Example 3

[0018] The method is carried out in the conditions of Example 2, but 40 % of the carbonization process fraction 160 - 420°C are introduced into the target product.

[0019] The characteristics of the components and the target product under Examples 1 - 3 are shown in Tables 1 and 2, respectively.

Industrial Applicability

[0020] The inventive method is industrially applicable and may be most successfully used in petroleum processing for producing a low-viscous marine fuel intended for use in marine and boiler plants. The inventive method may be implemented with the use of known standard equipment and dies not require developing and creating any special tooling.

Table 1

Parameter Names	Straight-run Fractions			Catalytic cracking distillates		Extract	Carbonization Fraction 160-420°C
	180 - 360 °C	270 - 380 °C	160 - 380 °C	160 - 420 °C	200 - 370 °C		
Density at 20°C, kg/m^3	842	882	850	886	876	898	896
Cinematic viscosity at 20°C, mm^2/s	5.20	17.52	5.94	6.70	5.64	-	38.9
Conditional viscosity (CV) at 20°C, degrees	-	2.66	1.47	1,30	-	-	5.1

Table continued

Parameter Names	Straight-run Fractions			Catalytic cracking distillates		Extract	Carbonization Fraction 160-420°C
	180 - 360 °C	270 - 380 °C	160 - 380 °C	160 - 420 °C	200 - 370 °C		
Flash point, °C	74	132	85	74	82	216	85
Congelation point, °C	-13	+5	-6	-9	-11	+23	-2
Total sulfur, weight per cent	0.72	1.52	0.8	1.8	1.4	1.8	1.2
Sore sulfur, weight per cent	0.0066	0.0097	0.0072	0.009	0.0385	0.0064	-
Coking ability, %	0.01	0.017	0.013	0.07	0.11	1.2	0.68

Table 2

Parameters	Norm under specification	Parameter values		
		Example 1	Example 2	Example 3
Density at 20°C	Not more than 890	863	877	875
Cetane number	Not less that 40	41	40	40
Sulfur fraction of total mass, %	Not more than 1.5	1.21	1.55	1.61
Coking ability, %	Not more than 2	0.039	0.28	0.40
Cinematic viscosity at 20°C, mm^2/s	Not more than 11.4	6.95	11.2	10.4
Iodine number, g J_2 per 100 g of fuel	Not more than 20	7.2	10.5	14.6

Claims

1. A method of producing a low-viscous marine fuel, comprising atmospheric vacuum distillation of oil with selection of straight-run and vacuum fractions, catalytic cracking of a wide vacuum fraction associated with separation of a catalytic cracking distillate and compounding of the selected fractions for the purpose of obtaining the target product, **characterized in that** the vacuum fraction is selected boiling out in the temperature range from 360 to 490°C, which fraction than is purified by a selective solvent, and thus obtained highly aromatized extract is compounded with the straight-run fractions and the catalytic cracking distillate in the ratio of 1:69:30 - 20:25:25, respectively.

2. The method according to Claim 1, **characterized in that** the straight-run fractions, boiling out in the temperature range from 160 to 380°C, and the wide vacuum fraction, boiling out in the temperature range from 339 to 540°C, is subjected to catalytic cracking, selecting catalytic cracking distillate, boiling out in the temperature range from 160 to 420°C.

3. The method according to Claims 1 or 2, **characterized in that** up to 50 per cent by weight the cocking process fraction, boiling out in the temperature range from 160 to 420°C, is introduced into the target product.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/RU 2003/000449

A. CLASSIFICATION OF SUBJECT MATTER

C10G 55/06

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)

C10G 55/06

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)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	RU 2149888 C1 (UFIMSKY GOSUDARSTVENNY NEFTYANOI TEKHNICHESKY UNIVERSITET), 27.05.00	1-3
A	US 4695367 A (THE M.W. KELLOGG COMPANY) Sep. 22, 1987	1-3
A	JP 63-054496 A (KIYOUSEKI SEIHIN GIJUTSU KENYUSHO) 1988-03-08 (abstract), [on-line] [naideno 2004-02-17] Naideno iz bazy dannykh EPOQUE PAJ.	1-3

☐ 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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"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
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