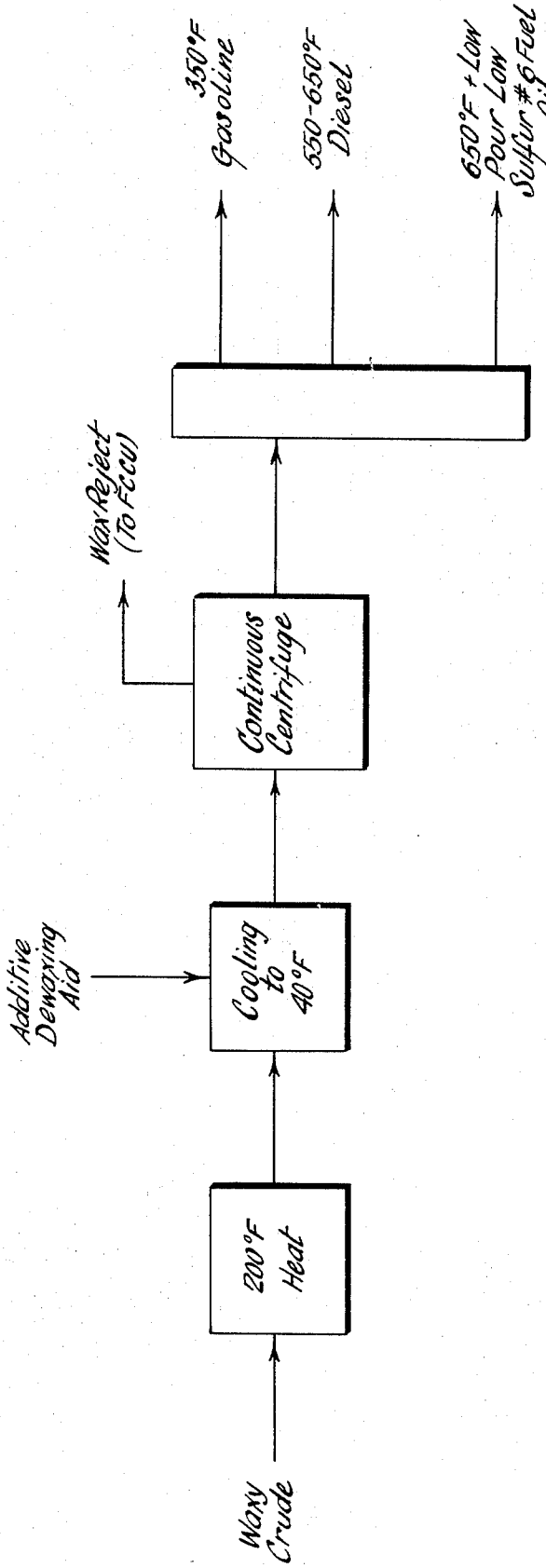
PROCESS FOR OBTAINING LOW POUR FUEL OIL

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PROCESS FOR OBTAINING LOW POUR FUEL OIL

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ABSTRACT OF THE DISCLOSURE

The introduction of a dewaxing aid into waxy crudes followed by preheating of the crude and the additive prior to dewaxing increases the amount of heavier wax reject stream and the fuel oil (or 650° F. fraction) recovered from the dewaxed crude by fractionation has a reduced pour point. The reduction in pour points ranges from 10° to 35° F.

BACKGROUND OF THE INVENTION

This invention relates to a process for obtaining a fuel oil having a reduced pour point and to means for making greater utilization of low sulfur fuel oils.

As is well known, air pollution has many contributing causes. One of these is the relatively high amount of sulfur dioxide contained in stack gases resulting from fuel oil combustion. Recognition of this cause has led to strict regulations concerning the sulfur contents of fuel oils used in the United States and in some European countries. In an attempt to comply with these regulations, fuel oil consumers are considering the use of low sulfur, high pour, waxy crudes, in particular those produced in North African fields. The main problem confronting such consumers is the high pour points of these crudes' fuel oil fraction. Many consumers have facilities which require a 50°–60° F. pour point fuel oil because they lack storage and line heaters. Typically, however, the pour points of the low sulfur crudes' fuel oil fractions are of the order of 85 to 110° F. and therefore such oils cannot be used in the above mentioned facilities.

The present invention is based on the surprising discovery that the pour points of the fuel oil fraction of low sulfur waxy crudes can be reduced appreciably by introducing dewaxing aids in the crudes, preheating the crude and the additives to about 160 to 200° F., cooling to about 10° to 70° F.; dewaxing and recovering the fuel oil fraction from the dewaxed crude by fractionation. Practice of the present process increases the amount of heavier wax reject stream with the consequent production of a lower pour 650° F.+ fuel oil fraction.

The present process is operative generally with crudes which have an API gravity ranging from about 30 to about 36°, a pour point ranging from about +50° F. and +100° F. and a wax content of about 8 to 16 percent.

As shown in the accompanying flow diagram which illustrates schematically a preferred embodiment of the invention, a waxy low sulfur crude such as a North African or Arabian crude or a mixture of these is heated and blended with from 0.005 and 2.0% by weight of an additive dewaxing aid. The resulting mixture is then cooled and continuously centrifuged under a force of about 15,000 *g* for a residence time of about 10 to 60 seconds. The wax reject is removed and sent on to a Fluid Cracking Catalytic Unit where it is thermally cracked or visbroken and, if desired, added to the fuel oil fraction which is obtained as the end product of the process. The dewaxed oil is then fractionated to remove a gasoline fraction, a diesel fuel fraction, and a 650° F.+ low pour, low sulfur fuel oil fraction.

Many dewaxing aids and pour point depressants will suggest themselves to those skilled in the art for use in conjunction with the manipulative steps of this invention. Among these may be mentioned acrylates, polymethacrylates, ethylene-maleic anhydride copolymers and diesters of such copolymers with predominantly straight chained alcohols having a carbon content ranging from C_{18} to C_{26}.

Preferred additives are sold under the trade names of "Elvax." The characterization of the various "Elvax" additives is given in Table I below, with the preferred additive being Elvax 250 which has a molecular weight of around 20,000 to 27,000. These can be added in the form of a hydrocarbon solution concentrate in, for example, toluene, or in the form of pellets.

These additives may be prepared by any convenient process, such as that of U.S. Patent 3,215,678, by a free radical-initiated polymerization of ethylene and a vinyl ester of a lower saturated monobasic aliphatic carboxylic acid.

TABLE I

"Elvax"	Percent vinyl acetate in co-polymer	Melt Index [1]
150	32–34	22–28
210	27–29	335–465
220	27–29	125–175
240	27–29	22–28
250	27–29	12–18
260	27–29	5–7
310	24–26	335–465
350	24–26	15–22
360	24–26	1.6–2.4

[1] In g./10 min. as determined by ASTM 1328 modified.

To illustrate the invention, about 2200 parts of crude, the properties of which are given in Table II, were preheated to 200° F. for 1 hour with stirring, cooled to 40° F. in a cold room and dewaxed at this temperature using a Sharples Super Centrifuge. The wax reject sample was analyzed by gas chromatography for carbon number distribution up to carbon number 40 (C_{40}). The dewaxed crudes were distilled and the 650° F.+ fraction was also analyzed.

Table II gives gas chromatographic data on wax reject samples as well as tests on the corresponding dewaxed 650° F.+ fractions. The gas chromatographic data indicate that a greater percentage of higher molecular weight materials (heavier wax fractions) were removed from Amna crude when 0.05 percent Elvax 250 was present (Runs 13.2, 23). The additive acts as a dewaxing aid in as low a concentration as 0.005 percent since 9.8 percent wax was recovered at 0.005 percent Elvax 250 compared to 6.5 percent in its absence (Runs 13.2, 21). When Amna crude was dewaxed without additive the maximum pour point of the dewaxed 650° F.+ fraction was +110° F. When Amna crudes containing 0.005 and 0.05 percent Elvax were dewaxed, the 650° F.+ maximum pour points were +95° F. and +175° F. respectively (Runs 13.2, 21, 23). The above data show that Elvax 250 acts as a dewaxing aid and also helps to selectively remove a heavier wax fraction during dewaxing. Because of the selective wax removal, a lower pour point 650° F.+ fraction is obtained with Amna crude. With Nafoora Crude, the 650° F.+ fraction maximum pour point was +95° F. when the crude was dewaxed in the absence of additive and +85° F. when 0.05 percent Elvax 250 was present in the dewaxing step (Runs 35, 37 in Table II). For a Nafoora (80%)-Arabian (20%) blend the maximum pour points were +90° F. and +80° F., respectively, for dewaxing without and with 0.05 percent Elvax 250 (Runs 28, 38 in Table II). Substantially similar results are obtained with the other copolymers listed in Table I.

TABLE II.—CRUDE PROPERTIES

	Description		
	Amna crude	Nafoora crude	Arabian crude
Gravity, °API	34.8	34.7	33.5
Pour point, ° F	+80	+80	−10
Maximum pour point, ° F	+75	+85	
Kin. vis. at 100° F, cs	17.66	35.0	7.05
Flash point, ° F	90	105	
Sulfur	0.17	0.1	1.73
Distillation, wt. percent:			
IBP–350° F	21.0	9.0	22.0
350–650° F	24.0	25.2	36.0
650° F.+	58.0	65.0	42.0
650° F.+ fraction:			
Pour point, ° F	+100	+105	+45
Maximum pour point, ° F	+110	+105	+45
Sulfur, wt. percent	0.28	0.10	2.82

made without departing from the spirit and the scope of the underlying inventive concept and that the same is not limited to the particular examples herein given and described.

What is claimed is:

1. A process for obtaining a low pour, low sulfur fuel oil which comprises adding from 0.005 to 2.0% by weight of an ethylene-vinyl fatty acid copolymer which contains from 24 to 34% of vinyl acetate and has a molecular weight of about 20,000 to about 31,000 to a low sulfur waxy crude, preheating the resulting mixture to about 160° to 200° F., cooling to about 10° to 70° F., removing wax from the cooled mixture only by centrifuging and recovering the fuel oil fraction from the dewaxed oil by fractionation.

TABLE III. ANALYSIS OF WAX REJECT SAMPLE AND 650° F.+ FRACTION

	Crude (or blend)									
	Amna				Nafoora			Nafoora (80%), Arabian (20%)		
Run number	(2)	13.2	21	23	(2)	37	35	(2)	28	38
Elvax 250, wt. percent (in Centrifuge step)	0	.005	0.05		0	0.05		0	0.05	
Centrifuge temp.° F	40	40	40		40	40		40	40	
Wax removed, wt. percent	6.5	9.8	10.0		8.8	10.3		8.4	9.3	
Wax carbon number analysis,[1] percent:										
C_8–C_{10}		11.0	10.0	1.0						
C_{11}–C_{20}		40.0	33.0	23.0						
C_{21}–C_{30}		36.0	43.0	45.0						
C_{30}–C_{40}		13.0	14.0	31.0						
650° F.+ fraction:										
Wt. percent of charge	58.0	58.0	60.5	61.5	65.0	63.0	64.0	59.0	59.0	64.5
Sulfur, wt. percent	0.28	0.30	0.21	0.24	0.10	0.16		0.59	0.59	0.66
Max. pour point, ° F	+110	+110	+95	+75	+105	+95	+85	+100	+90	+80
Vis. furol, sec. at 122° F	101.6		77.6	66.6		77.0	68.0			57.0

[1] Gas chromatographic analysis up to carbon number C_{40}. Values normalized to 100%.
[2] Tests on virgin 650° F.+ fractions.

In Table IV, properties are given of 650° F.+ dewaxed fractions into which a visbroken wax stream was reblended. The visbroken fraction was a wax blend obtained from various runs and which had been thermally treated at 800° F. for 14 hours to yield a lower pour material. The data indicate that pour point reductions of +10 to +15° F. with respect to the virgin 650° F.+ fractions could be achieved by mildly visbreaking centrifuged solids and reblending with the dewaxed 650° F.+ fraction.

TABLE IV.—EFFECT OF REBLENDING MILDLY VISBROKEN WAX FRACTION[1] WITH 650° F.+ FRACTION

	Crude			
	Amna	Amna	A–A[2]	A–A[2]
Run Number		25		30.3
Solids removed, wt percent		14.0		14.2
Dewaxed 650° F.+ fraction:				
Pour point, ° F	+100	+65	+95	+55
Max. pour point, ° F	+110	+75	+95	+60
Visbroken wax returned to 650° F.+ fraction		14.0		14.0
Blend properties:				
Pour point, ° F		+95		+85
Max. pour point, ° F		+95		+85

[1] Wax sample was composite of solids recovered from representa runs (m.p. 140° F.) Sample was visbroken at 800° F. for 14 hr.
[2] Amna (80 percent), Arabian (20 percent) blends.

Sustantially similar results are obtained when acrylates, polymethacrylates, ethylene-maleic anhydride copolymers and diesters of such polymers are used in the place of the "Elvax" copolymers. Accordingly, it will be manifest to those skilled in the art that such substitution may be

2. The process is defined in claim 1 wherein the removed wax is thermally cracked and added to the fuel oil fraction.

3. The process according to claim 1 wherein said copolymer contains from 27% to 29% weight percent of vinyl acetate and has a molecular weight of about 20,000 to about 27,000.

4. The process according to claim 1 wherein said crude consists of a mixture of Nafoora and Arabian crudes.

5. The process according to claim 1 wherein said crudes have an API gravity ranging from about 30° to about 36°, a pour point ranging from about +50° F. to about +100° F. and a wax content of between about 8 to 16 percent.

6. The process as defined in claim 1 wherein said centrifuging is effected under a force of around 15,000 g's for a residence time of about 10 to 60 seconds.

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