(CONVENTION. By one or more persons and/or a Company.) Form 42

COMMONWEALTH OF AUSTRALIA

Patents Act 1952-1969

CONVENTION APPLICATION FOR A PATENT

612266

(1) Here insert (in full) Name or Names of Applicant or Applicants, followed by Address (es).

xI/We (1) EXXON RESEARCH AND ENGINEERING COMPANY

of Box 390, Florham Park, New Jersey 07932, United States of America

(2) Here insert Title of Invention.

hereby apply for the grant of a Patent for an invention entitled: (2)

UPGRADING WAXY DISTILLIATES AND RAFFINATES BY THE PROCESS OF HYDROTREATING AND HYDROISOMERIZATION

(3) Here insert number(s) of basic application(s)

which is described in the accompanying complete specification. This application is a Convention application and is based on the application numbered (3)

285,436

(4) Here insert Name of basic Country or Countries, and basic date or dates

for a patent or similar protection made in (4) United States of America on 16th December 1988

xxx My/Our xx address for service is ~~Messrs. Edward Waters & Sons, Patent Attorneys~~ Watermark Patent & Trademark Attorneys

50 Queen Street, Melbourne, Victoria, Australia.

DATED this 13th day of June 1989

(5) Signature (s) of Applicant (s) or Seal of Company and Signatures of its Officers as prescribed by its Articles of Association.

(5) EXXON RESEARCH AND ENGINEERING COMPANY

by

009831 140689

D. B. Mischlewski

Registered Patent Attorney

To:

CONVENTION
(U.S. 285,436)

FORM 8

COMMONWEALTH OF AUSTRALIA

Patents Act 1952-1960

DECLARATION IN SUPPORT OF AN APPLICATION FOR A PATENT OR PATENT OF ADDITION

- - - - - - - -

In support of the Application made by EXXON RESEARCH AND ENGINEERING COMPANY for a patent for an invention entitled:

UPGRADING WAXY DISTILLATES AND RAFFINATES BY THE PROCESS OF HYDROTREATING AND HYDROISOMERIZATION

I, Anne Hershkowitz Jacobson of Madison, New Jersey United States of America

do solemnly and sincerely declare as follows:

1. I am authorised by EXXON RESEARCH AND ENGINEERING COMPANY the applicant for the patent to make this declaration on its behalf.

2. The basic application as defined by Section 141 of the Act was made in the United States of America on the 16th day of December, 1988, by Ian Alfred Cody and David Lloyd Brown.

3. Ian Alfred Cody of 2104 Huron Shores Drive, Clearwater, Ontario, Canada and David Lloyd Brown of R.R. #3 Wyonming, Ontario, Canada, respectively are the actual inventors of the invention and the facts upon which EXXON RESEARCH and ENGINFERING COMPANY is entitled to make the application are as follows:

The said EXXON RESEARCH AND ENGINEERING COMPANY is the assignee of the said Ian Alfred Cody and David Lloyd Brown.

4. The basic application referred to in paragraph 2 of this Declaration was the first application made in a Convention country in respect of the invention the subject of the application.

DECLARED at Florham Park, New Jersey 07932, United States of America this 18th day of July , 1989.

EXXON RESEARCH AND ENGINEERING COMPANY

By Anne Hershkowitz Jacobson
Assistant Secretary
Anne Hershkowitz Jacobson

SEAL

To:
THE COMMISSIONER OF PATENTS.

(12) PATENT ABRIDGMENT (11) Document No. AU-B-36342/89
(19) AUSTRALIAN PATENT OFFICE (10) Acceptance No. 612200

(54) Title
UPGRADING WAXY DISTILLIATES AND RAFFINATES BY THE PROCESS OF HYDROTREATING AND HYDROISOMERIZATION

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(71) Applicant(s)
EXXON RESEARCH AND ENGINEERING COMPANY

(72) Inventor(s)
IAN ALFRED CODY; DAVID LLOYD BROWN

(74) Attorney or Agent
WATERMARK PATENT & TRADEMARK ATTORNEYS , Locked Bag 5, HAWTHORN VIC 3122

(56) Prior Art Documents
US 4518485

(57) Claim

1. A method for upgrading waxy distillates and raffinates so as to achieve increased yields of all of increased viscosity index by the process comprising the steps of:

(a) hydrotreating the waxy distillate or raffinate under metal conditions so as to reduce the sulfur and nitrogen content thereof but convert less than 20% of the waxy distillates or raffinate feed into products boiling lower than the feed;

(b) isomerizing the hydrotreated feed from step (a), over a low total fluorine content isomerization catalyst having a fluorine content of less than 2 wt%, in the presence of hydrogen;

(c) dewaxing the isomerate to a pour point of 0°C and less.

Form 10

COMMONWEALTH OF AUSTRALIA

PATENTS ACT 1952-69

COMPLETE SPECIFICATION

(ORIGINAL)

612266

Class Int. Class

Application Number:
Lodged:

Complete Specification Lodged:
Accepted:
Published:

Priority :

Related Art :

Name of Applicant : EXXON RESEARCH AND ENGINEERING COMPANY

Address of Applicant : Box 390, Florham Park, New Jersey 07932, United States of America

Actual Inventor: IAN ALFRED CODY and DAVID LLOYD BROWN

Address for Service : ~~ED DX WATERS & SONS,~~ Watermark Patent & Trademark Atorneys
50 QUEEN STREET, MELBOURNE, AUSTRALIA, 3000.

Complete Specification for the invention entitled:

UPGRADING WAXY DISTILLIATES AND RAFFINATES BY THE PROCESS OF HYDROTREATING AND HYDROISOMERIZATION

The following statement is a full description of this invention, including the best method of performing it known to :- us

PRESENT INVENTION

Waxy distillates, and raffinates are treated so as to achieve high yields of lube oil of increased viscosity index by selectively converting the wax into oil. The waxy oil feed is first hydrotreated under mild conditions to reduce the sulfur and nitrogen content but convert less than 20% of the feed into products boiling lower than the feed. This hydrotreated feed is then passed with hydrogen over a low fluorine content isomerization catalyst, preferably a catalyst having a particle size of less than 1/16 inch and a fluorine content of less than 2 wt%. Optionally, the isomerized distillate or raffinate can be treated in a subsequent third treatment unit employing a good hydrogenation catalyst if necessary, to produce a product of improved stability and color.

DESCRIPTION OF THE INVENTION

Waxy hydrocarbon oils such as waxy distillates and raffinates containing from as little as 10% wax but more typically about 30% or more wax are upgraded by a process comprising the steps of hydrotreating the waxy oil to produce a material of reduced sulfur and nitrogen content, isomerizing the hydrotreated material over a low fluorine content isomerization catalyst preferably a low fluorine content small particle size isomerization catalyst, one having a fluorine content of less than 2 wt% and a particle size of less than 1/16 inch diameter and solvent dewaxing the resulting isomerate to produce an oil product of high viscosity index, low wax content, and low pour point in high yield.

Hydrotreating can be conducted under typical hydrotreating conditions to reduce sulfur and nitrogen

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contents to levels of 5 ppm or less nitrogen and 5 ppm or less sulfur. Any of the conventional hydrotreating catalysts can be employed, like Ni/Mo on alumina, Ni/W on alumina, Co/Mo on alumina, etc.; in other words, any of the Group VI-Group VIII on refractory metal oxide hydrotreating catalyst. Commercial examples of such catalysts are identified as HDN-30 and KF-840.

The hydrotreated waxy oil is stripped to remove NH_3 and H_2S and then isomerized over an isomerization catalyst. The isomerization catalysts are Group VIII metal on low fluorine content refractory metal oxide supports. Preferred catalysts contain Group VIII noble metals, e.g. platinum and palladium, typically 0.1 to 2.0 wt%. The catalysts preferably contain from 0.1 to up to but less than 2 wt% fluorine, preferably from 0.1 to 1.5 wt% fluorine. The refractory metal oxide support material is preferably an alumina containing material, more preferably predominantly (i.e. >50%) alumina, most preferably gamma or eta alumina. The support is preferably of small particle diameter of less than 1/16 inch and smaller. A preferred catalyst is noble Group VIII metal on 0.1 to up to but less than 2 wt% fluorine on alumina particles of diameter less than 1/16 inch. A more preferred catalyst is Pt or Pd on 0.1 to up to but less than 2 wt% fluorine (preferably 0.1 to 1.5 wt% fluorine) on alumina particles of diameter less than 1/16 inch (preferably 1/20 inch alumina trilobes). Preferably the catalyst is fluorided using an aqueous solution of NH_4F.

Isomerization is generally conducted at a temperature between about 300 to 400°C, preferably 300 to 380°C, a pressure between about 500 to 5000 psig, preferably 1000 to 2000 psig, a hydrogen gas treat rate of 500 to 10,000 SCF H_2/bbl, preferably 2,000 to 5,000 SCF

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H_2/bbl, and a LHSV of .5 to 5 V/V/hr, preferably 1 to 2 V/V/hr.

The total isomerate is generally then dewaxed under standard solvent dewaxing conditions to a low pour point on the order of 0°C and less, preferably -10°C and less, most preferably -20°C and less. In a preferred embodiment the total isomerate (before or after solvent dewaxing) is treated in a subsequent low temperature hydrogenation zone employing a good hydrogenation catalyst. This low temperature hydrogenation zone is run at a temperature in the range of about 170 to 270°C, preferably about 180 to 220°C, a pressure of about 300 to 1500 psi H_2, preferably about 500 to 1000 psi H_2, a hydrogen gas rate of about 500 to 10,000 SCF H_2/bbl, preferably 1000 to 5000 SCF H_2/bbl and a flow velocity of about 0.25 to 10 V/V/hr, preferably about 1 to 4 V/V/hr. This low temperature treatment is taught in copending application, Australian Patent Application No. 26941/88 filed December 16, 1988 in the names of Cody, MacDonald, Eadie and Hamner. This third catalytic stage is practiced to further improve the stability and the color of the product. The catalyst used in this stage can be any good hydrogenation catalyst, preferably a noble Group VIII metal on fluorided alumina, fluorine level ranging from zero to 10 wt%, more preferably a noble Group VIII metal on low fluorine (less than 2 wt% F) on small particle size alumina (less than 1/16 inch diameter) catalyst. While this third catalytic stage will help improve stability and color, it will not be completely effective if excessively severe conditions are used in either of the first 2 stages. It is preferred that temperatures in either of the first two stages do not exceed 380°C.

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The dewaxing solvent used can include the C_3-C_6 ketones such as methyl ethyl ketone, methyl isobutyl ketone, mixtures of MEK and MIBK, aromatic hydrocarbons like toluene, mixtures of ketones and aromatics like MEK/toluene, ethers such as methyl terbutyl ethers and mixtures of same with ketones or aromatics. Similarly, liquefied, normally gaseous hydrocarbons like propane, propylene, butane, butylene, and combinations thereof.

The waxy oils treated in the process contain as little as 10% but more typically about 30% or more but less than 70% wax. The oils are distillates boiling in the lube oil boiling range or waxy raffinates from which aromatic hydrocarbons have been solvent extracted. Typical feeds may be waxy distillates or raffinates boiling in the range 300 to 700°C. High wax content oils are usually not considered good lube oil feedstocks because the high wax content overloads wax recovery in the solvent dewaxing process. Similarly, high wax content means that catalytic dewaxing converts a substantial fraction of the feed to gaseous or light liquid product with a concomitant loss in overall lube oil yield.

EXAMPLES

Catalyst 1 contains 0.4 wt% F on a reforming grade catalyst originally containing 1% Cl^- and 0.3% Pt on 1/16 inch Al_2O_3. The comparative Catalyst 2 comprises 3% F on the same Pt/Al_2O_3 base. In both catalysts, fluoride was deposited using NH_4F aqueous solution using the incipient wetness technique, described below.

The feed to these catalysts was a South Louisiana hydrotreated raffinate. The properties of the original waxy raffinate prior to hydrotreating were:

Refractive Index	1.4667
Density at 15°C	0.8898
Total Nitrogen, ppm	140
Sulfur (X-ray), wt%	0.33
GCD °C, ibp/1	332/359
5/10	426/451
20/30	476/492
40/50	504/516
60/70	527/539
80/90	553/570
95/fbp	585/614

To establish the inherent properties of the oil component of the raffinate, dewaxing was performed on a portion of the feed using 100% MIBK at 3:1 solvent:feed ratio and a filter temperature of -13°C.

The dewaxed oil inspections on the raffinate were:

Recovered Wax, wt%	10.4
Viscosity @ 40°C, cSt	165.64
Viscosity @ 100°C, cSt	14.91
Viscosity Index	88
Pour Point, °C	-9
HPLC Separation	
Saturates, wt%	75.6
Aromatics, wt%	23.4
Recovery, wt%	99

The waxy raffinate itself contains a substantial quantity of saturated rings (naphthenes) which are poor VI molecules. However, VI can be increased somewhat with subsequent hydrotreating which converts a portion of the naphthenes into iso-paraffins. Hydrotreating also serves to lower sulfur and nitrogen concentrations.

Hydrotreating of the above waxy raffinate was performed using a NiW/Al_2O_3 catalyst containing about 6% fluorine following in-situ fluoriding using ortho-fluoro toluene. Properties of this catalyst and the method of activating are discussed below.

The hydrotreating catalyst was run at the following conditions:

Temperature, °C	353
Feed Rate, v/v/h	0.5
Gas Rate, SCF/B	3000
Pressure, psi H_2	600

These conditions are sufficient to reduce both S and N in the waxy product to <1 ppm each and mild enough so that less than 20% of the feed is

converted into products boiling below the boiling point of the feed.

Again, to establish the properties of the oily component of this hydrotreated waxy raffinate, the total liquid product was topped to 370°C on a Model C Hivac (removing 3.9 wt% 370°C⁻), then dewaxing was performed on a 370°C+ portion of the feed using 20/80 MEK/MIBK at 4:1 solvent:feed ratio and a filter temperature of -13°C.

The dewaxed oil inspections on the 370°C+ topped hydrotreated raffinate were:

Recovered Wax, wt%	13.0
Viscosity @ 40°C, cSt	116.16
Viscosity @ 100°C, cSt	12.28
Viscosity Index	95.5
Pour Point, °C	-12

Notice that the wax content of this product is relatively higher than in the original raffinate, i.e. conventional raffinate hydrotreating does <u>not</u> convert wax selectively.

The raffinate isomerization step was performed using the waxy total liquid product from the raffinate hydrotreating step as feed. The products from this part of the process were dewaxed using 20/80 MEK/MIBK at 4:1 solvent:feed ratio and a filter temperature of -13°C. The several products derived from treatments and the various conditions used over Catalyst 1 (low fluorine) and Catalyst 2 (high fluorine) are shown in Table 1.

Both Catalysts 1 and 2 convert the wax component of the hydrotreated raffinate more selectively than the other molecules in the feed since in all cases the residual wax in the 370°C+ product falls below the feed value of 13.0 wt%. In this respect, Catalysts 1 and 2 behave differently from the catalyst used in the hydrotreating step. Catalyst 1 though, is much more effective at wax conversion than catalyst 2 and is also better at increasing VI.

Taking the 370°C+ dewaxed raffinate feed as representing 100% of recovered product, Catalyst 1 preserves high relative yields (80 to 90%) while increasing the VI by as much as 10 to 17 points.

It is apparent from Table 1 that Catalyst 1 must be doing more than just isomerizing wax in order for the VI to be as high as 113. For example, even if all of the original wax in the hydrotreated raffinate feed were to be isomerized directly into 145 VI isomerate, this would still only raise the VI to just above 100 if no other chemistry were taking place. Clearly Catalyst 1 is also an excellent catalyst for ring opening naphthenes.

These results demonstrate that low fluoride level Al_2O_3-based catalysts are excellent "raffinate isomerization" catalysts even on low wax content feeds. However, even higher VI's can be obtained from raffinates or distillates derived from the waxier crudes.

Preferred catalysts for raffinate isomerization, therefore, are Al_2O_3-based catalysts comprising Group VIII metals or Group VIII/Group VI combinations and containing less than 2% F, preferably 0.2 to 1.5

wt% F. The preferred fluoriding media is aqueous NH_4F.

Experimental

(a) Test Units

The NH_4F-treated catalysts were tested in two different units in an upflow mode with 100 cc catalyst charges. These units are similar in design and operation and have previously given identical results for isomerization of a given feed by a standard catalyst. Both units operated on an eight hour per day basis.

(b) Activation Procedure

Each catalyst was activated in the same fashion:

1. Heat from room temperature to 100°C in H_2 at 50 psi, 3 cubic ft/hr over a two hour period.

2. Hold at 100°C for one hour.

3. Raise temperature to 350°C over a two hour period.

4. Hold at 350°C for one hour.

5. Cool to below 300°C, adjust pressure to 1000 psi (6.9 MPa) and gas rate to 5000 SCF/B (888 API m^3/m), and cut in feed at 0.9 v/v/hr (where LHSV is based on feed at room temperature).

(c) Oil Yield Determination

Oil yields on 370°C+ fractions (obtained by distillation on a Model C Hivac) were determined by the modified ASTM D3235 procedure, incorporating 100% MIBK as solvent rather than 50:50 MEK/toluene and by filtering at -35°C.

(d) Preparation of NH_4F Treated Catalysts

100 grams of a commercial reforming grade Pt on γAl_2O_3 1/16" extrudates catalyst containing 0.3 Pt and 1% Cl^- was treated with 55 ml of aqueous solutions containing NH_4F by drop-wise addition and stirring. This volume of solution was sufficient to just wet the entire 100 gm of catalyst.

The amount of hygroscopic NH_4F used to make up the 55 ml solution was:

Catalyst 1	1.05 gms (0.4% F on catalyst)
Catalyst 2	8.4 gms (3% F on catalyst)

The wetted extrudates were left for one hour at room temperature, dried at 120°C for 16 hours, then calcined in an air flow at the following conditions: hold at 150°C for one hour; raise temperature by 50°C every 15 minutes to 400°C; then hold at 400°C for one hour.

Table 1
Low Fluoride Catalyst Produces High VI Product in High Yields

Reaction Conditions	Hydrotreated Raffinate Feed	Catalyst 1 (0.4% F)				Catalyst 2 (3.0% F)			
Temperature, °C	-	361	364	372	380	303	286	276	282
Feed rate, v/v/h	-	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Gas rate, SCF/b	-	5000	5000	5000	5000	5000	5000	5000	5000
Pressure, psi H_2	-	1000	1000	1000	1000	1000	1000	1000	1000
Time on stream (1), hrs	-	169 to 170.5	176 to 177.5	182 to 183.5	185 to 190	71.5 to 74	79 to 81	87 to 89	93.7 to 95.5
Product Inspections									
Conversion to 370°C-, wt%	3.9	15.9	20.0	24.9	40.0	53.1	26.9	16.4	16.4
Dry wax in 370°C+, wt% (on feed)	13.0	9.7	8.9	7.5	6.4	9.6	11.0	12.4	12.0
Dewaxed Oil									
370°C+ yield on feed, wt%	83.6	75.9	72.9	69.4	56.1	42.4	65.1	73.2	73.6
Relative 370°C+ oil yield,%	100	90.8	87.2	83.0	67.1	50.7	77.8	87.6	88.0
Viscosity @ 40°C, cSt	116.16	72.68	64.45	56.39	47.12	54.77	85.76	96.08	93.2
Viscosity @ 100°C, cSt	12.28	9.42	8.79	8.14	7.30	7.75	10.12	10.85	10.69
Viscosity Index	95.5	106.5	109.7	113.0	116.1	105.7	98	96	97
Pour Point, °C	-12	-12	-12	-12	-15	-12	-12	-12	-12
ASTM Color D150	1.5	1.5	1.5	1.5	2.0	0.0	0.0	0.0	0.0

(1) Both Catalysts 1 and 2 had been on stream on hydrotreated 600N slack wax for 137 hours and 52 hours, respectively, prior to introduction of hydrotreated raffinate.

Example 2

This example shows the criticality of practicing hydrotreating and isomerization in sequence rather than by hydrotreating alone. The two stage process incorporates a conventional hydrotreating catalyst (KF-840) in the first stage and a 0.3 Pt on 0.4% F/Al_2O_3 catalyst in the second stage. The one stage process used a Ni-W on Al_2O_3 catalyst that containing about 6% fluorine following in-situ fluoriding using ortho fluoro toluene, on unhydrotreated distillate.

The waxy distillate contained about 42% wax, had a VI of about 85 and a viscosity @ 100°C of 6.5.

The results are presented in Table 2.

Table 2

WAXY DISTILLATE UPGRADED BY LOW FLUORIDE CATALYST

Feed: Waxy Broadcut Distillate (370 to 540°C)

Catalyst	Feed	NiW/F-Al_2O_3 (feed not hydrotreated)	Pt/F Al_2O_3 0.4%F 1/16" Extrudates (following hydrotreating using KF 840)
Reactor Temp. °C		385	390
LHSV, v/v/h		0.9	1.0
Pressure, psi H_2		1230	1000
Gas Rate, SCF/B		5000	5000
Net Conversion to 370°C-	-	20.0	11.2
VI	85	120	120
Viscosity, 100°C, cSt	6.5	4.7	4.6
% Wax in 370°C+	42	43	38
DWO Yield on Distillate, wt%	100	45.6	55.0

It is seen that the two-stage process can result in higher yields of a high VI product as compared to a one stage process. From all the above, it is seen that low fluorine catalysts are selective for wax conversion while high fluorine catalysts (e.g. ~3%) are not. Furthermore, low fluorine catalysts convert less material to 370°C⁻ product in producing oils of essentially the same VI and viscosity.

Example 3

Platinum on low fluoride content small particle size alumina catalysts were compared with platinum on low fluoride content larger (1/16 inch diameter) particle size alumina catalyst and platinum on high fluoride content small particle size alumina catalyst for wax isomerization. It was discovered that the low fluoride content small particle (1/20 inch diameter) catalysts are more selective for wax isomerization than either the low fluoride/large particle or high fluoride/small particle catalyst.

Catalysts A and B are low fluoride small particle catalysts; Catalyst C is a low fluoride, larger particle size catalyst; Catalysts D and E are high fluorine, larger particle and high fluorine small particle size catalyst respectively. These catalysts were evaluated for the isomerization of hydrotreated slack wax obtained from the dewaxing of 600N oil. Hydrotreating was accomplished using Ni/Mo alumina catalyst (KF-840) to a sulfur level of less than 1 ppm and a nitrogen level of less than 1 ppm. Wax isomerization was performed at the conditions recited in Table 3 which also reports the isomerization results.

It is seen that Catalysts A and B produced substantially higher yields of oil as compared to the product yields resulting from the use of Catalysts C, D and E.

TABLE 3

YIELD ADVANTAGES AT LOW FLUORIDE CONTENT AND SMALL PARTICLE SIZE

FEED: HYDROTREATED 600N SLACK WAX (20% OIL IN WAX)

Composition

	A	B	C	D	E
F, wt%	0.93	0.5	0.42	7.0	6.7
Pt, wt%	0.3	0.3	0.3	0.58	0.62
Particle Diameter (inch)	1/20	1/20	1/16	1/16	1/20
Shape (1)	T	T	E	E	T
Reaction Temp, °C (2)	355	370	380	320	330
Pressure, psi H_2	1000	1000	1000	1000	1000
LHSV, v/v/hr	1.0	1.0	1.0	1.0	1.0
Gas Rate, SCF/B	2500	2500	2500	2500	2500
370°C+ Yield on feed,wt% (3)	60	67	55	50	50

(1) E=extrudate, T=trilobe
(2) Temperature required for 70% conversion of wax in feed after 250 hr on stream.
(3) Maximum once-through yield of 370°C+ oil based on oil content determination using 100% MIBK.

Example 4

This example illustrates how a 2-staged process may be used to improve product color versus the 1-staged process. The poor stability and poor color of hydrotreated products versus solvent processed products is difficult to avoid in a one stage process because the conditions required for desirable ring opening are severe enough to create unstable and/or colored species. We have found that even the best conventional catalysts, such as Ni-W/F Al_2O_3 require temperatures of 370°C or higher to achieve significant VI improvement of raffinates or distillates. On the other hand, the 2 stage process is more flexible, and lower temperatures can be used to achieve the same VI improvement. For example, the first stage catalyst (R1) does not have to operate as a ring opening catalyst, except as is needed to lower nitrogen to ~1 ppm. Also the second stage catalyst (R2) may operate at low temperatures if the right catalyst composition is used. In Example 2, the second stage operated at relatively high temperatures but, as taught in the preceding Example 3, activity can be traded for selectivity. Reference to Table 4 shows that by adjustment of the fluoride content (i.e. low fluorine content) and the use of smaller sized catalyst particles, a desirable product can be made at moderate conditions from a 700N waxy raffinate.

Products of about the same VI and yield were made by both a one-stage treatment and by 2-stage treatment. The 2-staged product was lightly colored, whereas the one-staged product was bright yellow.

Thus 2 staging produces a significant advantage for lube products which are to be formulated for industrial oils use or to be sold as base oils.

TABLE 4

COMBINATION PROCESS ALLOWS LOW TEMPERATURES

STABLE PRODUCTS MAY BE MADE

Feed: 700N Waxy Raffinate

	Feed	1-Stage Process	2-Stage Process	
			R1	R2
Catalysts		$Ni-W/F-Al_2O_3$	$Ni-W/F-Al_2O_3$	$Pt\ F/Al_2O_3$ (1%F)/1/20" trilobe
Process Conditions				
Temperature, °C	-	375	363	340
Pressure, psi H_2	-	1230	1230	1000
LHSV, v/v/hr	-	0.9	0.9	0.9
Dewaxed Oil Product Properties (370°C+)				
VI	89	114.6	104.3	112
Viscosity, @100°C, cSt	14.8	8.7	10.7	8.6
Yield on feed, wt%	100	84.9	90.4	82.8
Wax Content in 370°C+	14.6	18.6	17.3	11.9
Color		Bright Yellow		light color

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:
~~CLAIMS~~

1. A method for upgrading waxy distillates and raffinates so as to achieve increased yields of all of increased viscosity index by the process comprising the steps of:

(a) hydrotreating the waxy distillate or raffinate under metal conditions so as to reduce the sulfur and nitrogen content thereof but convert less than 20% of the waxy distillates or raffinate feed into products boiling lower than the feed;

(b) isomerizing the hydrotreated feed from step (a), over a low total fluorine content isomerization catalyst having a fluorine content of less than 2 wt%, in the presence of hydrogen;

(c) dewaxing the isomerate to a pour point of 0°C and less.

2. The method of claim 1 wherein the waxy distillate or raffinate feed contains as little as 10% wax.

3. The method of claim 1 wherein the waxy distillate or raffinate feed boils in the range of 300 to 700°C and contains ~~about~~ 30% or more but less than 70% wax.

4. The method of claim 1 wherein the isomerization step is conducted at a temperature between ~~about~~ 300 to 400°C, a pressure between ~~about~~ 500 to 5000 psig, a hydrogen gas treat rate of 500 to 10,000 SCF H_2/bbl, and a LHSV of 0.5 to 5 V/V/hr.

AUSTRALIAN PATENT OFFICE

5. The method of claim 1 further comprising the step of treating the isomerate in a low temperature hydrogenation zone employing a hydrogenation catalyst before or after the dewaxing step.

6. The method of claim 1, 2, 3, 4 or 5 wherein the isomerization catalyst comprises a Group VIII noble metal on a 0.1 to up to but less than 2 wt% fluorine content on alumina containing refractory metal oxide support.

7. The method of claim 6 wherein the isomerization catalyst has a particle size of of less than 1/16 inch diameter.

8. The method of claim 6 wherein the isomerization catalyst comprises a Group VIII noble metal on a 0.1 to 1.5 wt% fluorine on alumina support.

9. The method of claim 8 wherein the isomerization catalyst comprises 1/20 inch alumina trilobes.

DATED this 13th day of June 1989.

EXXON RESEARCH AND ENGINEERING COMPANY

WATERMARK PATENT & TRADEMARK ATTORNEYS
50 QUEEN STREET
MELBOURNE. VIC. 3000.