Catalysts and Technology Licensing
A case study

ExxonMobil

InFocus™ Online Lube Optimization Model was used to analyze the effect of raising pour point on catalyst yield and life

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Situation

A major North American base oil producer has 2 production units. One of the units consists of a Lube Hydrotreater/Hydrocracker (HDT/HDC) and is integrated with a hydrodewaxing unit using ExxonMobil's proprietary MSDW™ dewaxing catalyst technology. The current production rate of this unit is 20 KBD.

Challenge

The refiner has a base oil pour point specification at -15°C; however, in order to ensure that product consistently meets specification, the operator is controlling pour point at an average of -18°C. The operator wanted to understand the potential yield improvement of the 20KBD unit if the pour point was modified from -18°C to -15°C.

Solution

ExxonMobil's InFocus™ Online Lube Optimization Model includes lube hydrocracker (LHDC) and MSDW™ dewaxing technology modules, which can be run independently or linked. Each module predicts process performance, product yields and qualities based on key operating variables such as average reactor temperature, space velocity, pressure, product fractionation cut point and separation efficiency.

In this scenario, the InFocus Online Lube Optimization Model calculated potential improvements in yield, energy consumption and catalyst life. The ultimate decision was made by the operator based on information provided in the model.

Modification of pour point could lead to:

>$200,000
ADDITIONAL POTENTIAL PRODUCT SALES

>$20,000
FUEL SAVINGS POTENTIAL OVER 6 MONTHS

The following is the process condition of the unit:

Feed Information:		
Waxy Sulfur	2.6	wt%
Waxy Nitrogen	884	ppm
Total Aromatics	49.6	wt%
Density @15°C	0.927	g/cc
Distillation (ASTM D2887)		
5%	389	°C
50%	458	°C
95%	511	°C

Feed 370°C+ Dewaxed Oil Qualities		
Dewaxed Oil Pour Point	-23	°C
Dewaxed viscosity @40°C	128.8	cSt
Dewaxed viscosity @100°C	10.6	cSt
Dry Wax	11.7	wt%

Feed Information:		
HDT Catalyst Volume (fract of LHDC)	1	-
LHDC Reactor Pressure (psig)	1600	psig
370°C+ Conversion	25	wt%
Liquid Hourly Space Velocity	0.5	hr^{-1}
Treat Gas Ratio	2500	scf/b

MSDW Catalyst

Tower Cut Points		
Naphtha	32	°C
Diesel	150	°C
Extra Light Lube	300	°C
Light Lube	300	°C
Medium Lube	314	°C
Heavy Lube	378	°C

Operating Variables		
Reactor Pressure	1450	psig
Lube Product Pour Point	-15	°C
Liquid Hourly Space Velocity (dewaxing catalyst only)	1.6	hr^{-1}

Product Specification		
Product CCS Reference Temperature	-30	°C

Results*:	
Total base oil (light and heavy) yield at PP @ -15°C	80.3 wt%
Total base oil (light and heavy) yield at PP @ -18°C	79.8 wt%
Estimated additional yield gain of	0.5 wt

Benefits:	
Volume yield at -15°C PP	86.5 vol%
Volume yield at -18°C PP	86.0 vol%
Delta volume yield gain	0.5 vol%
Total volume involved	0.1 KBD

Reactor Operating Temperature:	
WABT for PP @ -15°C	324°C
WABT for PP @ -18°C	326°C

Benefits of 2°C which may translated to lower energy cost or furnace firing:

Mass flow rate	= 132.5m^3/hr x 927 kg/m^3 = 122,827 kg/hr
Energy Saving	= 122,827 kg/hr x 2.13 kJ/kg.K x (2K) = 523,245 kJ/hr
Yearly Energy Saving	= ~650 FOEB

Catalyst Life Benefits:	
Estimated catalyst life benefits	+0.7 yrs

*Results are approximate

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