Catalysts and Technology Licensing
A case study

ExxonMobil

InFocus™ Online Lube Optimization Model allows the user to evaluate the impact of changes in base stock viscosity

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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 recently explored a new market where a base stock with 6.3 cSt viscosity offered higher margin compared with a 6.8 cSt viscosity base stock typically produced by the unit. To evaluate the economic impact of this new viscosity grade, the company wanted to understand the impact to the overall production yield, energy and catalyst life.

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 was used to calculate potential impact to yield, energy consumption and catalyst life based on changes in viscosity. The ultimate decision was made by the operator based on information provided in the model.

The potential impact of producing a lower viscosity product:

potential Net $750,000/year

ADDITIONAL REVENUE FOR HIGHER VALUE PRODUCT

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*:					
No.	**Parameters**	**Unit**	**6.8 cSt (a)**	**6.3 cSt (b)**	**Delta (b) - (a)**
1.	HDT/HDC Conversion	wt%	25	30	5
2.	Total base oil yield	wt%	80.3	76.8	-3.5

Reactor Operating Temperature:	
HDT WABT for 25% Conversion	347°C
HDT WABT for 30% Conversion	354°C

Debit of 7°C which may translated to higher energy cost or furnace firing:

Mass flow rate	= 132.5m^3/hr x 927 kg/m^3 = 122,827.5 kg/hr
Energy Debit	= 122,827.5 kg/hr x 2.13 kJ/kg.K x (7 K) = 1832074 kJ/hr
Yearly Energy Debit	= ~2300 FOEB

Catalyst Life Benefits:	
Estimated catalyst life	-0.7 yrs

*Results are approximate

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