



Online Lube Optimization Mode calculates impact of raising nitrogen feed on catalyst life

Energy lives here

Situation

A major North American base oil producer has 2 production units. One of the units consists of a Lubes 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 wanted to understand the impact of running a higher nitrogen feed stock in order to identify the best strategy to minimize impact on the life of the catalyst.

Solution

The 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 Online lube optimization model was used to calculate the possible impact on catalyst life from the effects of running a higher nitrogen feedstock. The ultimate decision was made by the operator based on information provided in the model.

Potential tradeoff of running
higher nitrogen feedstock:

MSDW CATALYST LIFE
IMPACT

-4 months

HDT CATALYST LIFE
IMPACT

-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 [*] :					
No.	Parameters	Unit	N 884 ppm (a)	N 1600ppm (b)	Delta (b) - (a)
1.	HDT/HDC Product N	ppm	4.6	8.2	3.6
2.	HDT/HDC WABT	°C	347	347	0
3.	MSDW™ Product N	ppm	0.3	0.6	0.3
4.	MSDW™ WABT	°C	324	325	1

Catalyst life impact -0.3 yrs MSDW

Results [*] :					
No.	Parameters	Unit	N 884 ppm (a)	N 1600ppm (b)	Delta (b) - (a)
1.	HDT/HDC Product N	ppm	4.6	4.6	0
2.	HDT/HDC WABT	°C	347	351	4
3.	MSDW™ Product N	ppm	0.3	0.3	0
4.	MSDW™ WABT	°C	324	324	0

Catalyst life impact -0.5 yrs HDT

*Results are approximate

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<https://www.exxonmobilchemical.com/en/catalysts-and-technology-licensing/lube-optimization-model>

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