



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

Energy lives here™

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

Collaborate with us today.
www.exxonmobil.com/InFocus

©2020 ExxonMobil. ExxonMobil, the ExxonMobil logo, the interlocking "X" device and other product or service names used herein are trademarks of ExxonMobil, unless indicated otherwise. This document may not be distributed, displayed, copied or altered without ExxonMobil's prior written authorization. To the extent ExxonMobil authorizes distributing, displaying and/or copying of this document, the user may do so only if the document is unaltered and complete, including all of its headers, footers, disclaimers and other information. You may not copy this document to or reproduce it in whole or in part on a website. ExxonMobil does not guarantee the typical (or other) values. Any data included herein is based upon analysis of representative samples and not the actual product shipped. The information in this document relates only to the named product or materials when not in combination with any other product or materials. We based the information on data believed to be reliable on the date compiled, but we do not represent, warrant, or otherwise guarantee, expressly or impliedly, the merchantability, fitness for a particular purpose, freedom from patent infringement, suitability, accuracy, reliability, or completeness of this information or the products, materials or processes described. The user is solely responsible for all determinations regarding any use of material or product and any process in its territories of interest. We expressly disclaim liability for any loss, damage or injury directly or indirectly suffered or incurred as a result of or related to anyone using or relying on any of the information in this document. This document is not an endorsement of any non-ExxonMobil product or process, and we expressly disclaim any contrary implication. The terms "we," "our," "ExxonMobil Chemical" and "ExxonMobil" are each used for convenience, and may include any one or more of ExxonMobil Chemical Company, Exxon Mobil Corporation, or any affiliate either directly or indirectly stewarded.