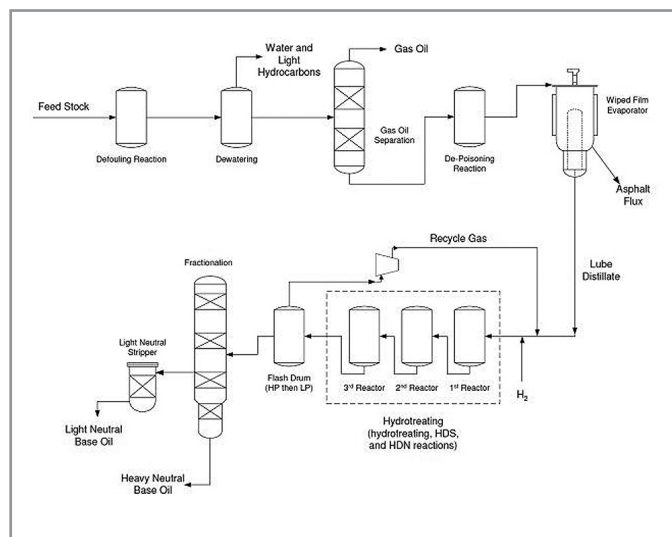


Used Oil Re-refining: Improvements in CEP Technology Make Economics More Attractive

Introduction

Lube base oil is one of the most valuable components in a barrel of crude oil. While many components of crude oil such as gasoline, jet and diesel fuels are 'lost' after combustion, lube base oil can be recovered and 'regenerated' to the quality equal to or better than its original virgin form by using a proper re-refining process such as Chemical Engineering Partner's (CEP) hydrotreating process. While there are other re-refining processes available such as clay treatment and solvent extraction, the lube oil produced from those processes does not meet the specifications of API Group II base oil. This is because of their inability to reduce the sulphur concentration low enough to produce the API Group II base oil. They also suffer lower yield due to the loss of product inherent to their processes. For example, the solvent extraction process achieves a high saturates concentration by selectively extracting the aromatic compounds. However, doing so also removes valuable products from the total lube oil available in the used oil. CEP's hydrotreating process, instead, converts these aromatics into saturated hydrocarbons, hence maintaining the highest yield of base oil recovery among all re-refining processes.



CEP's re-refining process, shown on the process flow diagram above, is regarded by many industry experts as the best available hydrotreating technology to recover and regenerate lube base oil. Such accomplishments could only be achieved by numerous advancements that were made since its start-up over 25 years ago.

Defouling Process

The chemical additives in the motor oil lead to two major processing challenges in re-refining. One is the fouling and corrosion of process equipment and the other is the poisoning of the hydrotreating catalysts. In order to minimise the fouling of the process equipment, CEP tested the Mohawk process developed by the Mohawk Re-Refinery in Vancouver, B.C. The Mohawk process treats the incoming feedstock to prevent fouling by neutralising the remnants of the chemical additives. Improvements and enhancements were subsequently made and reported.⁽¹⁻³⁾

Further research led to a better understanding of the fundamentals and the resulting improvements were patented.⁽⁴⁾

The process was further perfected by instrumenting the correct amount of heat and dosage of chemicals to the incoming feedstock. This significantly reduced fouling of process equipment and is referred to as 'Defouling Process' by CEP.

Catalyst Poisons

One of the causes that poison the catalysts is the 'entrainment' effect where the vapour carries the liquid droplets that contained the catalyst poisons during the flashing of the used oil in the wiped film evaporator. Through numerous tests and analyses, CEP has optimised the process conditions that allow the maximum lube oil recovery while minimising the entrainment of the catalyst poisons.

CEP conducted a major study on catalyst poisons in the full-scale semi-works operation to develop the 'De-Poisoning Process' to remove the hydrotreating catalyst poisons. In the 'De-Poisoning Process', the catalyst poisons are polymerised into high molecular weight compounds. The polymerised poisons are