Merox™ Process for Fixed-Bed Sweetening

Introduction

The Merox process for fixed-bed sweetening is one of the family of Merox process applications developed for control of mercaptans (thiols) in hydrocarbon streams. The conventional version of this process uses a fixed-bed catalyst, air, and caustic (NaOH) to treat hydrocarbon feeds such as heavy straight-run gasolines, visbroken and coker derived naphthas, kerosenes, and diesels. Depending on the application, pre- and post-treatment sections may be included in the process flow.

Chemistry

Merox sweetening involves the catalytic oxidation of mercaptans to disulfides in the presence of oxygen and alkalinity. Air provides the oxygen, and caustic provides the alkalinity. The disulfides formed remain in the treated hydrocarbon stream. The sweetening reaction is shown below:

\[ 4 \text{ RSH} + \text{O}_2 \rightarrow 2 \text{RSSR} + 2 \text{H}_2\text{O} \]

R represents a hydrocarbon radical that may be aliphatic, aromatic, or cyclic, and saturated or unsaturated. Merox catalyst accelerates the reaction rate to permit economical treating at normal refinery product rundown temperatures.

Process Flow Description

The reactor section of a fixed-bed sweetening Merox unit consists of a vertical fixed-bed reactor followed by a caustic settler. Air, the source of oxygen, is injected into the feedstock upstream of the reactor. The mixture enters the top of the reactor and percolates downward through the catalyst bed. The operating pressure is chosen to assure that the air required for sweetening will be completely dissolved at the operating temperature. The sweetened product exits the reactor and flows to the caustic settler. The caustic settler contains a reservoir of caustic for use in keeping the Merox catalyst alkaline. The caustic is periodically circulated over the reactor bed, while maintaining operations.

Depending on the feedstock properties and product specifications, a pre- and post-treatment section may be included in the flow scheme. A caustic prewash may be included upstream of the reactor to remove hydrogen sulfide or naphthenic acids. Post-treatment may include a sand filter, or in the case of jet fuels, a water wash, salt filter, and clay filter.

Benefits

Low Capital Investment

The non-corrosive environment, near ambient operating temperature and low design pressure allow for carbon steel construction throughout. The simple process flow lends itself well to modular fabrication.
LOW OPERATING COST
Operating costs are very low. Catalyst, chemical, and utility costs are only about one U.S. cent per barrel of treated product.

EASE OF OPERATION
A fixed-bed sweetening Merox unit is easy to operate. A wide range of feed rates and mercaptan concentrations can be accommodated by adjusting air rate and periodic reactor caustic circulation.

PRODUCT QUALITY
- The fixed-bed sweetening Merox process reliably produces on specification sweetened product.
- Properly designed pre-treatment and post-treatment, when applicable, ensure that other relevant product specifications are also met.

EXPERIENCE
The Merox process is overwhelmingly the most widely applied treating technology. More than 330 fixed-bed sweetening Merox units, having a total design capacity greater than 2,800,000 BPSD, have been placed on stream. The experience that UOP has gained in the design and operation of these units means that a refiner will obtain the most reliable, economic, and easy-to-operate treating unit available.

CATALYST
To ensure that catalyst of the highest quality is available, UOP manufactures a family of highly active and selective catalysts for the fixed-bed sweetening Merox process.

Merox FB™ catalyst is used for in-situ impregnation of the activated charcoal in the reactor. Alternatively, Merox No. 8™ pre-impregnated catalyst can be supplied. Merox No. 10™ catalyst has been developed for sweetening extremely difficult to treat kerosenes. UOP also offers Merox Plus™ activator to extend catalyst life, and provide additional catalytic activity when treating more difficult feedstocks.

For More Information
Merox technological services are available on request. For more information, contact your local UOP representative or contact our Des Plaines sales office:

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