
Question 11: What is your acceptable limit for organic chloride concentration in a naphtha hydrotreater feed? What are the possible consequences if this limit is exceeded?

CHRIS STEVES (Norton Engineering)

Chloride in naphtha hydrotreater feed can often lead to fouling and/or corrosion issues in the naphtha hydrotreater heat exchange equipment. Recommendations to keep chloride levels under 0.5 ppm in the feed are typical. If the target level is exceeded, then fouling and/or corrosion with ammonium sulfide and ammonium bisulfide salts may occur in the combined feed exchangers or the reactor effluent coolers. Facilities for intermittent washing of the CFE (combined feed exchanger) bundles may need to be installed to mitigate the impact of this salt formation, and metallurgical upgrading of the exchanger equipment may also be required. Topsoe Dual-Phase, Single-Stage Scale Catcher MHC (mild hydrocracking) unit can be utilized to process either heavy gas oil or heavy gas oil blended with DAO (deasphalted oil). The unit typically has demetallization [HDM(hydrodemetallization)] catalysts in addition to high-powered/high-activity HdT(hydrotreatment) catalysts. The primary Topsoe technology for mild hydrocracking of heavy gas oil is the Haldor Topsoe Staged Partial Conversion (SPC). Additionally, catalyst selection will have a large impact on MHC operation. At low pressure operations, we recommend TK-947: Haldor Topsoe's NiMo (nickel molybdenum)/zeolitic HDC catalyst. At moderate pressure operations, select a NiMo version of a higher-zeolite HDC catalyst. The range of conversion and product selectivities is highly dependent upon the HDC catalysts selected. MHC is performed in units with pressures ranging from 850 to 1,600 psig (pounds per square inch gauge). Conversions range from 15 to 50%.

DENNIS HAYNES (Nalco Champion)

Due to the amount of ammonia typically generated in hydrotreating, even very low amounts of chlorides can drive ammonium chloride salt formation and result in fouling and corrosion. Any organic chloride in the feed should be avoided, if possible.

CANDICE CARRINGTON and **STEVE PHILOON** (Honeywell UOP)

The maximum allowable organic chloride in the feed to a naphtha hydrotreating (NHT) unit will mostly depend upon the solution used for the wash injected into the reactor effluent stream to control the pH of the aqueous phase that condenses between the feed effluent exchanger and the separator water boot. For an NHT unit with a simple water wash (the most common design), the limit of organic chloride in the feed is typically 20 ppmw. With this level of chloride, it will generally be possible to keep the pH of the water in the separator water boot between 5.5 and 6.5. When there is more than 20 ppmw chloride in the feed, it may become difficult to keep the pH of the water boot water above 5.5. As the water

becomes more acidic, the rate of corrosion will accelerate. Therapid rate of corrosion may necessitate a redesign of the system to allow for the addition of a neutralizer into the wash water and possibly an upgrade in metallurgy between the feed/effluent exchanger and the product separator.

For NHT units with the capacity to add a neutralizer (e.g., most commonly, ammonia) to the wash water the typical limit of feed organic chlorides is around 50 ppmw while keeping the pH of the water-boot water above 7.5. Note that it is important to avoid pH between 6.5 and 7.5. In this range, the rate of corrosion spikes due to the interaction of chloride and sulfur on the metal surface. As above, the consequence of exceeding this limit is accelerated corrosion of the downstream piping and equipment, which can ultimately lead to leaks or loss of containment. There is an additional consideration in that some organic chlorides can be difficult to hydrotreat with only 80 to 90% of the chloride in the feed being removed across the NHT reactors. As a result, the chloride in the feed to the Platforming™ unit may contain a quantity of chloride sufficient to impact catalyst chloride level.

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Year

2016