

Removal of nitrogen compounds from bitumen-derived gas oil and its impact on hydrotreating

Lina Del Rocio Parra Galvis, Murray Gray, Yadollah Maham, Rainer Reimert.
*Department of Chemical and Materials Engineering,
University of Alberta, Canada*

Nitrogen compounds present in bitumen and petroleum products cause significant inhibitory effects on processes such as catalytic cracking and hydrotreating due to poisoning of the catalyst. Consequently, selective removal of the nitrogen species may improve the efficiency of the above processes. Hydrotreatment is the only technology employed for sulfur and nitrogen removal at industrial scale, but it has been demonstrated that nitrogen compounds present in the feed strongly inhibit the hydrotreatment process.

Alternative techniques for removal of nitrogen compounds have been widely investigated in the last decade. In this study, extraction of nitrogen compounds by complexation with copper chloride was found to be an efficient alternative; removal of all of the basic nitrogen and approximately 60% of the total nitrogen was accomplished. The novel invention in this study was the addition of liquid water which dramatically improved both, the rate of removal and the extent of removal, with no effect on the sulfur content.

Hydrotreatment experiments were conducted in a micro batch reactor with commercially available Ni-Mo/ γ -Al₂O₃ hydrotreating catalyst. Hydrotreating of the reduced-nitrogen extracts showed that the rate of sulfur removal was increased by a factor of 2.5 using a standard catalyst. Therefore, selective removal of nitrogen compounds would allow less severe operation conditions.