Question 3: How can lubricity be improved in ultra-low sulfur jet fuel?

ESTEBAN (Suncor Energy, Inc.)

The increased desulfurization of distillate fuels removes sulfur nitrogen and aromatics, which are components favorable for lubricity properties. The recent market conditions have led most refiners to not only produce ULSD, but also ULSK (ultra low sulfur kerosene), in order to maximize distillate production. At Suncor, we have been driving our facilities to maximize the distillate. We often do not take advantage of the minor impacts that could come from flexibility with feed streams and blend components, or even minor impacts from changes in reactor loadings, in order to have some difference on our finished product lubricity. The level of hydrotreating required to meet sulfur specifications on distillate fuels removes and/or changes so many trace components good for lubricity that it is much more economical to use lubricity additives to maximize refinery yields.

At the Denver Refinery, we produce commercial Jet A, which is a non-additized fuel. There is no lubricity specification for that particular fuel. We produce Jet A using similar blend components to #1 ULSD, which allows us to minimize our overall storage requirements. While Jet A is the only product that we produce, there are jet fuel products with lubricity specifications that we do not produce for military use. Those fuels are additized.

LEICHTY (Chevron USA, Inc.)

Straight run fuels have good lubricity due to the presence of trace compounds containing sulfur, nitrogen, and oxygen. These compounds are removed by hydroprocessing. Because it is impossible to predict the lubricity based on bulk properties, lubricity must be measured using the BOCLE (Ball-on-Cylinder Lubricity Evaluator) test. Fortunately, modern engines are designed for low lubricity fuel and can burn Jet A, which has no lubricity specification. However, other grades of jet fuel may require additives to improve lubricity. These additives also act as corrosion inhibitors.

Chevron operates facilities where the finished jet products are 100% hydrotreated and/or hydrocracked. These products include Jet A, Jet A-1, and JP-8. The testing and additive requirement depends on the fuel. When additizing, it is possible to optimize the response and dosage by doing testing ahead of time. There are three approved additives: Nalco 5403, Innospec DCI-4A, and Afton HiTEC 580.

For Jet A, there is no lubricity testing requirement.

For Jet A-1, lubricity testing is required if any of the following four conditions are met:

1. The fuel is derived from greater than 20% severely hydrotreated material, meaning that it is hydroprocessed at a pressure greater than 1015 psi (pounds per square inch).

2. The fuel is made from greater than 95% hydroprocessed material.

3. The fuel is synthetically derived, i.e., Fischer-Tropsch reaction-derived material.

4. The wear scar by the BOCLE test is greater than 0.85 mm (millimeters).

For JP-8, additives are required regardless of processing condition.

AHMAD AL-JEMAZ (Kuwait National Petroleum Company)

A question on ULSD protection: Do you have any experience having a reactor with both hydrotreating and dewaxing beds in one reactor?

LEICHTY (Chevron USA, Inc.)

Yes. We do have one unit with that has a dewaxing catalyst layered into the hydrotreating catalyst.

AHMAD AL-JEMAZ (Kuwait National Petroleum Company)

So, there is a robust design that you can rely on that enables you to do without the lubricity additives?

LEICHTY (Chevron USA, Inc.)

We have not had any issues with this unit.

SUBHASH SINGHAL (Kuwait National Petroleum Company)

Is it preferable for these lubricity additives to be added inside or outside of the battery limit? What is the usual preference of the refiners if there are lubricity additives inside the ULSD unit, or it is done outside in tankers area?

ESTEBAN (Suncor Energy, Inc.)

We have our additives downstream of blending, so they go in with the finished fuel.

DAN WEBB (Western Refining)

Does anyone have experience co-processing jet or pulling a jet stream off of the ULSD unit stripper or fractionator, especially in light of the previous discussion of co-processing coker naphtha?

ESTEBAN (Suncor Energy, Inc.)

Our ULSD unit in Denver pulls a sidecut of kero (kerosene). Typically, that is then either blended back into the diesel stream or, in some cases, used as a jet blend stock.

DAN WEBB (Western Refining)

How does that process scheme affect your jet products, as far as lubricity and any of the other specs?

ESTEBAN (Suncor Energy, Inc.)

We have two separate jet product streams. One is from a ULSK unit, which is lower pressure: around 300 psi. With the ULSD unit that is operated at about 1200 psi, we have a side-draw kerosene product. The two together do not have an issue in our blend pool. I do not know if we have ever looked at one of them individually to really see if that presents a problem. That being said, the only market that we sell to has no lubricity requirements.

OHMES (KBC Advanced Technologies, Inc.)

We have seen a couple of units that do pull the jet cut like that. Normally, it is those with a lot of kerosene in the feed which are able to do that and have the proper fractionation to pull it. I concur with James on the lubricity issue, but you brought up coker naphtha. Obviously, you can pull a jet kerosene cut, but it really depends on what the impact will be on your aromatics from the jet and what else gets blended in with it. You can get away with it, but you must have other streams to dilute the aromatics and still meet specification.

ANDREW LAYTON (KBC Advanced Technologies, Inc.)

In my experience, you do not actually need much low hydrotreated or even un-hydrotreated material to meet the lubricity specs. In the past, some people have found a way to put some low hydrotreated material into the blend. One does not actually need much unhydrotreated material.

ESTEBAN (Suncor Energy, Inc.)

Since new regulations have mandated the reduction in sulfur content for diesel fuels in both on road and non-road markets, more refiners have shifted to also hydrotreating kerosene crude fractions to ultra-low specifications because of the value that these components present as a blend component in diesel fuels. Often kerosene is used as a blend component in diesel fuels to increase pool volume and improve blended properties especially in markets where diesel fuels are subject to more stringent cold flow properties specifications.

Lubricity properties of distillate fuels have remained a topic of concern due to increased hydrotreating, since lubricity properties of both jet and diesel fuels are a function of fuel boiling range, aromatics content and sulfur/ nitrogen content. In order to improve the lubricity properties of the Suncor Energy, Inc. blended diesel fuels we use injected additives to meet the fuel specifications. Strong distillate margins and market conditions have driven Suncor to select catalysts for ULSD production that improve volume swell across hydrotreating units which can have adverse impacts on lubricity properties without the addition of chemicals to our final products. The addition of these chemicals permits a profitable maximization of distillate volume.

While chemical additives are a simple solution for product diesel streams the specifications for jet and #1 ULSD although somewhat similar, are not the same with respect to lubricity properties. The current

specification for commercial use Jet A (ASTM D1655) does not require that the fuel meet a lubricity specification and further requires that the product be free of additives. As a result, the product marketed by Suncor Energy, Inc. as Jet A is sold free of additives and is not subject to a lubricity specification. Furthermore, at our Denver Refinery both hydrotreated and non-hydrotreated kerosene streams are routinely used in our jet pool with no issues or impacts to our customers.

There are, however, different jet product specifications that do require fuels to meet lubricity specifications and permit the use of lubricity additives. Typically, these fuels are specified for military use and have lubricity specifications because of differences in applications from commercial use.

Print as PDF:

Tags

Aromatics

Blending

Catalysts

Crudes

ULSD

Year

2012