Question 11: Are any operators still using salt dryers for ULSD or Jet? If so, do you have any related product quality or corrosion issues?

Michael Chuba (Sunoco)

Sunoco has a few ULSD units that employ salt drying of their ULSD rundown product. These units produce an on-specification product that meets the D4176 Haze spec of 2. As far as corrosion, no major issues have been identified to date. When using salt drying there will be a tendency to accumulate a water/brine layer in the finished product tanks that must be drained periodically. Provided the driers are sized and operated correctly no other major issues with product quality should be observed. The main issue with these driers is trending salt level and predicting when they need to be reloaded with salt. Salt level is predicted based on total oil processed in combination with frequency and duration of water draw-off.

Earlier this year an attempt was made to install and test a guided wave radar level device for online trending of the level. However, we are having issues interpreting the results of this new guided wave radar application.

Vern Mallett (UOP)

The decision as to what equipment is needed to meet product specifications is mainly based on customer product requirements. Drying will not be required if there is a Fired Reboiler Side Cut Stripper or a Reboiled Side Cut Stripper. If the side cut is steam stripped, UOP will design a combination coalescer and salt dryer for the diesel product if the required water content is equal to or greater than 250 ppm. If the diesel product water content required is 100 ppm, a vacuum drier is added. Further drying can be achieved through the use of molecular sieve drying which can reduce the total water content to less that 10 ppm.

For straight run Kerosene or Jet product needing to meet WISM (ASTM-D2550) clay treating of the product is required. Usually hydrocracker derived Kerosene does not need to be clay treated. Clay treating will filter out water and also color bodies and surfactants such as naphthenate and sulphonates which stabilize haze. Molecular sieve drying and vacuum drying are also options that can be considered depending on the product requirements.

Product Quality - The most common product quality issue for ULSD coming from a salt drier is a hazy product that does not meet the “bright and clear” test. The haze point, or saturation point, of the diesel product is the temperature at which water dissolved in the diesel will start to precipitate and become free water droplets in the diesel causing it to appear hazy. There are common causes for diesel product treated with a salt drier to become hazy:

· Drier Temperature - One common cause of a hazy product is when the storage temperature of the product is much less than the drying temperature of the product. Haze will be a problem unless water is removed by a salt filter. This will reduce the temperature at which haze is a problem to about 25ºF below

the saturation temperature.

· Salt Choice – UOP specifies commercial grade rock salt (sodium chloride) to be used in the drier. Using the wrong type of salt such as solar/marine salt or CaCl can lead to salt bridging or high pressure drop in the drier.

· Drier Operation – UOP recommends a total change out of the salt every two years, top off of salt as needed (~ every 3 months), and draining water from the brine solution daily. Failure to follow these recommendations can lead to the drier not functioning properly and hazy product.

Corrosion Issues – UOP doesn't have hard data on the corrosion issues pertaining to downstream equipment. There should be no free water leaving the drier. If there were a problem with the coalescer or drier that lead to free water in the diesel product, that water would contain chlorides and could potentially lead to corrosion in downstream units and tanks. Failure to regularly empty the briny water solution from the bottom of the drier or regularly top off the salt could also lead to chlorides in downstream units.

Salt Specification

UOP recommends that only commercial grade rock salt should be used. Rock salt has a crystalline surface that dissolves slowly without mechanical crumbling. Rock salt is mined and crushed into discreet pieces of glass like crystal – often with a yellow or brown color tinge. It is translucent just as window glass. It is not opaque or optically white in the way that table salt and sugar usually is.

Solar/marine salt is not recommended. Solar/marine salt is re-crystallized from brine production. Since impurities are often insoluble in brine, there is risk that it will eventually result in an ineffective desiccant due to gross accumulation of the insoluble residues. Also, solar salt, marine slat and salt produced as brine will generally be in small particle size, possibly compressed into lumps similar to sugar lumps but of low density. These dissolve too rapidly or disintegrate into fines such that the bed volume decreases as the interstitial spacing gets filled, giving rise to potentially greater pressure drop, short contact time due to channeling, carryover of fines to the finished product. Solar/marine salt has also been shown to retain biologically active materials unless specially treated. These materials can continue to grow in.

Dan Webb (Western Refining)

Yes, several refiners do operate salt driers downstream on their ULSD product particularly when a live steam treated product stripper is used in the process unit. The major product quality issue directly related to salt drier operation is that the online product analyzer may be negatively affected if the drier is not routinely drained, and brine is entrained into the product stream. This has been directly confirmed by refinery lab tests that have revealed off-spec ULSD product meets the sulfur specification after the aqueous phase (brine) was separated from the product sample.

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