Question 64: What are the impacts on coker operation (yields, capacity, energy, coke quality) of excess VGO (1000F-) in the feed?

Jeff Lewellen (HollyFrontier)

Our El Dorado facility has transitioned from a 950o F HVGO/VTB cut point coker feed to a +1075 F while maintaining a fairly constant feed rate to the delayed coker unit. Our experience has seen coke and off-gas yield increase while HCGO yield decreases.

Our Conclusions:

• Yields – VGO range material is a relatively small contributor to coke yield in the unit. Between meter error and coke yield estimates, we have been unsuccessful in quantifying the exact yield impact.

• Capacity - Depending upon unit constraints, additional VGO occupies feed volume in the unit that could be used as VTB/residuum feed.

• Energy – The major impact is increased heater firing due to energy required to vaporize the excess VGO. This may also increase required drum temperatures to achieve equivalent VCM% results.

• Coke quality - Additional VGO may act similar to adding internal recycle to the unit. Although generally not aromatic, it could shift coke from shot to sponge coke. However, this is much more crude composition, drum velocity/pressure dependent.

Rajkumar Ghosh (Indian Oil Corporation)

Excess VGO in Coker feed is obviously not a desirable situation as it amounts to down gradation of straight run product. In one of our old refineries, we run a small Coker with long residue (RCO) as feed. Based on the experience there, the Impact of excess VGO in feed on Coker operation is explained as below:

a. Yield: The VGO part in the feed will have a free ride to the fractionator, thereby numerically reflecting higher distillate on Coker feed and consequent reduction in coke make. However, increase in coke drum vapor velocity will force higher pressure operation to prevent foam-over, leading to higher coke make from the residue part of the feed to the unit. The extent of increase in pressure will be dictated by the amount of VGO in feed.

b. Capacity: In the VR only case operation, if the feed to Coker is limited by Coke drum Capacities, then we certainly have a case for processing higher throughput in the excess VGO case, due to lower overall coke make. However, in such a case, Coke drum vapor velocity will also have to be cross checked and be maintained within the safe limit of 0.5 ft/sec. With lighter feed to Coker, the extent of vaporization in

the heater tubes will be higher, leading to higher pressure drop across the heater. Heater duty will increase and may impose capacity limitations. Further, HCGO section flooding in the fractionator, HCGO product and pumparound circuit limitations may also become reasons for capacity bottleneck.

c. Energy: Excess VGO in feed will require higher heater duty. This may impose heater limitation with consequent lower COT. Lowering recycle under such a situation may help. However, it may result in higher HCGO CCR due to inadequate internal reflux in the wash zone. If HCGO circuit is not limiting, some of the heat can be recovered back into feed due to higher HCGO make.

d. Coke Quality: With the reduced wt% of asphaltenes, resins and metals in the feed, the coke quality will tend to improve. All the green coke produced with RCO feed is expected to be sponge coke with moderate VCM. Depending on the feed Sulfur content, the coke can be graded into Anode grade.

Eberhard Lucke (Commonwealth E&C)

Delayed Cokers are built to process residue, not gasoil. Excess VGO in the coker feed will only replace residue in the feed and will cause downgrading of almost all VGO to HCGO. HCGO yields will increase accordingly. The charge heater may benefit slightly from increased vaporization and lower fouling rates in the tubes. The coke may see an increase in VCM and may get a little softer, but this can be compensated by correct steam stripping.

Tags

Aromatics

Coker

Crudes

Delayed Coking

Distillation

Fouling

Process

Year

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