Question 75: What are the pros and cons of driving coke VCM (volatile combustible matter) to a low level? What are the lowest green coke VCM you have consistently achieved?

Rajkumar Ghosh (Indian Oil Corporation)

Volatile combustible material (VCM) is an important parameter of Petcoke. VCM is basically unconverted pitch in the coke. The metal and sulphur are controlled by the type of crudes processed, but VCM content of coke is mainly in the control of DCU operators. The obvious benefit of driving green coke VCM to a low level is more distillate yield and less coke yield. Each 1 wt% reduction in VCM could increase refinery GRM by 5 cents/bbl. Moreover, lower VCM implies a relatively harder coke and lesser generation of undesirable fines during the coke cutting. Our objective is to achieve the coke VCM in the lower range of around 9%wt. for fuel grade coke. Coker operating parameters such as coke drum overhead temperature, pressure, COT, recycle, coke drum cycle time and steam quench rate play prominent role in determining VCM in the coke. Some of the rule of thumb for Coker variable on coke VCM are:

• With each 5o C rise in coke drum vapour temperature, VCM in coke decreases by 1 wt%.

• Decreasing cycle time by 6 hrs, increases coke VCM by 1.0 wt%.

• 2-3o C increase in COT reduces coke VCM by 1 wt% Comparison of VCMs in 18hr and 24hr cycle is given below:

As a best practice for reducing coke VCM, we increase the COT by 2o C, an hour prior to drum switch. We continue with the higher temperature through the drum switch and get back to normal COT once the receiving drum top temperature reaches near normal value. Steaming of the offline drum is another factor that impacts VCM.

If the steaming of the offline drum is not done for sufficient time with sufficient amount of steam, this may contribute to an increase in VCM. The steaming amount depends on the drum diameter. For a typical 28 ft drum to a larger diameter drum i.e. 32 ft; steam flow is varied in the range of 15–18 MT/ hr. These figures have been arrived at based on our experience w.r.t. adequacy of Coke Bed cooling & VCM of the Coke. It was also observed that on reducing the amount of steam to around 10 MT/ hr, there was an increase in VCM of approx. 0.5-1 wt%.

Flip side of very low VCM is that the coke becomes very hard and coke cutting operation consumes longer time, resulting in delay in the coke drum cycle. Also, very hard coke (low Hardgrove Grindability Index, HGI) makes it difficult for the customer to crush and use and hence less acceptable to them.

Lowest level of coke VCM achieved at our Cokers is 8.5 to 9 wt%. Typical VCM level that we are

achieving on sustained basis is around 9-10 wt%.

Jeff Lewellen (HollyFrontier)

I agree with the primary answer. For fuel grade cokers, optimizing VCM is primarily an economic decision balancing liquid yield with unit operation. Our approach to optimization is:

o First, optimize coke drum stripping steam volume and duration for recovery, and limited by drum and fractionator velocities and available cycle time.

o Second, target coil outlet temperature (COT) to minimize VCM while maintaining required drum cycles and heater run lengths.

Optimum VCM target is somewhat feed dependent with our normal range in the 8 – 10 wt% range.

Eberhard Lucke (Commonwealth E&C)

The drivers to lower the VCM of the green coke can vary depending on what kind of operation you run. Fuel grade coke operations typically don't monitor VCM on a regular basis. The only advantage in lowering VCM would be to reduce the loss of very heavy gasoil material with the coke product. But the required measures to reduce VCM (longer steam stripping, more stripping steam, or higher coil outlet temperature etc) and associated cost most likely exceed the gains. In anode grade operation, the VCM has a direct relation to the vibrated bulk density (VBD) of the calcined coke and therefore, controlling and minimizing the VCM content of the green coke is crucial to a successful anode coke business. In the past we achieved best results by maintaining a rigorous steam stripping regiment and by implementing a temperature ramp function for the coil outlet temperature that allows to drive more volatile material out of the coke bed before the drum will be steam stripped. With all these measures in place we achieved consistently VCM values around 8wt% and consequently very good VBD results in the calcined coke. The price is a slightly higher energy consumption in the charge heater which can be compensated by further optimization of the control scheme for the coil outlet temperature. Other tests with lowering the drum operating pressure didn't show the same effect and couldn't be repeated on a consistent basis.

Print as PDF:

Tags

Coker

Operations

Optimization

Process

Year

2011