QUANTA REVAMP ™ & FCCU START-UP E-CATS

Objective: To start your FCCU up as rapidly and smoothly as possible with enhanced yields.

FCC Units Technology keeps evolving and becoming increasingly sophisticated, FCCUs now incorporate advanced riser termination devices, new high flux strippers and in some cases, long standpipes. Many of these modern components are designed to operate smoothly at typical operating conditions; however, during units' start-up or shutdown, catalyst circulation rates can approach turn-down conditions, increasing the risk of catalyst defluidization in diplegs or catalyst carry-over to the fractionator. This undesirable situation can lead to delayed start-ups, resulting in high opportunity and cleaning costs, as well as reliability issues at pumps. This can also lead to environmental non-compliance and missed sales opportunities due to off-spec products. As an example, for a typical FCCU with 50,000 BPD capacity and a net margin of $10-20/bbl, every extra day the unit is down, represents 0.5 to 1.0 $MM/day of money lost.

FCCUs circulation is smoother during start-ups with the right catalyst properties. It has long been recognized in the industry that a good start-up catalyst should have a proper particle size distribution (PSD) for the most stable fluidization.

The optimum PSD should help to prevent the possibility of defluidization at low superficial gas velocities and to minimize the formation of bubbles at high velocities. A well-known way to maximize this velocities' range is to ensure a high Umb/Umf, or the ratio of minimum bubbling to minimum fluidization velocities. A simplified form if this ratio can be expressed as:

$$\frac{U_{mb}}{U_{mf}} = \frac{exp^{\left(0.176\, F_{45\mu}\right)}}{\bar{d}_p{}^{0.8}\, ABD^{0.934}} \qquad (1)$$

FCCU inventory age increases with run time. It is also a well-known fact that FCC cyclones are designed to retain coarser particles more efficiently than finer particles. As a result, over time the FCCU circulating inventory develops a wide age distribution where coarse particles typically become the most aged and less spherical particles. Laboratory testing has shown that in some cases, there can be a difference of as much as 12% points in activity between the youngest and the oldest fraction of an FCCU inventory; therefore, removing the coarsest and oldest material can greatly improve the circulating inventory catalytic performance. This is especially important in FCCUs with minimal or zero e-cat withdrawal.

Mass transfer can be improved by modifying the catalyst PSD

Quanta's R&D efforts have confirmed via laboratory testing and commercial trials that mass transfer rates are improved by modifying the FCCU catalyst PSD to a narrow range. This is typically achieved by optimizing the amount of particles smaller than 40µ and minimizing those larger than 100µ (*). The observed "fingerprint" of a yields' shift resulting from improved mass transfer is reflected in the form of increased slurry cracking and gasoline + LCO yields, along with improved LPG olefinicity. This is theorized to be the result of rapid diffusion of large feed molecules to the catalyst active sites as well as the preservation of intermediate reaction products due to their rapid egress from the catalyst particles. Our proposed reaction model suggests that mass transfer is improved due to a combination of factors resulting from our patented technology, such as increased external surface area per volume of catalyst, increased number of catalyst particles, improved particles' sphericity and a reduced probability of bubbles formation.

Taking advantage of Quanta's REVAMP Technology

As can be seen in Eq. (1), the fluidization factor can be improved by modifying the catalyst PSD such that the amount of fines (F45µ) is higher and the mean particle size is lower. This is where REVAMP Technology comes into play. Quanta can take the spent catalyst from the FCCU inventory during a shutdown and separate it off-site into different fractions by applying our patented technology. The coarsest and/or the finest fractions would be removed and rejected in order to 1) improve the fluidization factor, 2) reduce the inventory age and 3) enhance diffusion rates. The amount of fines can be optimized due to a concentration effect or by mixing an additional amount of fines if needed. In order to replenish the material rejected by the separation process, Quanta can compensate with a high-quality e-cat with narrow PSD, low metals, and high activity. The result would be a new e-cat ready to be shipped back with much better fluidization properties, younger age and higher performance that can be used for a smooth, low risk and successful start-up.

Customers are already taking advantage of this technology. Call Quanta today so we can help you minimize downtime and improve performance.

(*) Quanta US Patent 9,393,556

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