Question 33: Can you share your experience with chemical additives to prevent fouling in the naphtha hydrotreater feed side of the feed/effluent heat exchangers or resolve reactor pressure drop issues?

CHRIS CLAESEN (Nalco Champion)

The answer is partially the same as the one given to Question 28. First, the root cause needs to be determined. If the dP is caused by corrosion products due to corrosion in the upstream refinery units, the corrosion in these units can be reduced by applying the proper corrosion control program. If the dP is caused by gum formation, the gum formation needs to be controlled by applying a program in the feed and storage system. While we recommend that the focus be on prevention measures, we have successfully reduced hydrotreater dP on many units by applying an online cleaning program.

DENNIS HAYNES (Nalco Champion)

A hydrotreater processing import naphtha was experiencing reactor bed pressure drop well into the run. It was suspected that particulate iron sulfide was a main component of the material restricting the upper portion of the reactor. It was not possible to stop the pressure drop increase in this case, but application of a dispersant resulted in a reduction in the rate of pressure drop increase to the extent that the unit could make it to turnaround. For chemical additives, it is important that due diligence is done in the evaluation of the fouling mechanisms so that the appropriate inhibitors can be fit for purpose.

WALTER MILITELLO, PhD (Nalco Champion)

Several units have shown some degree of fouling, usually impacting the heat transfer performance of heat exchangers and producing hydraulic restrictions at HT reactors. Fouling nature can be organic or inorganic, depending on feed contaminants and operating conditions. The most successful approach to minimize pressure drop buildup is the application of top reactor dispersant agents. The function of those agents is to disperse the foulant material, thereby reducing its adhesivity and compacting. Often those agents are able to break fouling crust, if injected properly and at the correct dosage and duration. If it is not possible to implement the dosing system during the plant operations, an alternative solution is the injection of dispersants from the preheat train. The immediate benefit is to recover heat transfer across feed/effluent exchangers; because usually, the fouling problem also impacts the cross-exchangers. But careful dosing strategy and accurate monitoring must be in place to avoid significant fouling material transportation from heat train to reactor, making the hydraulic situation worse. Recent experience of dispersant around a Saudi plant, showed a FF (fouling factor) reduction of cross-exchangers from 0.007 ft2hr°F/BTU growth every month, to a growth rate of less than 0.001 ft2hr°F/BTU per month. The reactor norm-dP(flow corrected) growth during the chemical program was only 0.12 psig per day, compared to previous cycle where norm-dP grew at a rate of 0.22 psig per day, resulting in a premature

cat skimming after 11 months from fresh cat startup.

RALPH WAGNER (Dorf Ketal Chemicals LLC)

The fouling precursor can be classified into two groups: organic and inorganic. Organic precursors are due to the presence of unsaturated in cracked feedstock which forms polymers and coke, depending on the operating conditions. Inorganic precursors are due to the presence of a corrosion product coming from the unit upstream. Both precursors agglomerate and deposit on the preheat exchanger surface; and at a break-even point, they get carried to the reactor, further aggravating the fouling scenario. Dorf Ketal offers a range of antifoulant chemistries specific to the precursor type. Typically, an antioxidant is used to terminate the polymer formation, while dispersant chemistry uses steric barrier to limit the particle size and deposition. Dorf Ketal has successfully treated naphtha hydrotreaters worldwide for organic and inorganic fouling. Dorf Ketal's FeS agglomerate has been proven successful for inorganic fouling and has resulted in run-lengths being increased by several months with sustained pressure drop.

Tags

Corrosion

Fouling

Heat Exchangers

Naphtha Hydrotreating

Operations

Start-up

Year

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