

Abstract

EFFECTIVE FOULING PROTECTION OF STRIPPERS, COMPRESSORS, CAUSTIC TOWERS AND RECOVERY SECTION FOR OLEFINS PLANT

Authors: Berthold Otzisk (Kurita), Lorenzo Carollo (Kurita) & Subrato Saha (AquaChemie)

In Olefins plant, the cracked gas contains very reactive compounds such as ethylene, acetylene, propylene, butadiene, styrene, hydrogen, carbon monoxide, etc. Oxygen is a key factor and can react even at ambient temperatures with carbon free radicals by forming Peroxy radicals. Trace amounts of oxygen or oxygen containing compounds promote formation of polymers or gum formation. This significantly increases the risk of polymer fouling. Temperature plays a key role in the rate of oxidation of organic materials. Significant oxidation can occur and high amounts of oxidation initiators can be formed.

An unsaturated hydrocarbon such as ethylene, propylene, butadiene or styrene, etc. can add to itself to create a long chain polymer. In petrochemical processes, the reactions often involve a free-radical vinyl polymerization reaction. The free-radicals are generated by heat, metals or peroxides. They act as initiators for the polymerization reactions. As the polymerization reaction proceeds, the length of the polymer/ copolymer chain increases forming what has been termed "Gums".

Butadiene fouling is a common problem in olefins unit, where formation of "popcorn" polymer is often reported. Butadiene is a highly reactive molecule. It follows a dimerization of two butadiene molecules and will make a C8 compound or higher mole weight compounds. If oxygen or metal oxides are present, "gum formation" as a result of unwanted free-radicals polymerization may also occur. In many cases fouling is related to butadiene fouling in the reboiler, which follows a radical polymerization process.

Quench tower systems, cracked gas compressors or distillation equipment of the recovery section are often suffering with severe polymer fouling. In caustic wash towers red oil fouling is an omnipresent concern, which is mainly following an Aldol condensation process. This article describes very powerful polymer inhibition programs. The benefits of these treatment concepts are better performance, increased run time and higher productivity. Tailor-made antioxidants stop the oxidation and unwanted polymerization process. Antipolymerants are high performing inhibitors, which also stop oxidation and radical polymerization reactions. Often, they also contain coke suppressants or metal deactivators to inhibit catalyzed reactions on the metal surface. Dispersants keep small polymers in a mobile phase and additionally help to stabilize the viscosity of the feed stream. Special formulations avoid red oil formation in caustic wash towers.

The paper discusses Kurita Technology, Chemistry & field Experience to combat each type of fouling for better reliability & operation of the Olefins plant.