



CONFIDENTIAL

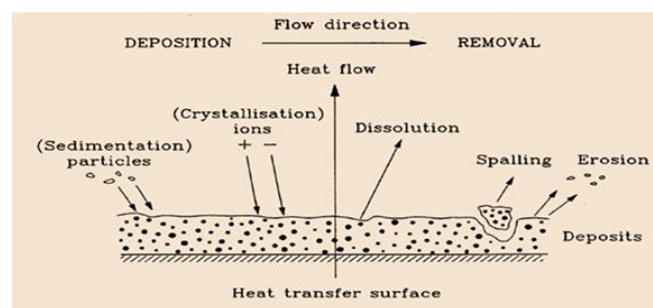
HP THERMOPRO : A Novel Antifoulant Additive for the Heat Exchangers

Fouling of refinery process equipment is a common problem resulting in severe economic penalties due to energy loss, throughput loss as well as significant safety concerns. Typical problem areas include crude and short residue/vacuum residue preheat exchangers, furnaces, hydrotreater exchangers, reactor beds, FCCU slurry exchangers and thermal cracking process exchangers. Multiple factors impact fouling including crude type, equipment design, flow rates, temperature, unit's operational severity and fluid characteristics.

Fouling deposits can be categorized into two major types : Inorganic and Organic. Inorganic fouling is due to the deposition of solid inorganic contaminants such as sand, silt and corrosion products of process equipment such as iron sulfide and iron oxide in the heat exchangers. Organic fouling resulting from the separation and deposition of high molecular weight hydrocarbons such as asphaltenes at high temperatures due to incompatible blending of crudes and polymerization of dienes and alkenes. Hence, modern refineries strive for reliability and processing flexibility with longer run lengths and minimal equipment fouling.



HPGRDC developed a novel Antifoulant by characterizing and studying the fouling deposits formed via various mechanisms in different process heat exchangers in the refinery.



developed based on these studies to mitigate fouling. The performance was evaluated against various crudes, crude blends and short residue using Refinery Process Fouling Simulator (RPFS). The in-house developed formulations exhibited superior performance in comparison with the commercial benchmarks.

Crude	w/o Antifoulant ΔT ($^{\circ}C$)	Bench mark-1 ΔT ($^{\circ}C$)	Bench mark-2 ΔT ($^{\circ}C$)	HP THERMOPRO ΔT ($^{\circ}C$)
Crude-1	-35.6	-10.1	-29	-5.2
Crude-2	-66.8	-18.3	--	-14.6
Crude-3	-31.8	-5.6	-48.0	-1.5
Blend-1	-20.6	-8.6	-25.6	-4.6
Blend-2	-37.6	-14.6	--	-7.3
Short residue	-34.2	-22.3	--	-8.2

Ultimately, a single Antifoulant Formulation could be used for both crude and SR Units. This formulation was scaled up to 50 MT for refinery trials on both crude and SR, in Visakh Refinery, HPCL. The trials were successful. The product is ready for Commercialization