

Granular Activated Carbon for Desulfurization

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Desulfurization

Natural gas feed stocks are used for the production of many chemicals including ammonia, methanol and hydrogen. A feedstock virtually free of sulfur is required to protect the catalysts from deactivation. Precious metal catalysts are highly susceptible to sulfur poisoning and subsequent loss of production and shortened life.

Depending on the sulfur concentration, various sulfur control technologies can be applied. When H₂S or other low molecular weight sulfur compounds are present at 10 ppm or less (as total sulfur), plants have successfully used granular activated carbon to remove the sulfur compounds. Metal oxide impregnated activated carbons are specifically designed to chemisorb hydrogen sulfide and mercaptans.

As shown in Figure II, the metal oxides within the activated carbon pores react with the sulfur compounds to form sulfides and sulfates. The granular activated carbon can then be regenerated in situ with hot gas containing traces of oxygen to restore the impregnants to the metal oxide form. If large amounts of undesirable high molecular weight organics are present in the feed gas, a guard bed of un-impregnated activated carbon is used.

This method of sulfur control is being utilized at more than 60 plants in the United States. At a Louisiana chemical plant, several beds of granular activated carbon are being used for desulfurization of the methanol and ammonia plant feedstocks. Table III details the design conditions. The influent H₂S concentration in the natural gas varies up to 10 ppm. Each unit has two activated carbon vessels in series operation. When the concentration of H₂S in the natural gas leaving the lead vessel reaches 0.22 ppm, the vessel is regenerated with steam and traces of oxygen. The regenerated granular activated carbon bed is then put into the polish position. Currently, the time between regenerations is six months, but this can vary depending on H₂S concentration in the natural gas.

