



## Activated Carbon | Catalyst and Equipment Protection

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Process and plant engineers have found that using activated carbon is an excellent way to protect expensive catalysts and process equipment from other low concentration poisons which can deactivate catalysts or damage equipment. Activated carbon is highly cost-effective and relatively simple to use.

Some of the applications for utilizing activated carbon as a guard bed include:

- Removal of organic compounds that can foul downstream equipment
- Arsine control in acetylene, ethane-propane, and other hydrocarbon streams
- Aromatics removal to prevent "charring" of Claus catalyst
- Compressor oil removal for high purity gases
- Acid gas removal to protect sensitive electrical equipment
- Purification of process air

Impregnated and non-impregnated activated carbons to control a wide variety of contaminants to very low effluent levels. Since these activated carbons are extremely versatile and can operate at existing plant conditions, capital investments and operating costs are minimal. All of the multitude of applications cannot be discussed here; however, a few examples are presented.

One equipment protection application involved a tertiary oil project which utilized triethylene glycol (TEG) dehydration prior to the cryogenic separation plant. Plant personnel and the design engineers became concerned that the TEG would plate out in the cryogenic processes and foul equipment. They installed pelletized activated carbon upstream for removal of the TEG. The estimated influent TEG concentration to the activated carbon beds was 9 ppm with an effluent objective of 0.02 ppb. Data collected from the site indicates high loading of the TEG (15 wt. %) on the activated carbon and excellent removal efficiencies.

With the advent of sophisticated computer and motor control systems, the need has arisen to protect this equipment from acid gas corrosion. The Instrument Society of America has issued guidelines for computer and motor control room air quality. The concentrations listed below are for a G1 (mild) environment:

Component	Max Concentration (ppb)
Hydrogen Sulfide	3
Chlorine	1
SO <sub>2</sub> , SO <sub>3</sub>	10
NOX	50
HF	500
Ozone	2

Failures of sensitive circuitry in computers, laboratory equipment, and other electronic equipment can lead to long downtimes and high maintenance costs.

All-fiberglass system utilizing a specially impregnated activated carbon specifically developed for acid gas removal. Air contaminated with corrosive gases is filtered at the fan inlet to remove particulate matter. The

air is then delivered at a controlled rate and pressure to a deep bed Granular Activated Carbon to remove the corrosive gases. Treated air is then passed through a 30% and a 99% ASHRAE filter to remove micron size particulates. As shown, the integrated activated carbon system can be placed on the make-up air and/or the re-circulating air depending upon the level of severity. Sulfur plants are an obvious source of hydrogen sulfide, SO<sub>2</sub>, and SO<sub>3</sub>.

Activated carbon is impregnated with sodium hydroxide to enhance adsorption of acid gases. Since the gases are chemically bonded to the activated carbon surface, there is no potential for desorption of the acid gases and the activated carbon can effectively remove hydrogen sulfide to non-detectable levels even under varying influent conditions.

### **Summary**

Granular activated carbon has been employed in many gas conditioning and related processes. To obtain optimum results, each application should be individually evaluated by an activated carbon expert to determine the appropriate activated carbon and design parameters. A properly designed activated carbon system can reduce downtime, improve gas quality, protect equipment and catalysts, and reduce overall operating costs.