H_2S Saturated Media

Regenerated Media

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SULFA-BIND™ FOR HYDROGEN SULFIDE GAS STRIPPING

There are two basic applications for using **SULFA-BIND™** adsorption systems to remove hydrogen sulfide from gas streams:

1. From odorous air streams - after H_2S is stripped, the air is discharged to atmosphere.

2. From biogas produced in anaerobic digesters - H_2S is stripped and the methane is recovered and flared or used as fuel in co-generation equipment.

In these applications, the odorous air or gas is conveyed to a fixed media bed of **SULFA-BIND™,** a granular ferric hydroxide medium. The gas flow is upward through the media bed at a velocity of five feet per minute, which results in a contact time, within the media, of one minute. H_2S is effectively stripped from the gas when it exits the top of the media bed. Pressure drop through the media bed is about 0.25 psi to 2 psi. To achieve H_2S reductions to less than 0.2 ppm, the gas stream should be water saturated. The adsorber vessels can be supplied as ASME code pressure vessels, at the required working pressure of the system. For air streams, discharging to atmosphere, the vessels can be closed, vented top, of HDPE or fiber glass construction.

H_2S is stripped from the gas stream according to the following chemical reactions. The ferric hydroxide coating on **SULFA-BIND™** reacts with H_2S:

$$2Fe(OH)_3 + H_2S \leftrightharpoons 2Fe(OH)_2 + 2H_2O + 1/8\ S_8$$
$$2Fe(OH)_2 + 2H_2S \leftrightharpoons 2FeS + 4H_2O$$

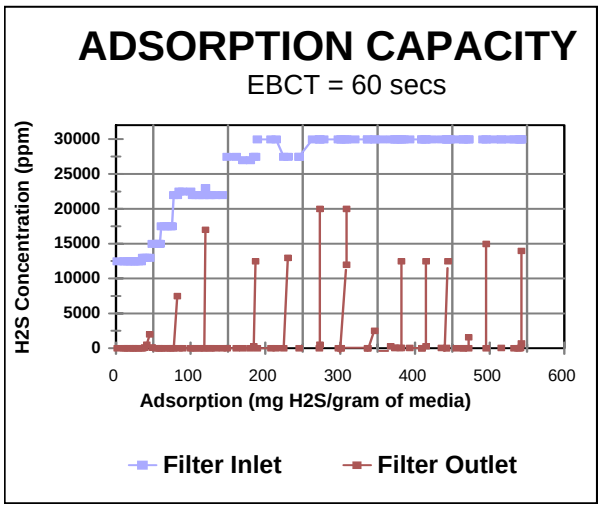
This reaction results in the creation of ferrous sulfide, which turns the media black. Ferrous sulfide can be converted back to ferric hydroxide as follows:

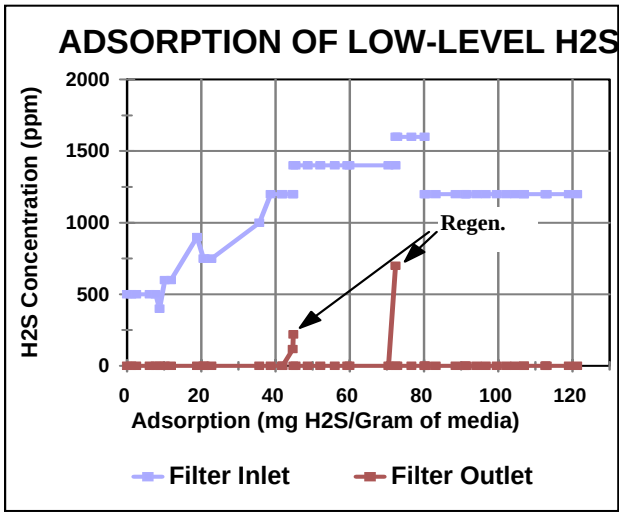
$$2FeS + 3/20_2 + 3H_2O \leftrightharpoons 2Fe(OH)_3 + 1/4S_8$$

This reaction is created by blowing ambient air through the media bed. Oxygen converts the FeS to ferric hydroxide and elemental sulfur that stays attached to the media. Visual observation during regeneration shows the media turning to its original orange color with small sulfur particles attached.

One cycle is defined as the completion of the two reactions above. Each cycle results in the adsorption of 30 to 40 mg H_2S per gram of media. At least 14 cycles are possible, which means a total adsorption capacity of over 350 mg H_2S per gram of media. As an example, 1000 cfm of gas at 1000 ppm of H_2S will provide 210 days of continuous use, with a sulfur recovery rate of 120 lbs/day. With such a high sulfur loading within the media bed, gas flow becomes restricted after 14 regenerations or cycles. Theoretically, these reactions can cycle greater than 14 times if the sulfur can be separated from the media.

Biogas is mainly comprised of methane, nitrogen, carbon dioxide and hydrogen sulfide. Only hydrogen sulfide is adsorbed within the media bed. This means that the methane can be recovered, free of sulfides, for use as a fuel. Also, there is very little, if any, carbon dioxide adsorption. Combustion of methane will not generate sulfur dioxide emissions because the sulfur has been removed from the gas. Typically, digester gas is very corrosive to pipes and equipment due to the presence of moisture and H_2S. With the H_2S removed, corrosion is greatly reduced.





Air streams obviously contain oxygen with the H_2S. In this application, continuous regeneration is taking place at the same time as H_2S adsorption. The time to saturation is then much longer than if no oxygen was present.

After 14 cycles, or when adsorbed sulfur is 30% to 50% of media weight, the media is spent and must be disposed. Spent media was subjected to leachate testing, using both the US EPA Toxicity Characteristic Leaching Procedure (TCLP) and the Canadian Reg. 347, to determine whether the saturated media would be considered hazardous waste. From both tests, the media easily passed.

Contact & sources for additional information:

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