Hydrogen Sulfide (H₂S) Removal Using Caustic Scrubbing Technology

Reduce caustic consumables and OPEX for Renewable Natural Gas (RNG) Projects

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Summary: Hydrogen sulfide (H₂S) removal for biogas upgrading plants is performed during the pre-treatment phase, regardless of whether the renewable natural gas (RNG) is being used in low or high BTU applications. DMT specializes in a range of desulfurization techniques under the Sulfurex® umbrella, including the Sulfurex® CR which harnesses caustic scrubbing technology for H₂S removal. This article covers 1) the process of the Sulfurex® CR, 2) how its Sulfurex® SDS (Smart Dosing System) reduces operational expenses (OPEX), 3) how the Sulfurex® SDS compares to other H₂S sensors on the market, and 4) how the Sulfurex® SDS can affect the bottom-line.

Hydrogen Sulfide (H₂S) Removal in Renewable Natural Gas

With increasing awareness of renewable natural gas (RNG) as a major climate change abatement strategy, biogas upgrading is taking center stage. There are currently hundreds of RNG projects under development in the United States and Canada alone and thousands more in untapped biogas upgrading potential. Biogas is generated through the decomposition of organic matter from various feedstocks such as wastewater treatment plants (WWTP), separated source organics (SSO), agriculture (e.g., dairy manure), or paper mills. To transform biogas into RNG, it requires conditioning through process units designed to remove certain contaminants from the raw gas. A usual pollutant in biogas is hydrogen sulfide (H₂S), which is typically removed regardless of whether the RNG is being used in low or high BTU applications. H₂S removal is important because H₂S is a highly corrosive and toxic gas that can damage CHP engines and feed gas compressors, thereby, dramatically increasing maintenance costs on RNG projects.

DMT specializes in H₂S removal through a range of desulfurization technologies under the Sulfurex® umbrella. Each H₂S removal treatment method has its own specific advantages that if leveraged correctly, can help maximize a project’s ROI. DMT’s Sulfurex® CR (Chemical Reaction) uses caustic scrubbing technology for H₂S removal and has proven in the field to provide operational ease and a small footprint at remarkably low capital expenditure (CAPEX). The system ingeniously combines desulfurization with gas cooling and drying through the integrated dehydration system. Cooling the gas also increases the selectivity for H₂S over CO₂. So how does the Sulfurex® CR work?

Desulfurization Using Caustic Scrubbing Technology

The Sulfurex® CR operates as a counter-current scrubber where raw biogas containing H₂S interacts with a caustic solution in a crossflow manner over packing media in the scrubber tower. This desulfurization technique ensures maximum contact between the incoming biogas and caustic solution, thereby, providing high-efficient H₂S removal. During this process, H₂S is absorbed by the caustic solution and converted into sodium hydrosulfide (NaHS). It is the Sulfurex®’s Smart Dosing System (SDS), however, that keeps operating expenses (OPEX) low.
What does “SDS” mean? One of the main concerns our clients have regarding biogas desulfurization is the high cost of consumables, which in this case is caustic solution. To dose the right amount of caustic requires knowing exactly how much H₂S is in the biogas. The ‘Smart’ in SDS means intelligently controlling the amount of chemicals being dosed in response to real-time information on H₂S loading in the raw biogas entering the plant. With the Sulfurex® CR, only the amount of caustic needed at any point in time is dosed, keeping OPEX under control.

**SENSORS IN H₂S REMOVAL AFFECT OPEX**

With other H₂S removal systems in the RNG market, an electro-chemical sensor is installed which allows H₂S to oxidise on a pair of enclosed electrodes, changing the electrical current passing from one electrode to another. Once calibrated, the change in H₂S levels (i.e. the amount of H₂S being oxidized) is proportionate to the change in current. The problem with this technique, however, is that the oxidized H₂S needs to be removed from the electrodes with air for it to accurately calculate H₂S levels on the next sample. This process can take up to one hour to complete. By then, H₂S levels may have drastically changed, causing the current caustic dosing amount to be out of sync with the reality of the H₂S load.

In contrast, the Sulfurex® CR’s H₂S sensor is always online due to the innovative way DMT mixes a specific combination of raw biogas with air in the sample line. This H₂S treatment method allows measuring and cleaning the electrode simultaneously which means the sensor is continuously feeding the dosing pump information on how much caustic solution to dose at any moment in time. This real-time information provides a better performing plant and a massive reduction in OPEX.

**SULFUREX® SDS, A BOTTOM LINE SOLUTION**

The Sulfurex® SDS is for the RNG customer who no longer wants to constantly worry about whether they are dosing caustic correctly, or to decide dosing constantly for peak events versus for average loadings (e.g., having off spec gas during peak events). What can a customer expect to save in OPEX as a result of DMT’s Sulfurex® SDS? Field studies indicate that these H₂S removal systems are capable of responding to real-time changes in the feed gas which results in a saving of 30 to 35% in caustic consumption. For a RNG plant with a biogas inlet concentration of 350 standard cubic feet per minute (scfm), receiving 10,000 ppm of H₂S as an example, the investment on the smart system is paid back within 24 months on caustic purchases alone. Now that’s Smart!

**About DMT Clear Gas Solutions**

DMT Clear Gas Solutions is a technology supplier specializing in biogas upgrading and gas desulfurization. We are part of a global organization with more than 30 years of experience, 100 employees and offices/agents spread throughout Europe & Asia. Our award-winning portfolio, paired with 24/7/365 customer support, is the best the market has to offer to companies seeking sustainable solutions. With key accounts and some of the largest operational renewable natural gas (RNG) plants in North America, our customers see a profitable return on investment when upgrading with DMT. Learn more at www.dmt-cgs.com

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