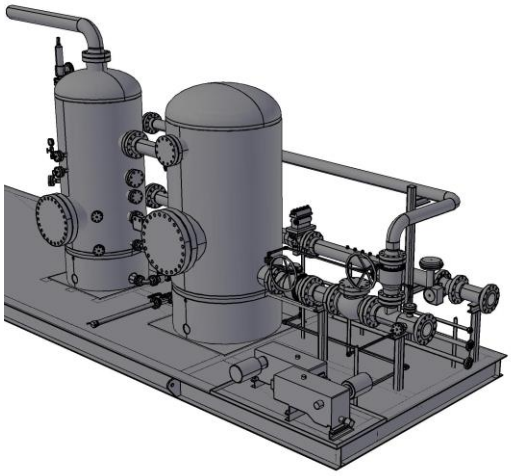
RESIDUAL HYDROGEN SULFIDE MEASUREMENT AFTER GAS SWEETENERS

Lead acetate based detectors work best

Natural Gas Sweetening

A common method of removing H_2S from natural gas ("sweetening") is to flow the gas through a contactor containing a liquid scavenger to absorb the H_2S, such as the Ultrafab Zero Sour system.



The scavenger can be an aldehyde, metal oxide, alkanolamine, or other alkali, but the use of triazine compounds is often the favored method. Triazines react with H_2S to form a mixture of sulfur-containing products such as thianes, thiazines and alkylamines or alkanolamines. This product stream is separated and disposed of or recycled. However, during scrubbing, trace (ppm) levels of the scavenger or the reaction products can be vaporized into the gas stream.

Hydrogen Sulfide Measurement

After scrubbing it is important to measure the H_2S concentration to verify that the regulatory limit is met, typically below 4 ppm. Possible measurement instruments include colorimetric gas detection tubes, impregnated colorimetric tape systems, metal oxide semiconductor (MOS) sensors, electrochemical sensors, photoionization detectors (PIDs), UV detectors, and tunable diode lasers. Of these methods, all suffer from varying degrees of interference by the scavengers or products, except for the lead acetate based systems. Lead acetate detection of H_2S is called for in ASTM Standard Method 4084. Suitable systems include paper tape impregnated with lead acetate (e.g., Envent Model 331), and gas detection tubes using this chemistry.

Two Types of H_2S Tubes

Gas detection tubes for ppm measurement of H_2S typically employ either

- Mercuric chloride ($HgCl_2$) Yellow → Pink
- Lead acetate ($Pb(OAc)_2$) White → Brown

The mercury based tubes are normally used in lower range tubes for measuring 1-7 ppm (e.g.,Uniphos SHS-1H) or 0.2-3 ppm because they have a stronger color change at these low concentrations. Lead acetate tubes are used mostly for the 1-30 ppm tubes (Uniphos SHS-2*) and higher concentrations because of fewer interferences and less toxic reagents. However, the mercury based tubes suffer from interference from some acids, mercaptans and other sulfur-containing compounds, including those from triazine-based scrubbers. These tubes may give a response when no H_2S is present when used immediately after a scrubber. Therefore we recommend using a lead acetate-based tube or paper tape system in such cases. Lead acetate systems have not shown any interference to scavengers used in gas sweeteners, to our knowledge. Uniphos SHS-1* (0.5-10 ppm), SHS-2* (1-30 ppm) and SHS-3L* (2.5-60 ppm) tubes are lead acetate tubes suitable for post-scrubber H_2S measurements.

Distinguishing the Two H_2S Tube Types

The two H_2S tube types are easy to tell apart. First, consult the tube data sheet that should be in each box of tubes. This should identify the tube chemistry and possible interferences. If the tube sheet is not available, one can tell a mercury-based tube from its yellow or orange starting color, compared to the pure white color of all lead acetate tubes.

* FDSE equivalent part numbers are as follows:
SHS-1: FD01-01-SHS1 SHS-1H: FD01-01-SHS1H
SHS-2: FD01-01-SHS2 SHS-3L: FD01-01-SHS3L