HYDROGEN SULFIDE (H₂S) PRODUCTION TECHNOLOGY

The worldwide market for H₂S continues to grow at an impressive rate.

H₂S is used to make mercaptans, other downstream chemicals and for mining and metallurgy applications. Unitel has recently provided the technology and engineering & design for two commercial H₂S plants -- a unit located in Europe to make 48 MTPD of H₂S while the other one in Southeast Asia includes two trains each producing 60 MTPD of H₂S.

Unitel’s H₂S production technology was developed in the mid-80’s. The process was first demonstrated in a commercial unit located near Rotterdam in The Netherlands. Since that time, the reactor has been designed to work with a variety of feedstocks including those that contain the 8S form of sulfur. The process has also been optimized to yield a turndown ratio of 100% down to 30%.
In the past, hydrogen sulfide was usually obtained from “sour gas” contained in natural gas.

Nowadays the preferred route for making pure hydrogen sulfide is to react sulfur with hydrogen.

**Methyl Mercaptan: CH₃SH**

This is one of the most important intermediates made from H₂S. It is used to produce methionine which is the only sulfur containing amino acid and is used extensively as a food supplement in the poultry industry. Methionine is currently a $3 billion dollar market with a 5% growth rate.

**Hydro Metallurgical Extract**

H₂S is used to extract nickel out of limonite type laterite ores. The mined ores are leached with sulfuric acid and then subjected to a H₂S reduction process to remove copper. The pH is adjusted to about 2.5 and the liquid is then reacted with H₂S to selectively precipitate the nickel and cobalt compounds.

**Gas Odorizers**

Ethyl Mercaptan and t-Butyl Mercaptan are widely used as gas odorizers by pipeline companies. Both these compounds are made by reacting appropriate feeds with H₂S.

Minor applications: sodium hydrosulfide (NaSH), etc.
**H₂S PRODUCTION PROCESS**

**Operating Parameters:**
- System operating pressure ≈ 8 bar (100 psig)
- H₂ supply pressure > 10 bar (~150 psig)
- Bright liquid supply temp. ≈ 135°C-150°C (275°F-300°F)
- Reaction temperature ≈ 425°C-480°C (800°F-900°F)

Hydrogen sulfide is commercially produced by reacting hydrogen with molten sulfur at elevated temperatures.

**Raw Materials & Utilities**

Per metric ton of H₂S.
- 98% conversion of H₂ to H₂S and 10% blowdown of S
- Hydrogen (>99% purity @ 10 bar) ≈ 740 m³ (26,000 SCF)
- Bright liquid sulfur ≈ 1,100 kg (2,425 lbs)
- Power connected load ≈ 10 kWh
- Steam @ 4 bar ≈ 150 kg (330 lbs)
- Cooling water @ 30°C ≈ 40 m³ (1400 ft³)
Integral Reactor & Quench Tower
- The reactor is a vertical tower filled with molten sulfur at 425°C to 480°C (800°F to 900°F).
- The quench tower is directly mounted on the reactor and operates at a temperature of 135°C (275°F).
- Due to the temperature variance in the reactor and the quench tower, special designs have been utilized to minimize thermal stresses and buckling.
- The internals are designed to eliminate the formation of high viscosity polymeric sulfur pockets.

Special Features of Unitel’s H2S Process
- The process is adaptive to various categories of sulfur feedstock.
- Ash in the sulfur can build up in the reactor. Some sulfur is periodically removed to keep the ash level below a prescribed minimum.
- Typically the blowdown amounts to approximately 10% of the feed sulfur.
- The Unitel design enables a rapid response to changes in operating conditions.
- Unitel’s process offers a high turndown ratio from 100% to 30%.
- Unitel has addressed the special problem posed by the S form of sulfur present at 25-50 ppm.
- Swing duty sulfur gettering beds are used downstream of the condensers.
- Speed control of primary sulfur pump slaved to sulfur level in the reactor.

If you are interested in learning more about Hydrogen Sulfide Production Technology, please contact Unitel Technologies:

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