

uniteltechnologies

Your Partner in the Pursuit of Process Innovations

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%.



EUROPE - 48 MTPD H₂S Production Facility. Licensed & Engineered by Unitel Technologies. Photo used with permission



SOUTHEAST ASIA - H₂S Production Facility, two trains each 60 MTPD. Licensed & Engineered by Unitel Technologies.

H₂S APPLICATIONS

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.

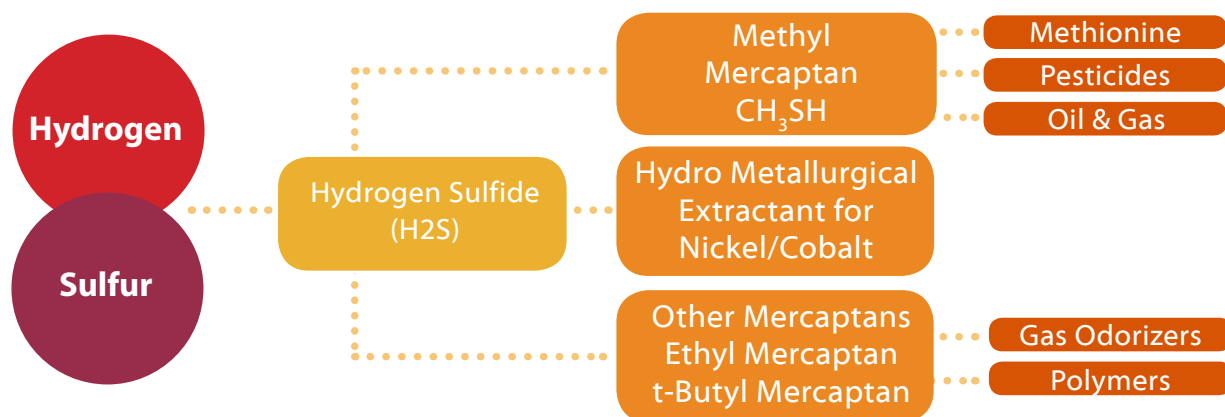
Hydro Metallurgical Extract

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.



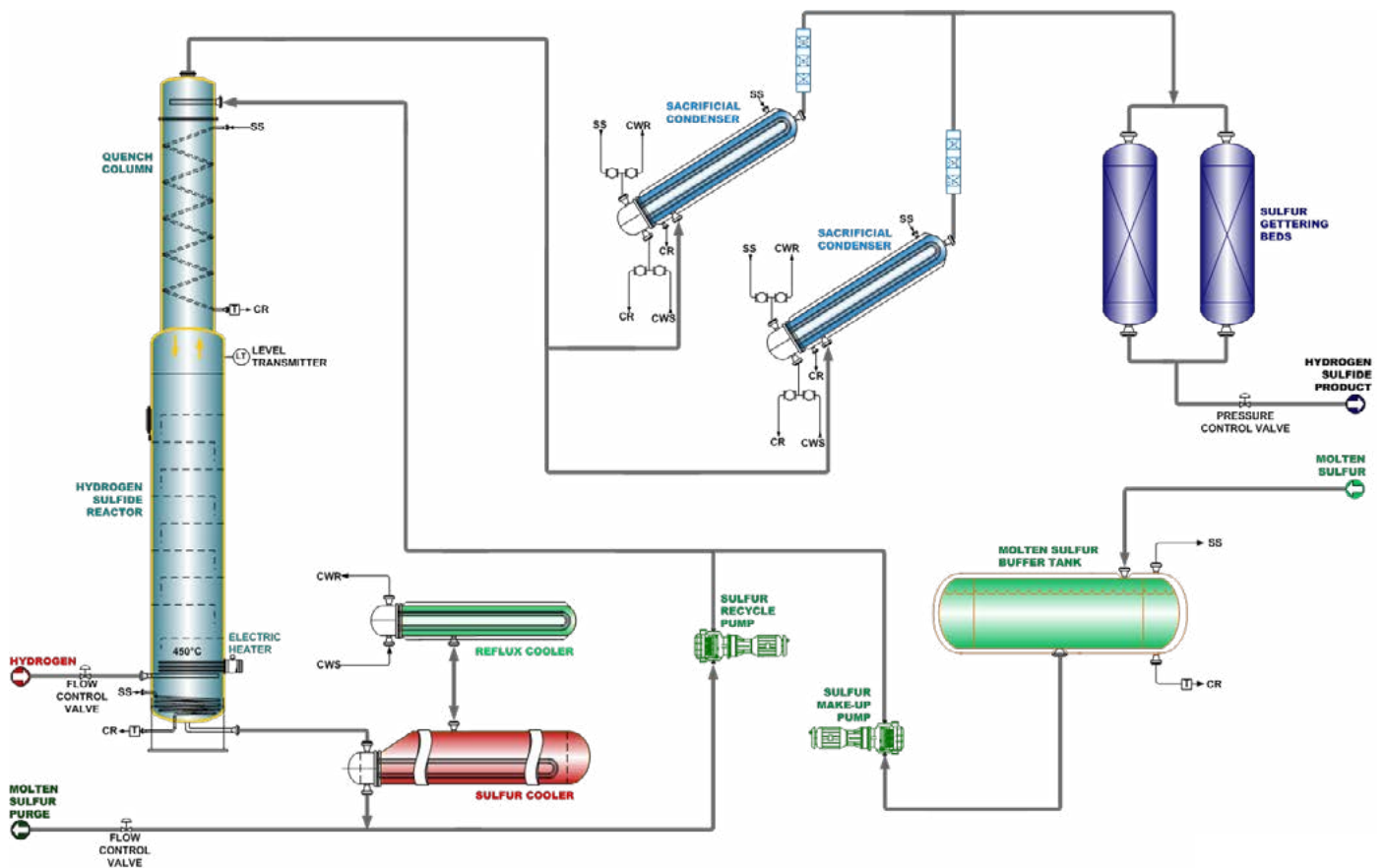
Minor applications: sodium hydrosulfide (NaSH), etc.

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)

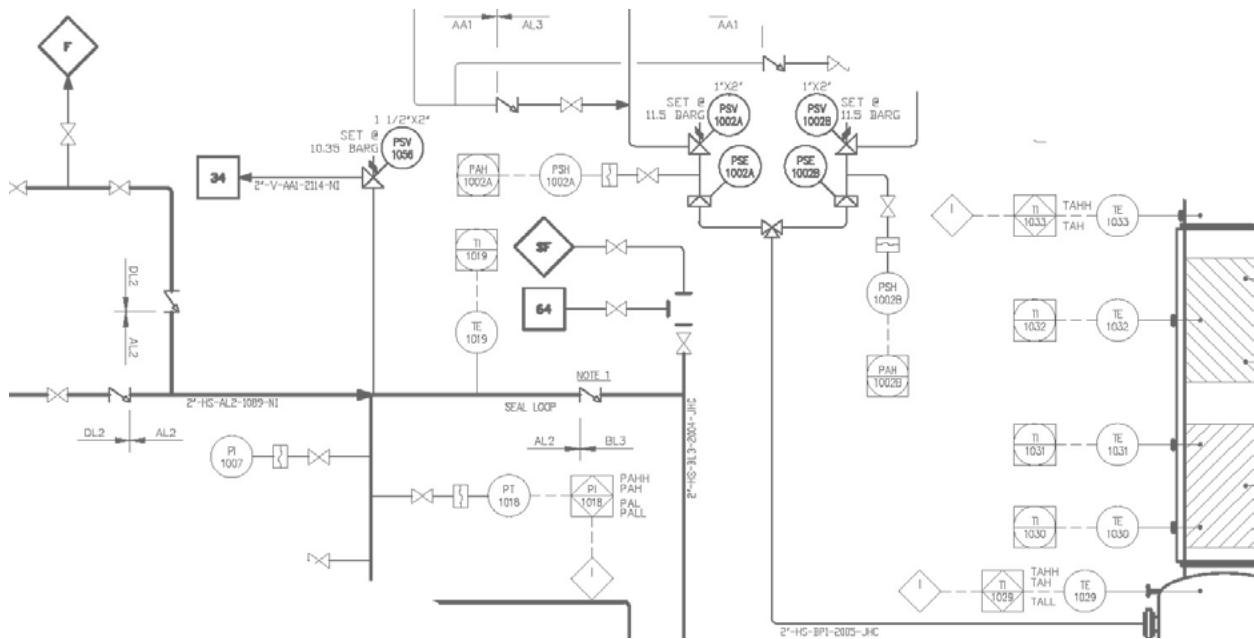
- Bright liquid sulfur ≈ 1,100 kg (2,425 lbs)
- Power connected load ≈ 10 kWh
- Steam @ 4 bar ≈ 150 kg (330 lbs)
- Cooling water @ 30°C ≈ 40 m³ (1400 ft³)

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 ⁸S form of sulfur present at 25-50 ppm.
- Swing duty sulfur gettinger 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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- 479 Business Center Drive #105
- Mt. Prospect, IL 60056
- Tel: 847-297-2265
- www.uniteltech.com