PRODUCTION OF CARBON DISULFIDE FROM MOLTEN SULFUR AND NATURAL GAS

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1. OVERVIEW:

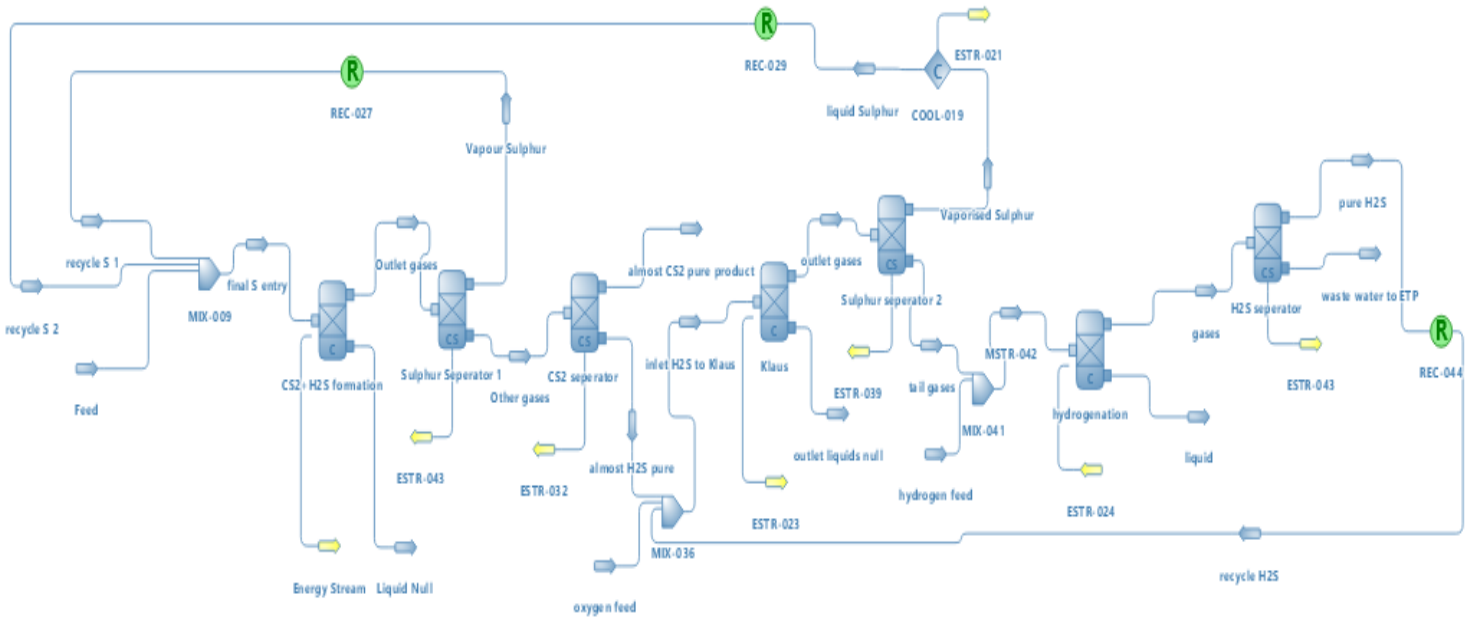
CS_2 manufacturing unit was set up in 2010 in the Jhagadia plant and it played a key role in enhancing the production of many other products of UPL. AkzoNobel, Netherland is the technology provider for the unit. CS_2 is majorly used as a raw product for the production of Mancozeb, WDG, and Antrocol. H_2S is the by-product of the reaction which is either converted back to Sulphur or used for NaHS synthesis. In present simulation, we are recycling entire H_2S and not synthesizing NaHS. The design production capacity of the plant is 110 TPD, which is what we have tried to achieve with this simulation.

2. PROCESS REACTIONS:

- Main reaction $2CH_4 + S_8 \dashrightarrow 2CS_2 + 4H_2S$
- Klaus reaction $2H_2S + O_2 \dashrightarrow 2S + 2H_2O$
- Hydrogenation $S + H_2 \dashrightarrow H_2S$
  $CS_2 + 4H_2 \dashrightarrow 2H_2S + CH_4$

3. RAW MATERIALS:

Sulfur is obtained from Reliance Refinery, whereas Methane requirement is met from ONGC and GGCL.



This is the Process Flow Diagram for the simulated plant.

4. **PROCESS OPERATIONS:**

a. The main reaction between methane and molten sulfur is carried out in a conversion reactor operating at 650°C. It achieves a conversion of 99.9% in terms of methane.

b. Unreacted Sulfur is recovered in a sulfur separator and is recycled back to the main reactor.

c. Product vapors consisting of CS_2 and H_2S with small amounts of methane are sent to a compound separator which separates CS_2 and almost pure H_2S with traces of methane leave the system.

d. The H_2S stream goes to a mixer where it combines with oxygen feed and recycle stream of H_2S from H_2S separator.

e. This combined stream goes to another conversion reactor where Klaus reaction takes place and controlled amounts of H_2S are converted back to elemental sulfur in vapor form.

f. This sulfur is recovered in a sulfur separator, cooled by a stream cooler and recycled back to the main reactor.

g. The tail gases, mostly containing H_2S with some water and traces of CS_2, sulfur, methane and oxygen are sent to a hydrogenator where CS_2 and sulfur are again converted back to H_2S.

h. The gases released from hydrogenator are processed in an H_2S separator from where H_2S is recycled back to the Klaus reactor as explained earlier.

i. The waste water stream, consisting of water along with traces of hydrogen and methane is sent to effluent treatment, which is not further explained in our diagram.

5. **RESULTS:**

Pure CS_2 obtained after CS_2 separator is found to have a mass flow rate of 1.218 kg/sec, which corresponds to 105.24 TPD plant capacity. As the operational plant at UPL has a capacity of 110 TPD, we have successfully simulated the plant dynamics with necessary unit operations and have obtained the results well within error limits.