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H_2S removal from H_2 enriched natural gas: experimental assessment and model simulations

Aim

Experimental evaluation of the reactive adsorption of H_2S from natural gas on activated carbon at a wide range of operating conditions as well as model simulations.

Justification

The removal of H_2S from natural gas through a reactive adsorption is an already proven technology which is currently being used in the industry. In the presence of air, H_2S dissociates into H_2O and elemental sulphur. The latter stays adsorbed on the active carbon material. As a consequence, the active carbon needs to be replaced upon saturation. The upcoming energy transition involves using evermore H_2, which brings new challenges for this technology as it is planned to inject H_2 (5 to 10%) into natural gas reservoirs. Hence, although the technology has been proven successful, it has yet to be demonstrated in a H_2 rich environment. Due to the reasons mentioned before, a set-up will be constructed which should be able to handle model molecules as well as real feedstock. With every new set-up, a safety assessment must be done in order to ensure the operational safety of the researchers. In this environment, the safety assessment (e.g. HAZOP) will be of high importance as H_2S is a highly toxic molecule. Finally, model simulations will be performed in order to help assess the most critical operating conditions for the experiments and to evaluate conditions outside the experimental ones.

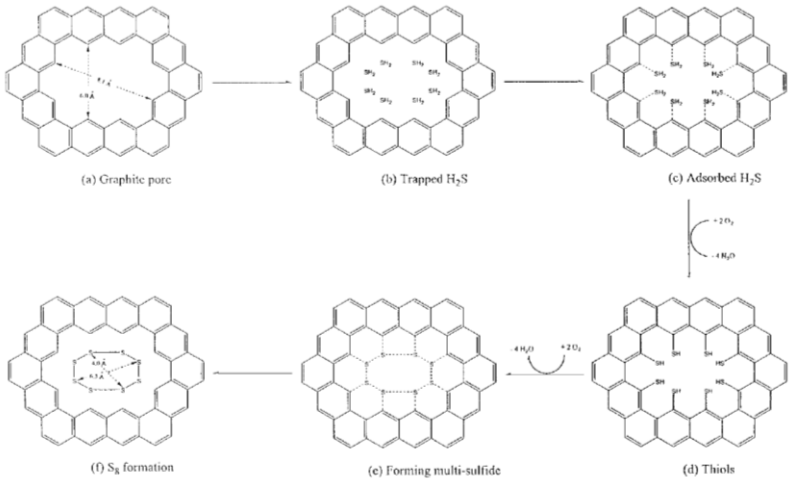

Figure 1 Adsorption reactions of H_2S on activated carbon [1]

Program

1. Literature review on reactive adsorption of H_2S on active carbon and operational safety.
2. Determination of the needed operating range of future the set-up and in general be involve in the construction of the set-up.
3. Experimental assessment on the reactive adsorption of H_2S on active carbon under a H_2 rich environment in the high-throughput kinetics setup using model compounds: CH_4, H_2O, H_2S, H_2 and air.
4. Model simulations on reactive adsorption of H_2S.

[1] H. L. Chiang, J. H. Tsai, G. M. Chang and Y. C. Hsu, “Adsorption Kinetic Characteristics of H2S on Activated Carbon” *Adsorption*, vol. 8, no. 4, pp. 325-340, Dec. 2002, doi: 10.1023/A:1021537530695