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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. Upon the addition of a precise amount of ambient air, H_2S dissociates over active carbon 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 rather than natural gas, which brings new challenges for this technology as it is planned to initially inject H_2 (5 to 10%) and, ultimately, up to 100% H_2 into underground storage reservoirs. Hence, although the technology has been proven successful for natural gas, it has yet to be demonstrated in a H_2 rich environment. Due to the reasons mentioned before, a set-up within LCT is being modified which will be able to handle model molecules as well as real feedstock. Different types of activated carbon are available with different properties, either in physical appearance (powder, granular, extrudates) or chemically (carbon black, graphitic,…). Activated Carbons will be acquired for physico-chemical characterization and performance testing. Finally, model simulations will be performed to adequately understand the occurring phenomena and determine the optimal operation conditions.

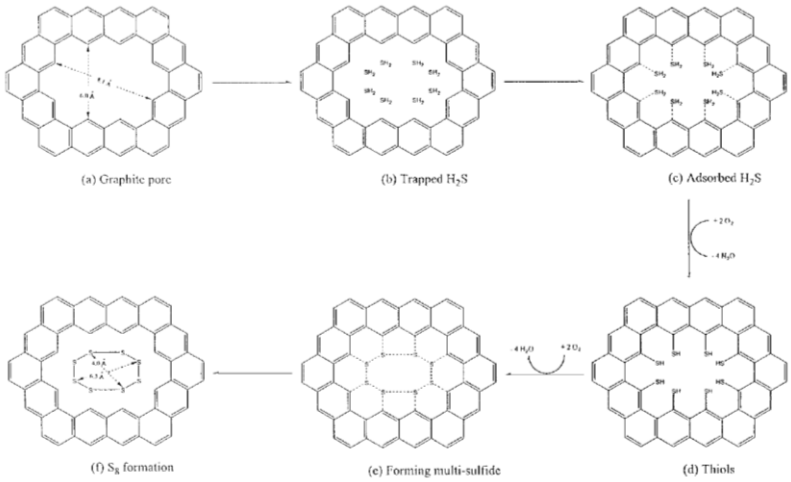

Figure 1 Adsorption reactions of H_2S on activated carbon [1]

Program

1. Literature review on selective catalytic reactive adsorption of H_2S on active carbon.
2. Physico-chemical characterization of the different activated carbons.
3. Experimental assessment on the reactive adsorption of H_2S on active carbon under a H_2 rich environment 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

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