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Coach	**Supervisor(s)**	**Funding**
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Kinetic modeling and upscaling of oxidative H_2S removal from underground-stored gas

Aim

Providing more insight into the oxidative removal of H_2S from underground-stored natural gas enriched with hydrogen. The study commences from modeling laboratory-scale data from the REMGAS setup and then extrapolating to the desulphurization towers of the Fluxys' Loenhout site through implementing modeling of the hydrogen sulfide (H_2S) oxidation on active carbons in fixed bed reactors.

Justification

In line with global clean energy transitions, Fluxys has planned to support Belgium's shift toward a CO_2-neutral energy system by converting its Loenhout site from an underground natural gas storage to hydrogen storage. To achieve this, it is essential to assess the impact of hydrogen introduction on the operational performance. Currently, the natural gas extracted from the reservoir contains H_2S, an impurity formed through underground microbial and geochemical interactions. Thus, on-site elimination of H_2S is required to ensure that the gas meets grid specifications. Currently, high-pressure desulphurization towers loaded with active carbon as catalyst/adsorbent material, carry out the oxidation of the sulphur impurities through the reaction:

$$2\ H_2S + O_2 \rightarrow 2\ S + 2\ H_2O$$

This thesis aims to evaluate the effects of hydrogen introduction into the above-ground gas treatment facility by developing and validating a predictive model using laboratory and operational data. The insights gained will help optimize desulphurization strategies, ensuring continued effectiveness under hydrogen-enriched conditions.

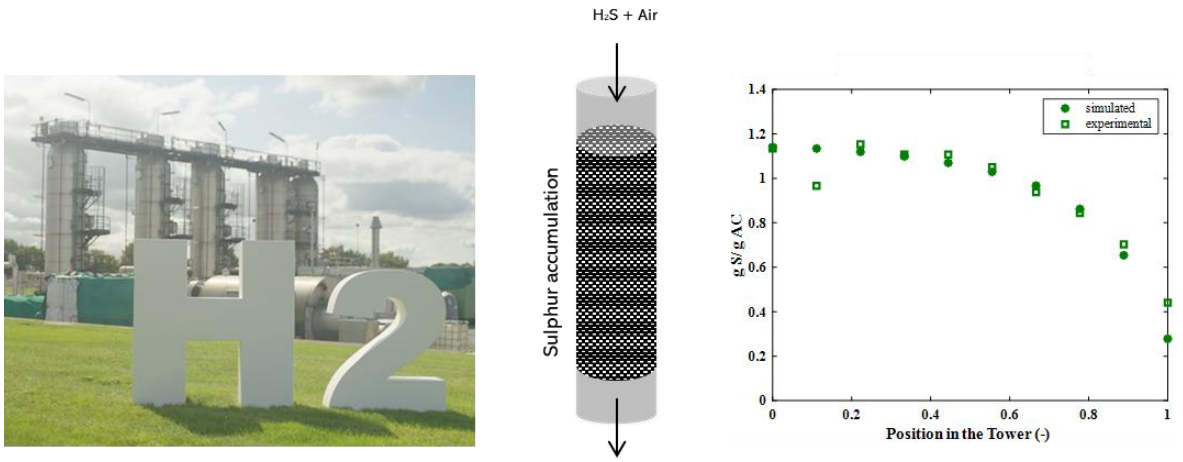

Figure 1- from left to right, Fluxys' Loenhout site, oxidative H_2S elimination, simulation of sulphur deposition on the desulphurization tower's bed

Program

1. Literature study of oxidative H_2S removal on activated carbon
2. Kinetic Model Development
3. Reactor-Scale Model Implementation