Hydrothermal oxidation of H2S spent scavengers. Removing organic pollutants and reducing toxicity

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Hydrothermal oxidation of H_2S spent scavengers. Removing organic pollutants and reducing toxicity

Nikos Montesantos, Alaa Khalil, Jens Muff, Marco Maschietti

Section of Chemical Science and Engineering, Department of Chemistry and Bioscience, Aalborg University

Introduction

The discharge to the sea of spent H_2S scavengers accounts for a considerable part of the total environmental impact factor of offshore oil and gas production. In this work, hydrothermal oxidation is utilized to convert the spent scavenger (SUS) wastewater stream constituents to CO_2, water and inorganic salts rendering it less harmful. The process is evaluated on real offshore samples, with respect to the destruction of the scavenging reaction products and the unreacted MEA-triazine as well as to the overall toxicity of the effluent in comparison to the feed spent scavengers.

Targeted application

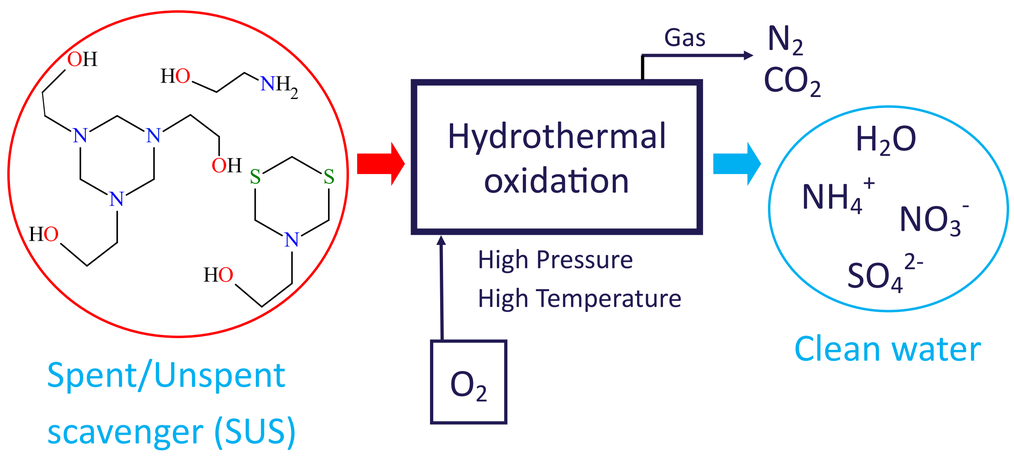
- Triazine-based H_2S scavenging of natural gas

Objective

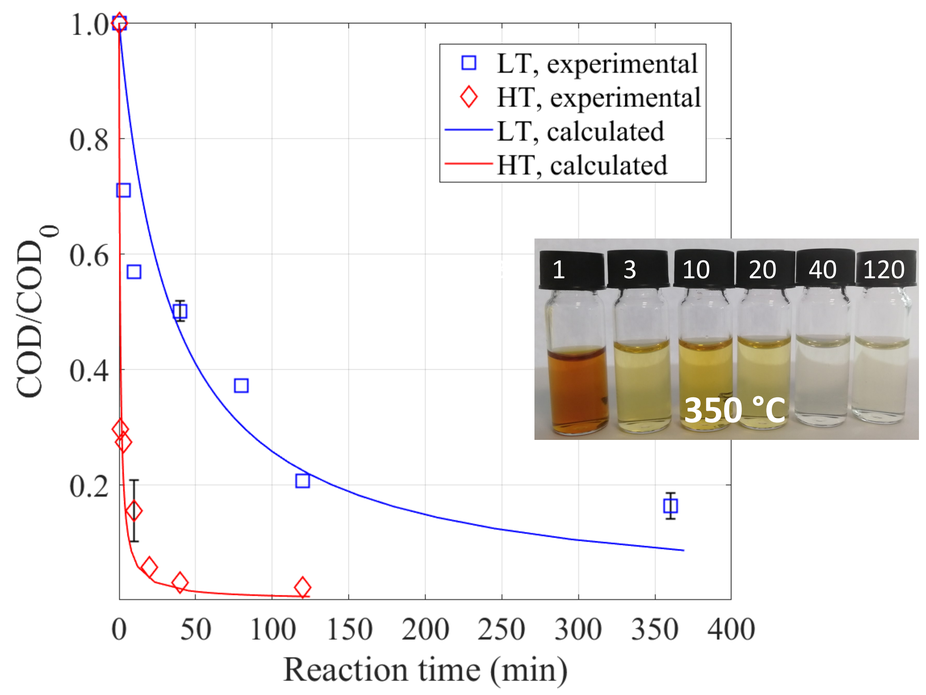
- Zero discharge of H_2S scavenging related chemicals

Hydrothermal oxidation of SUS

Objective



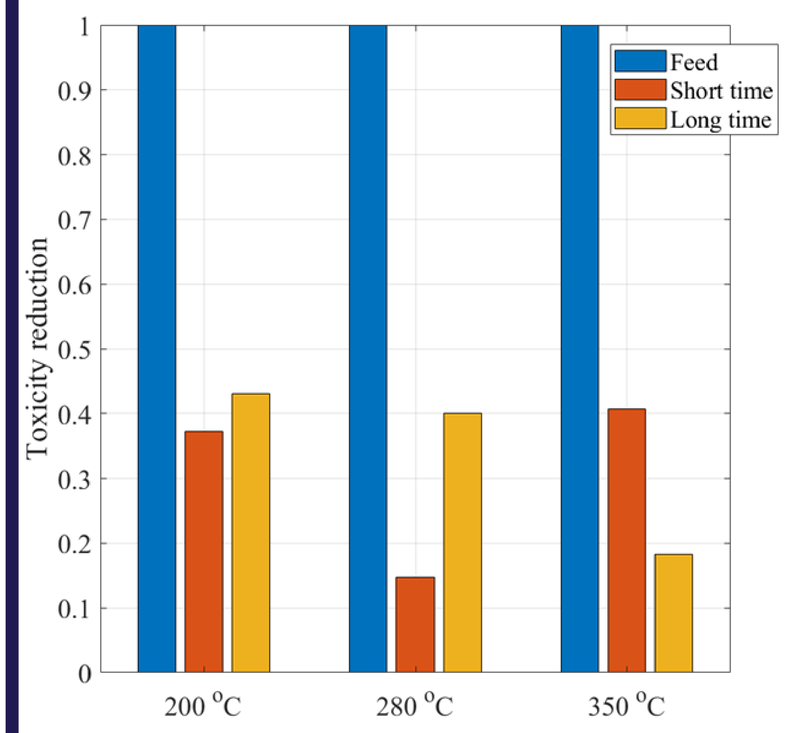
Destruction of organic pollutants



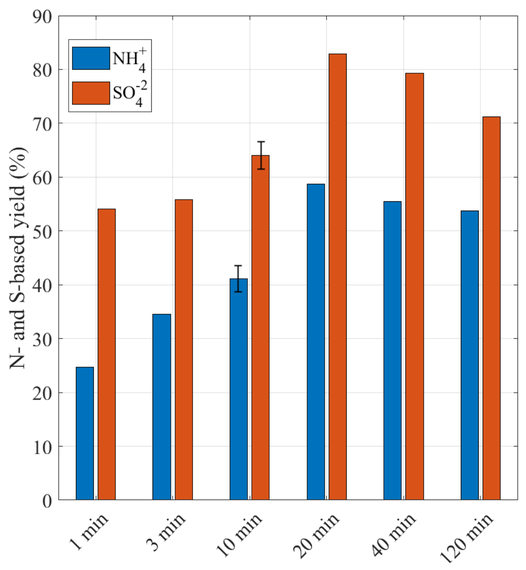
Highlights

- Up to 98 % COD and TOC reduction
- Up to 80 % toxicity reduction
- Significantly faster oxidation at 350 °C
- Organic nitrogen converted to ammonium
- Organic sulfur converted to sulphate
- Carboxylic acids are intermediate oxidation products

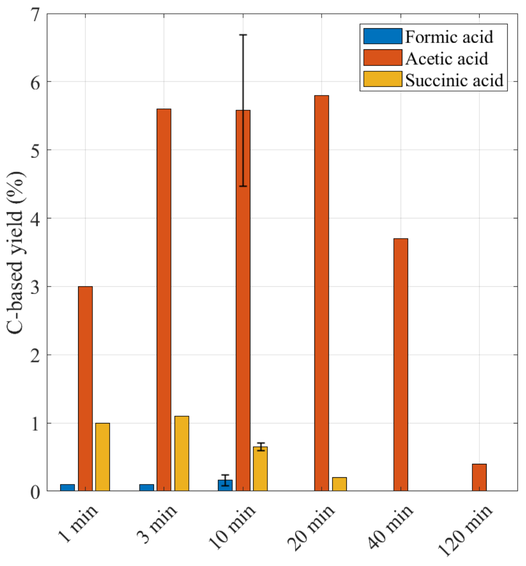
Toxicity reduction



Ammonium and sulphate at 350 °C



Carboxylic acids at 350 °C



Conclusions

- Hydrothermal oxidation significantly reduces the organic load of spent H_2S scavengers.
- The process effectively decreases the overall toxicity of the spent scavenger feed in the range of 60 % to 80 %.
- Hydrothermal oxidation leads to the complete oxidation of MEA-triazine, MEA and spent H_2S scavengers to CO_2 water and salts.
- High temperature significantly improves the oxidation reaction rate.

References

[1] N. Montesantos, M.N. Fini, J. Muff, M. Maschietti, Proof of concept of hydrothermal oxidation for treatment of triazine-based spent and unspent H2S scavengers from offshore oil and gas production, Chemical Engineering Journal, 427, 131020 (2022). https://doi.org/10.1016/j.cej.2021.131020.

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