

# Danish Hydrocarbon Research and Technology Centre Technology Conference 2018

## Investigation of microbial souring mechanisms and test of natural antibiotics for corrosion prevention

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### Presenting author:

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### Research Programme:

Radical Innovation Sprint 2018

### Abstract:

Offshore oil production facilities are subjectable to internal corrosion, which can occur through microbiologically influenced corrosion (MIC) and souring (sulphide production by sulfate-reducing prokaryotes, SRP). Seawater contains sulfate (up to 25-30 mM in the North Sea), thus allowing prominent SRP; sulphate-reducing bacteria (SRB), sulphate-reducing archaea (SRA) and methanogens to attack as an embedded matrix (often with bioinorganic matrixes) referred to as biofilms. The petroleum industry relies on biocides to avoid MIC, souring and biofouling.

Active phytochemicals including strong antimicrobials from halophytes were applied in this study to combat contamination by inhibiting MIC microorganisms such as methanogens and SRP. A bioreactor system for biofilm production was setup and inoculated with production well fluids/biofilm samples to emulated onsite MIC. Next generation sequencing (NGS) of DNA from bacteria and archaea will help identify the strains and study the effects of antimicrobials on these strains. The inhibitory effect of using selected halophyte plant extracts on SRB, SRA and methanogens was studied and novel biologically inspired long-term solutions to prevent MIC and souring are proposed.

# Danish Hydrocarbon Research and Technology Centre Technology Conference 2018

## Preparation of tailored emulsions by using Membrane Emulsification process

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Radical Innovation Sprint 2018

### Abstract:

Under this project, an oil-water emulsion to be used as smart injection fluid will be prepared from produced water. Membrane emulsification process will be applied to prepare the emulsion. Membrane emulsification offer several advantages including freedom of tuning the droplet size of the dispersed phase by changing the membrane properties and operating conditions, very narrow droplet size distribution and significantly less energy consumption compared to state-of-the-art emulsification processes. In this project, oil-in-water emulsions will be prepared under various operating conditions by using the produced water from different stages of separators. The emulsions will be characterised in terms of droplet size distribution and stability under various conditions. Energy efficiency and the footprint of the membrane emulsification unit producing a specific volume of the emulsions will be estimated. It is expected that the project will provide ground breaking work on application of produced water as a smart injection fluid.

# Danish Hydrocarbon Research and Technology Centre Technology Conference 2018

## H<sub>2</sub>S: A hazard or a pathway towards value creation

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### Research Programme:

Radical Innovation Sprint 2018

### Abstract:

Sour natural gas compositions can vary over a wide concentration of H<sub>2</sub>S and CO<sub>2</sub> and a wide concentration of hydrocarbon components. If the H<sub>2</sub>S content exceeds the sales gas specification limit, the excess H<sub>2</sub>S must be separated from the sour gas. The removal of H<sub>2</sub>S from sour gas is called "sweetening." The concept of our research is simultaneous catalytic conversion and separation of H<sub>2</sub>S. The main objective is studying the feasibility of capturing H<sub>2</sub>S followed by its conversion in a liquid phase. In this case, one possible route for H<sub>2</sub>S capture is absorption in a primary liquid phase. The absorbed H<sub>2</sub>S then can be directly converted in a same unit operation. Bi-phasic homogenous catalytic and/or phase transfer catalytic systems can be used to produce organic materials (e.g. thiols) from H<sub>2</sub>S absorbed in the primary liquid phase. A basic illustration of the proposed concept is shown in the scheme below (Figure 1).

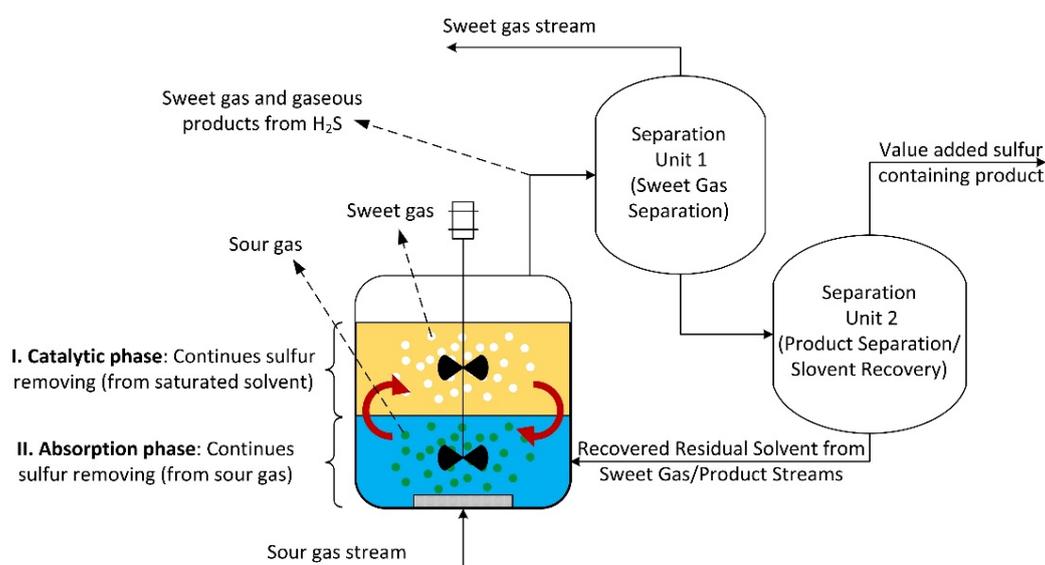


Figure 1. Schematic illustration of the proposed concept.

# Danish Hydrocarbon Research and Technology Centre Technology Conference 2018

## Intelligent Pipeline Inspection Using Modularized Autonomous Robot

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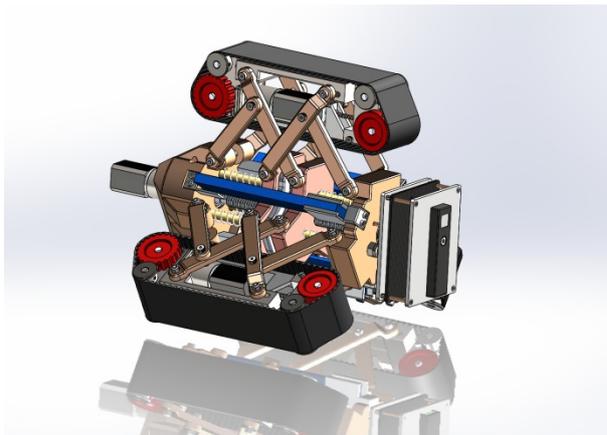
Ying Qu and Rolan Ossi

### Research Programme:

Radical Innovation Sprint 2018

### Abstract:

Globally there are more than **3 million km** of active pipelines under the oceans. However, most of these installations are only inspected once or twice per year at a regular schedule. Nevertheless, no matter which existing inspection approaches, e.g., based on either usage of ROVs/AUVs, or intelligent inline pigging systems, these approaches are often very expensive and require high and complicated supporting and maintenance technologies. Along with boosting in AI & robot technologies, the usage of small but autonomous robots could change the game of pipeline inspection, and provide very cost-effective, reliable and high-frequent inspection solutions. This project is to develop and demonstrate a **modularized autonomous crawler robot** equipped with some **corrosion inspection** tool for committing inner-pipeline corrosion inspection.



# Danish Hydrocarbon Research and Technology Centre Technology Conference 2018

## A New Membrane for the Abatement of Hydrogen Sulfide in Sour Gas

### Authors and affiliations:

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### Research Programme:

Radical Innovation Sprint 2018

### Abstract:

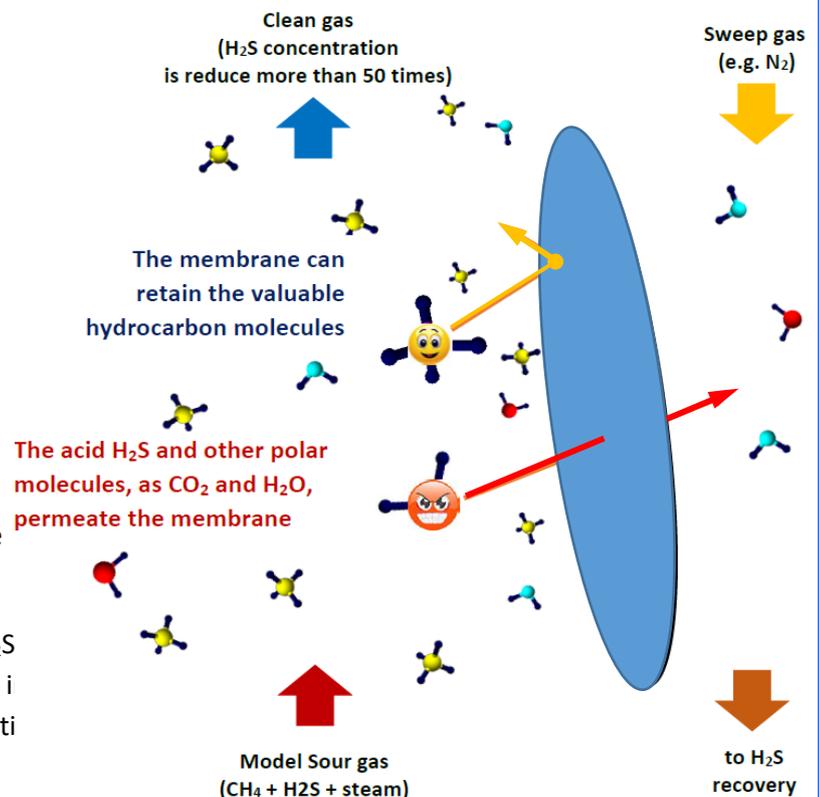
Hydrogen sulfide ( $H_2S$ ) in sour gas causes corrosion of pipelines and equipment, and is a risk for humans and the environment. Chemical scavengers are currently used for  $H_2S$  abatement with a consequent increase in the costs and complexity of the production and processing operations.

In this context, we aim to develop a synthetic membrane that has the potential to separate  $H_2S$  from natural gas. Three modifiers are used to control the perm-selectivity and the stability of the membrane materials.

Our first tests under static conditions show the membranes to be stable in  $H_2S$  atmosphere.

In November 2018 we are going to tests the  $H_2S$  selectivity and permeability of the membranes i a dedicated gas-filtration system with a syntheti gas mixture ( $H_2S$  conc. = 200 ppm, feed pressure = 4 bar).

### Project objective:



### Experimental set-up:

