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Application of natural antimicrobial compounds for reservoir souring and MIC prevention in offshore oil and gas production systems

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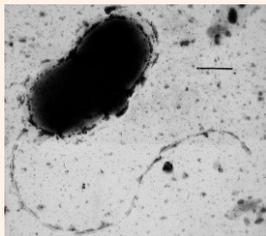
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Background - problem

Offshore oil production facilities are subjectable to internal corrosion, potentially leading to human and environmental risk and significant economic losses. Microbiologically influenced corrosion (MIC) and reservoir souring - sulphide production by sulfate reducing microorganisms in the reservoir - is believed to be an important factor in these major problems in the petroleum industry (1,2). The sulphide-producing microorganisms can be Bacteria (SRB) or Archaea (SRA) with the main focus in the literature being on SRB (4-7). Although SRB can use a variety of organic electron donors, including low-molecular-weight aliphatic and aromatic hydrocarbons, alcohols, and carboxylic acids, volatile fatty acids (VFA) are considered important electron donors in oil fields (4).

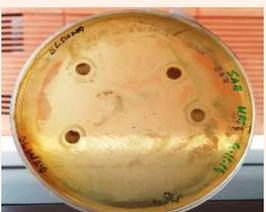


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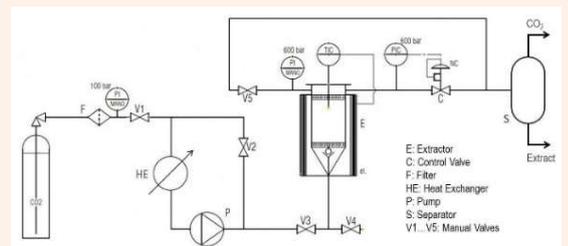
Suggested solution

Halophytes are plants that can grow in seawater. They have been shown to produce a wide variety of very active phytochemicals including strong antimicrobial compounds (8). In our previous studies, we have extracted and enhanced these natural halophyte antimicrobials for efficient use as contamination control in anaerobic fermentations (ethanol fermentation with yeast) where they were shown to significantly inhibit methanogens and VFA producing bacteria (9). The halophytes have specialized in thriving in the very competitive aquatic environment, protecting themselves from attacks by seawater bacteria and archaea, and hence our hypothesis is that the natural antimicrobials produced by halophytes can act as natural and safe MIC and reservoir souring inhibitors.



Preliminary results and on-going work

GC-MS and LC-MSMS analysis of halophyte extracts shows promising results of a wide array of potent antimicrobial phytochemicals. Tailoring and use of these extracts in plating of anaerobe bacteria showed efficient inhibition – with wide inhibitions zones of up to 15 cm. For ongoing experiments, a new supercritical CO₂ extraction set-up will be tested for more efficient extraction (figure to the right) and based on plant analysis efficient antimicrobial mixtures will be formulated and tested on SRB and SRA.



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