Are Future Liquid Energy Carriers Microbially Stable?

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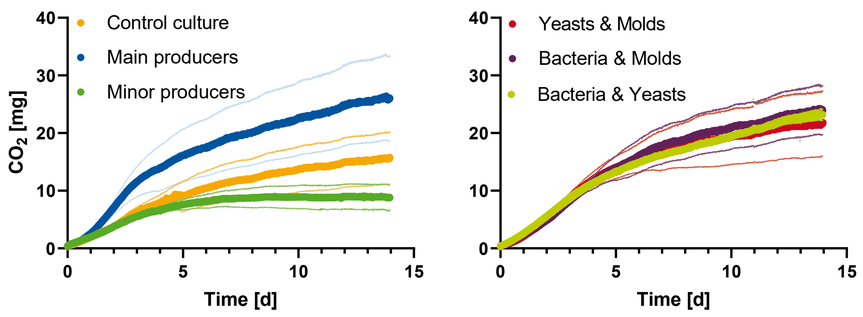
Introduction

- Fuels stored in tanks for prolonged time are prone to microbial degradation.
- Microbial degradation leads to corrosion and biofouling of materials and quality loss of the fuel.
- The increasing use of biogenic compounds in fuels influences microbial activity.
- Strategies are needed to prevent microbial degradation of fuels.
- This study presents a workflow to investigate the microbial activity in future liquid energy carriers.

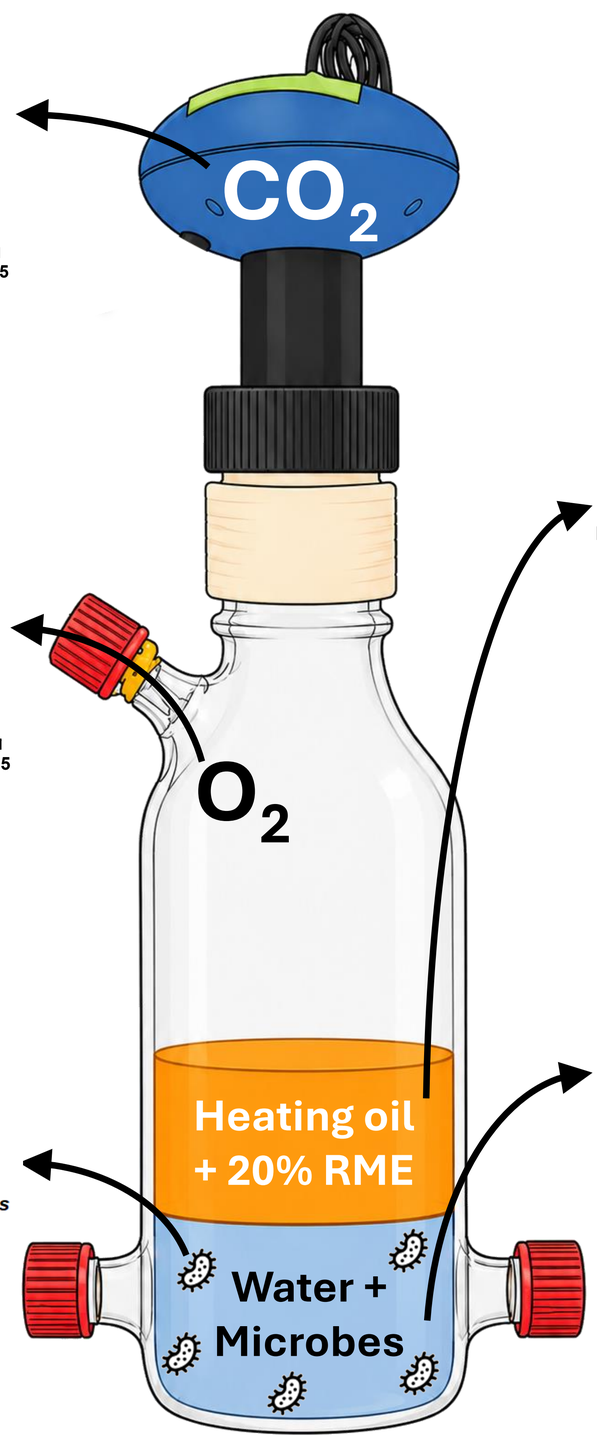
Take Home

- Main producers clearly outperformed the control culture in terms of CO_2 production.
- CO_2 production indicated the active microbial metabolism using substance classes from the oil phase as sole carbon sources.
- The water:oil (1:1) system is a robust model, indicating no O_2 limitation after 14 days of incubation.
- Bacterial composition changes over time which might influence degradation of fuels.

Results & Discussion

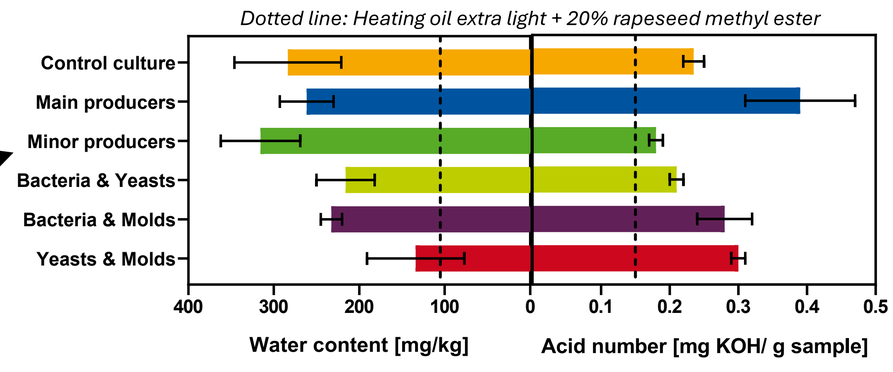


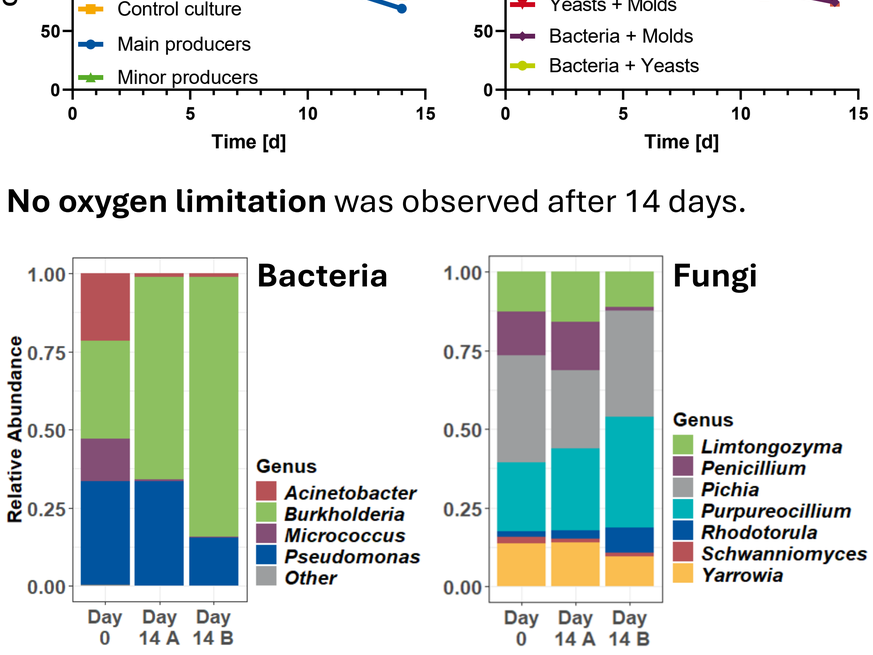
The **CO_2 production** of the **primary producers** was 1.7-fold and **3-fold higher** than the control culture and the secondary producers after 14 days.



Fuels in the Pipeline

GtL, HVO, FAME, Isobutanol, Methanol, Diesel, MGO, HFO, + Blends

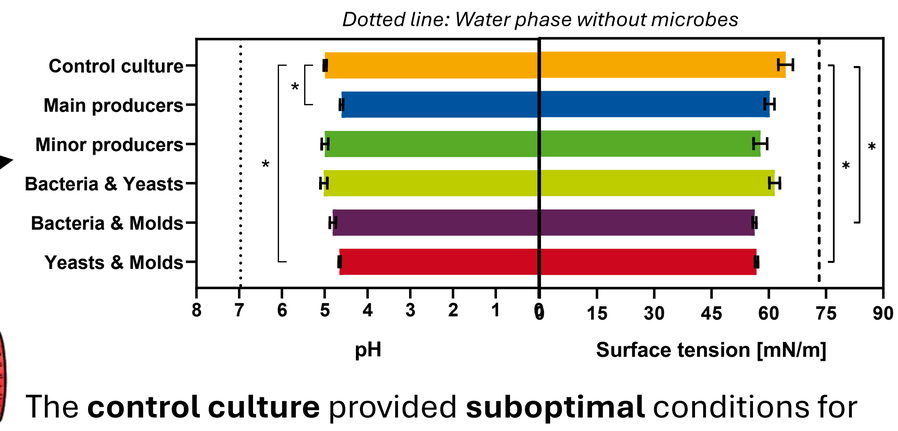




No oxygen limitation was observed after 14 days.

The **highest acidity** level was detected in the **primary producers** group. **No** significant **differences** in **water content** were observed.

Acinetobacter and ***Micrococcus*** were **displaced by *Burkholderia*** after 14 days. **No changes in fungal composition** after 14 days.



The **control culture** provided **suboptimal** conditions for **biosurfactant** production. The **primary producers** were identified as the main contributors to **acid production**.

Methods

- Inoculation of defined microbial culture (bacteria, yeasts, molds) into water phase
- Overlaid with oil phase to form water:oil (1:1) system and headspace followed by incubation for 14 days
- Online CO_2 measurement using BlueSens BCP sensors
- O_2 measurement using Multiple Gas Analyzer
- Analysis of water phase (surface tension, pH) and oil phase (water content, acid numbers)
- Extraction of DNA from water phase to investigate changes in microbial composition

Next Steps

- Investigation of microbial metabolic pathways for different substance classes in oil
- Further optimization of the defined microbial culture
- Application of the optimized microbial culture to various fuels
- Comparison with microbial community present in real oil tanks
- **Chemical analysis of water phase to identify microbial degradation products**

Contact details

Project website

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