Fermentation and recovery of bio-refinery thin stillage to volatile fatty acids with zero-chemical input

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1. Methanogenic activity

Chemical-free pH-oscillation for inhibition of methanogens

Volatile fatty acids (VFA) – applicable as building blocks in the chemical industry - can be produced through fermentation of biorefinery waste streams. The main drawbacks to be addressed are: i) inhibition of methanogenesis and chemical input for pH control; ii) product extraction from fermentation broth; and iii) steering the microbiome towards target products. All three of these key issues are tackled using membrane electrolysis coupled to an acidogenic fermenter.

2. Separation of product

VFA-production
No significant influence of extraction on total production

Recovery of VFA
28.2±3.8% of produced VFA extracted as acids in a clean stream with unoptimised extraction

Elongation of VFA
With extraction coupled, fermentation yields longer VFA

3. Ecology of the fermenting community

Lactobacillus spp. and Megasphaera sp. elongation?

Acetate + Lactate \( \rightarrow \) Butyrate + CO$_2$ + H$_2$O
Butyrate + Lactate \( \rightarrow \) Caproate + CO$_2$ + H$_2$O
Propionate + Lactate \( \rightarrow \) Valerate + CO$_2$ + H$_2$O

H$_2$-driven selection of elongating species?

NAD$^+$ + H$_2$ \( \rightarrow \) NADH + H$^+$

More energy for H$_2$-consumers

To be confirmed

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