Production of Primarily Caprylic Acid (C8) in Chain Elongation Bioreactors

Invention Summary

This invention describes a process to generate caprylic acid (C8 or *n*-octanoic acid) in anaerobic reactor microbiomes with ethanol as the primarily source of carbon by maintaining a high ethanol to acetate substrate ratio.

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Cornell Reference:
D-7298

Technology Overview

In 2015, 14.8 billion gallons of ethanol was produced in the U.S., mainly derived from corn. It is the most used alcohol in the biofuel industry. Ethanol is, however, miscible in water and additional steps and energy are necessary for its extraction. Alternatives are production of higher added value chemicals that are hydrophobic and derived from organic wastes (industrial or agricultural).

Syngas fermentation offers a high ethanol-to-acetate substrate ratio for its products. Its effluents represent, thus, a renewable source of ethanol and acetate. Cornell researchers have utilized this type of resource to continuously produce *n*-caprylate (C8) by chain elongation via the reverse β-oxidation pathway with a reactor microbiome.

The inventors have also demonstrated the feasibility to produce *n*-caprylate using ethanol as the sole source of carbon (e.g., wine lees, which consisted primarily of settled yeast cells and ethanol from wine fermentation).

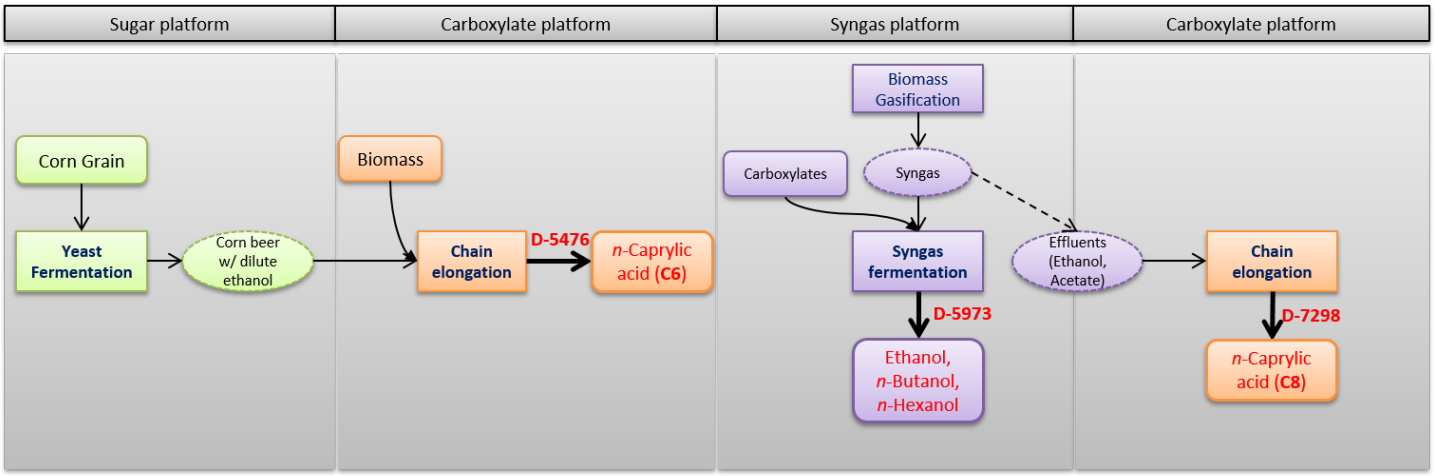

Chart inspired from the Figure 1 in Richter H., et al. (2013). Integrating syngas fermentation with the carboxylate platform and yeast fermentation to reduce medium cost and improve biofuel productivity. *Environmental Technology*. 34:13-14, 1983-1994. DOI: 10.1080/09593330.2013.826255

Symbols: Process; Effluents obtained; End-products desired; Initial biowaste or substrates

Potential Applications

- Production of *n*-caprylic acid (C8) for biofuel
- Production of *n*-caprylic acid (C8) for manufacture of soaps, cosmetic agent, plasticizer, food flavors.

Advantages

- Highest reported ratio *n*-caprylic acid (C8) to *n*-Caproic acid (C6)] as compared to known methods
- Produces C8 at high specificity
- Enables production of C8 in ethanol only
- Instead of converting short chain carboxylates (SCCs) into methane in several steps, SCCs are elongated by two carbons per cycle to medium chain carboxylates (MCCs).
- Reduces the energetic production cost of the product extraction.

Publications

- Kucek L. A., et al. (2016). Waste conversion into n-caprylate and n-caproate: resource recovery from wine lees using anaerobic reactor microbiomes and in-line extraction. *Frontiers in Microbiology*, Vol. 7, No. 1892. DOI: 10.3389/fmicb.2016.01892
- Kucek L. A., et al. (2016). High n-caprylate productivities and specificities from dilute ethanol and acetate: chain elongation with microbiomes to upgrade products from syngas fermentation. *Energy and Environmental Science*, Vol. 9, No. 11, pp. 3482-3494. DOI: 10.1039/C6EE01487A

- Similar technologies: D-5473.