Scaling up advanced biofuels and biochemical production

Acronym: Scaling Up

Coordinator:
Delft Advanced Biorenewables (NL)

Partners:
- **Bioprocess Pilot Facility(NL)**
- **Firmenich(CH)**
- **Delft University of Technology - Department of Biotechnology(NL)**
- **SkyNRG(NL)**

Project Duration:
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Contact: [Delft Advanced Biorenewables]

Introduction

A promising production method of advanced biofuels or biochemicals from lignocellulose is fermentative production. The oil product separation during this type of fermentation is often complicated by emulsion formation. This forms, especially for the biofuel sector, one of the large bottlenecks to roll out advanced biofuel fermentation technology. Delft University of Technology (TUD) and Delft Advanced Biorenewables (DAB) developed a proprietary reactor concept to produce and separate, in one single process step, the aimed fuel compounds. The uniqueness of the integrated system is scalability, and the cost price reduction of 20-30%, as well as the environmental impact reduction of CO_2 emission by 60%. The project objective is to demonstrate and predict a cost efficient oil production method at pilot scale by: strain and fermentation optimisation and integrating an in-situ recovery method at pilot scale. The system is called FAST, fermentation accelerated by separation technology. The concept of the system itself is very simple, also with regard to the design and construction of the reactor, which should lead to considerably lower investments for the construction of large-scale production installations compared to the installations currently used. All in all, this would lead to cost and energy savings in the biofuels, chemicals and related sectors. However, it was only demonstrated in the lab on a single fermentation with low productivity and stability. The challenging objective that was set for this project was to demonstrate a scale version of the FAST to m^3 level.

Results

The approach was as follows: (1) we developed a robust strain with a reproducible protocol for the production of fuel-like molecule; (II) a modeling tool was set up to predict the performance of of the FAST in a scaled up reactor; (III) we scaled and demonstrated pilot-in-situ recovery technology for fermentation of a representative Food & Fragrance intermediate. Eventually (IV) a technical-economic evaluation was performed to measure the impact of FAST on two processes a specific biofuel molecule and a Food & Fragrance ingredient.

With the developed strain of the partner a fermentation run could be carried out within the consortium with integrated recovery up to 96% of the product phase. The pilot was scaled up to a 1 m3 level by connecting the FAST100 prototype to an existing 1 m3 reactor at the Bio Process Pilot Facility (BPF) in Delft. The successful pilot of proof-of-concept and the positive techno-economic evaluation by SKY-NRG show the enormous potential for a broad application of the proposed technology in the biofuels and biotech-derived chemicals sector.

Acknowledgment

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The ERA-NET Bioenergy is a network of national ministries and agencies. It contributes to further development of the European research area in bioenergy and strengthening of national research programmes through enhancing international cooperation and coordination.

Please check our website to find out the latest developments and for more information contact the secretariat.

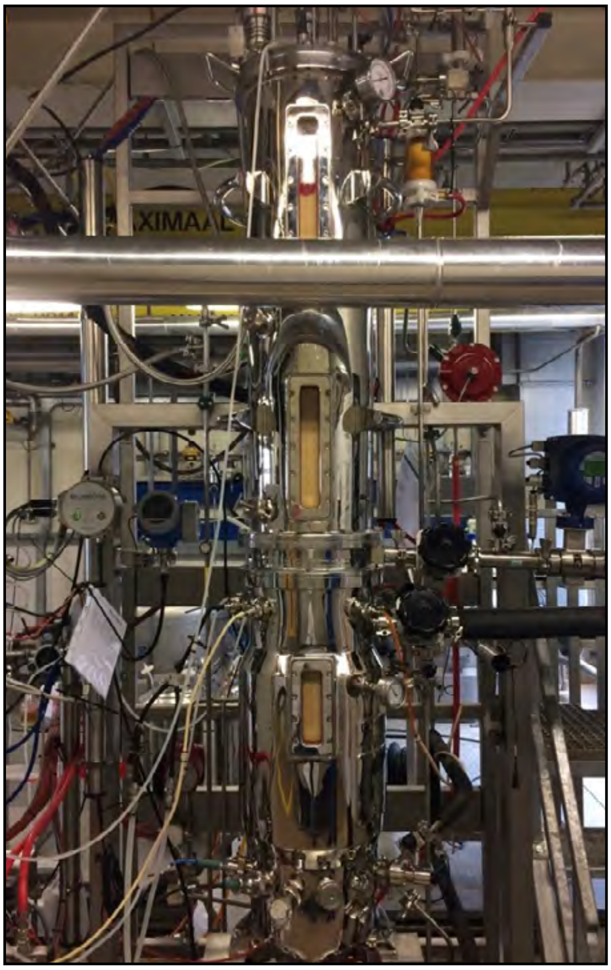

Figure 1: FAST prototype.

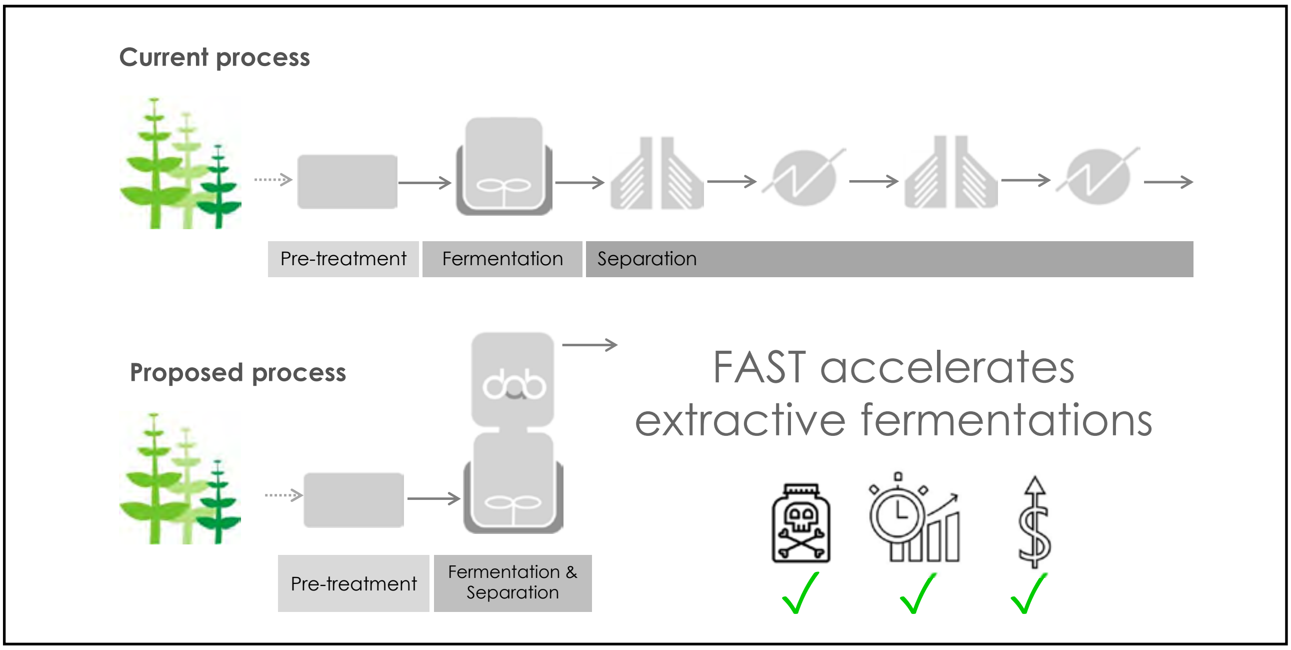

Figure 2 FAST flowchart.