



ELLIPSE – Valorizing heterogeneous wastes through microbial acidification for bioplastics

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Background

The **ELLIPSE project** aims to transform industrial residues into valuable bioproducts through co-processing of heterogeneous waste streams. This includes wastes from slaughterhouses, pulp and paper industry, and glycerol from biodiesel production. For this, BEST operates a 1m³ pilot plant where microorganisms convert the organic material into VFA (volatile fatty acids). Which are used in subsequent steps to produce polyhydroxyalkanoates (PHAs) and recover bio-based fertilisers (BBFs) for agricultural and personal care applications. An overview of the project activities is given in Fig. 1.

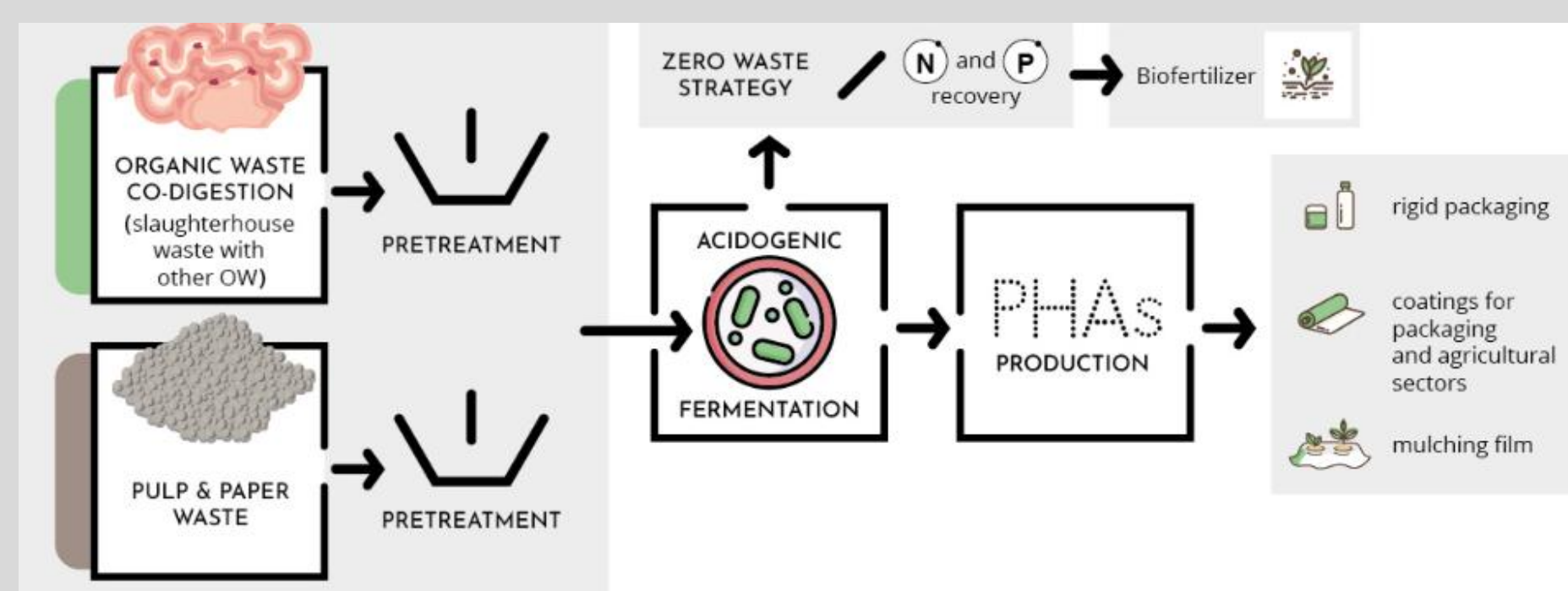


Fig. 1: ELLIPSE project: Overview of activities

Pilot scale acidification: 1m³ reactor

A continuously stirred tank reactor (see Fig. 2) was operated for 2 years by BEST including feedstocks from pulp and paper industry as well as, glycerol and slaughterhouse wastes in a co-digestion. This pilot will be operated until the end of the project (April 2027).

Results

In Fig. 3 results of the co-digestion from pulp and paper residues (RCF10-05) and glycerol are shown. Effective glycerol conversion to VFA was achieved when the feed concentration was set to 30 g/L, resulting in 18 g/L VFAs. Glycerol concentration exceeding 12 g/L limited microbial activity, even when pure glycerol was used.

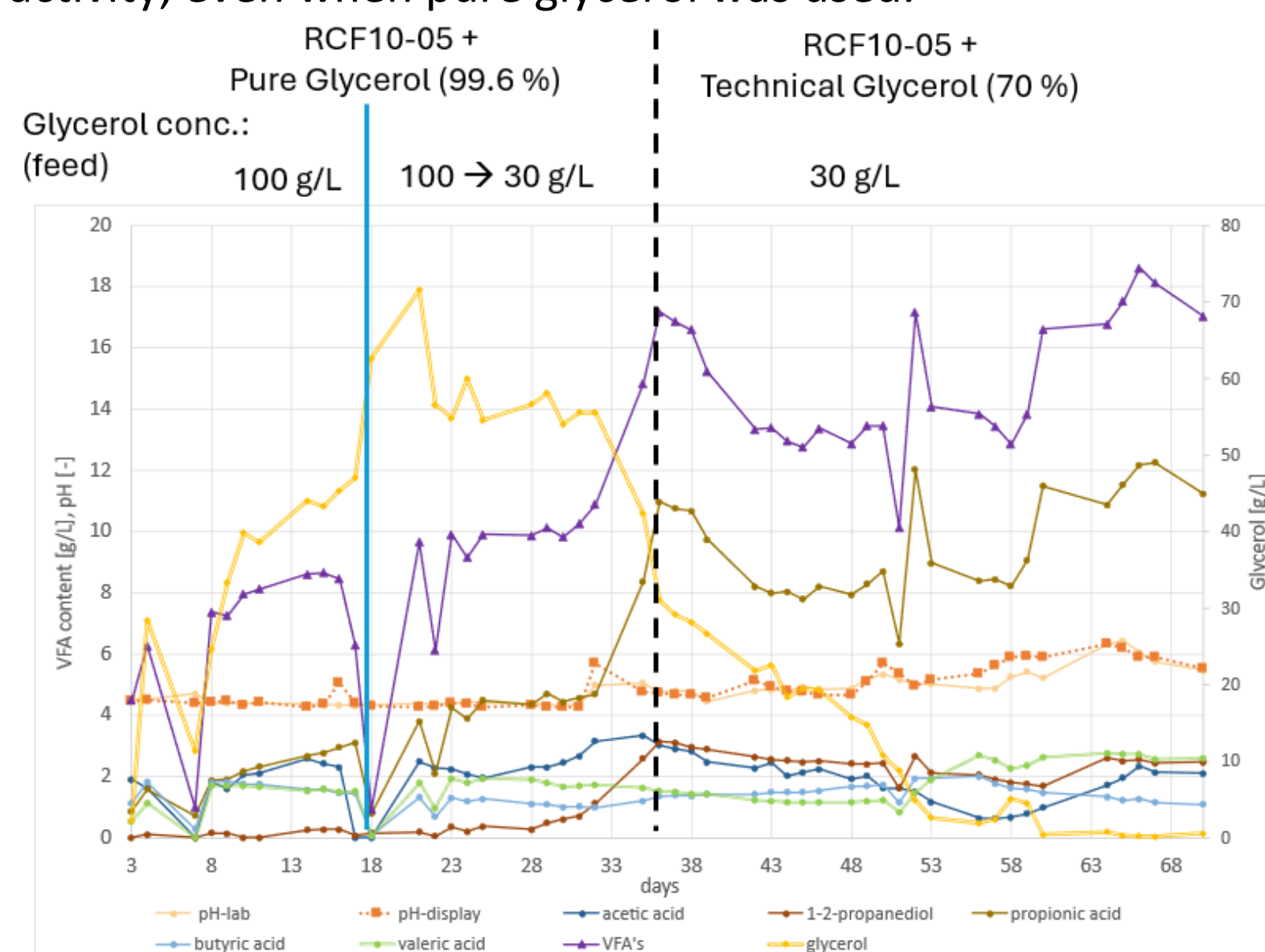


Fig. 3: Co-digestion of pulp and paper residues & glycerol – VFAs [g/L] pH and glycerol [g/L]

Conclusion

Within this project, it was demonstrated that heterogeneous industrial residues can be effectively converted into VFA-rich streams. Several unforeseen challenges regarding process and pilot plant stability were encountered and had to be addressed to ensure reliable and effective treatment of these residues. VFA concentrations of up to 20 g/L were achieved, representing an important first step towards the targeted production of VFA-rich streams. Nevertheless, further increases in VFA concentration are required to improve the performance of subsequent PHA fermentation. For the remainder of the project, the focus will be to improve both process and pilot plant stability to increase the conversion of residues into VFA.

Acknowledgments

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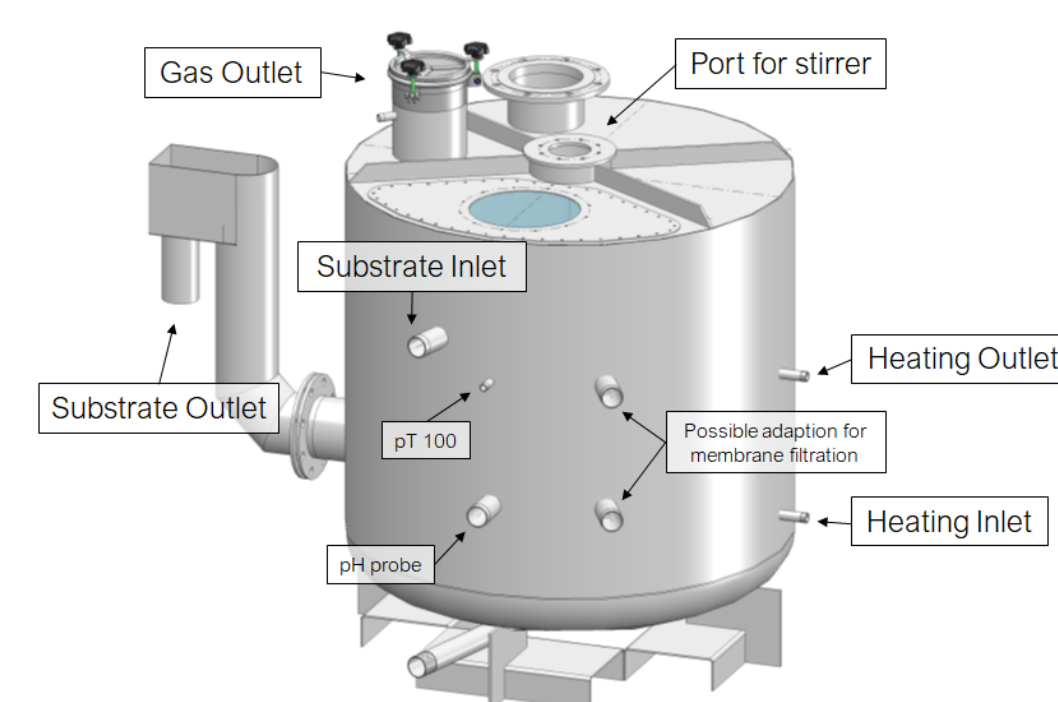


Fig. 2: Reactor for pilot-scale acidification; CSTR, 1 m³

In Fig. 4 results of the co-digestion from glycerol and rumen content are shown. Not only does rumen content provide nutrients (N, P) which are necessary for fermentation, additionally microorganisms and enzymes in the rumen fluid can help to digest the lignocellulosic fibers. VFA levels increased once the pH was set to alkaline, preventing prior observed methanogenesis activity.

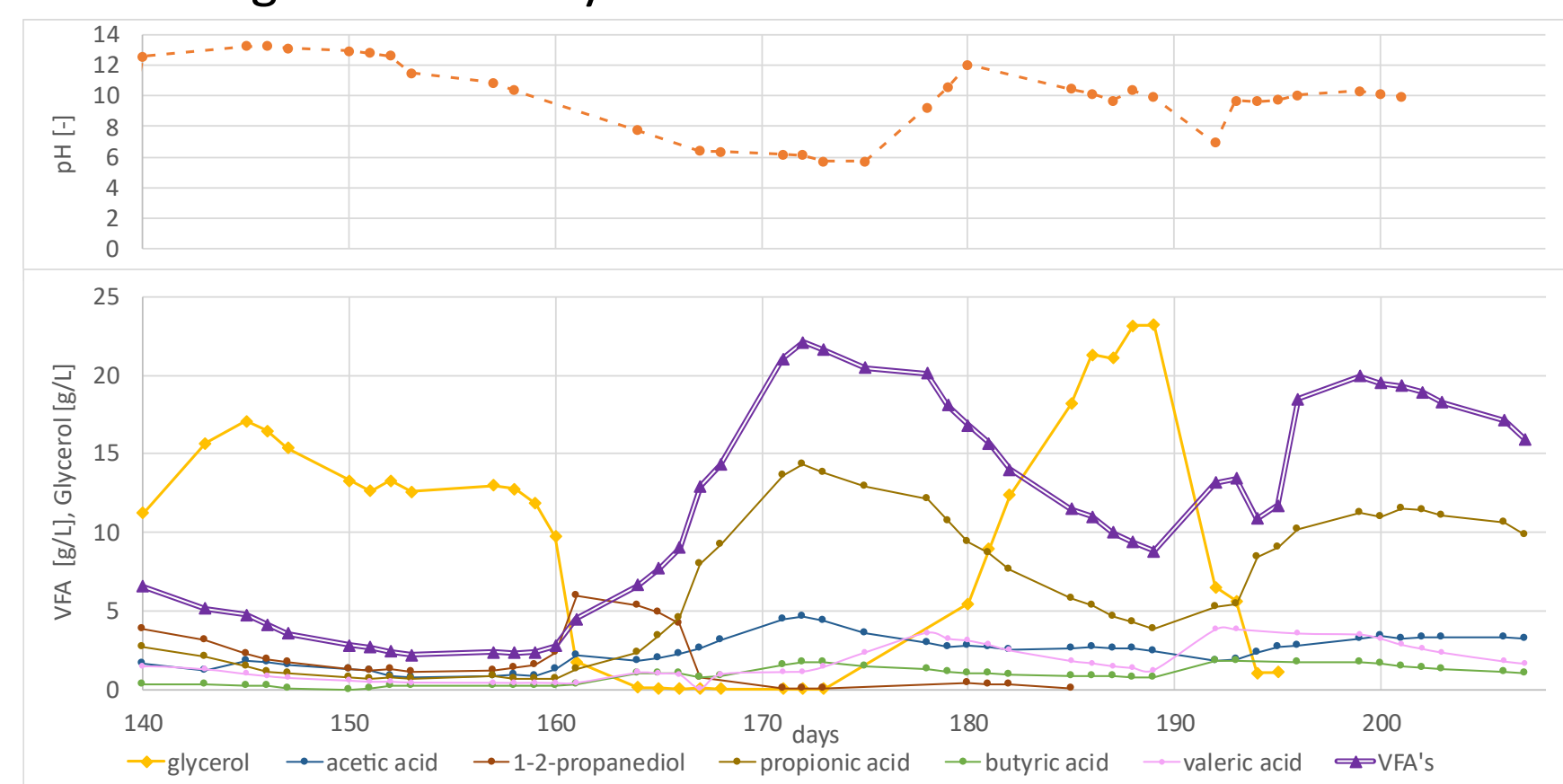


Fig. 4: Co-digestion of slaughterhouse waste (rumen content) & technical glycerol – VFAs, pH and glycerol



Fig. 5: Project team picking up substrate

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