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Description:

Due to the rapidly increasing surplus of glycerol as a by-product from oil plant processing (e.g. biodiesel production), new applications using glycerol as raw material are gaining interest. One of the bioconversion products from glycerol is the emerging bulk chemical 1,3-propanediol (PDO). To reduce the processing costs, industrial glycerol directly from biodiesel production plant is used in this work. In particular, a natural microbial community from anaerobic sludge of a wastewater treatment plant is used to convert glycerol into the main product PDO while other organic material in the glycerol water and toxic byproducts of PDO formation are converted into biogas as energy. This work is a part of the Propanergy: Integrated bioconversion of glycerol into value-added products at pilot plant scale.

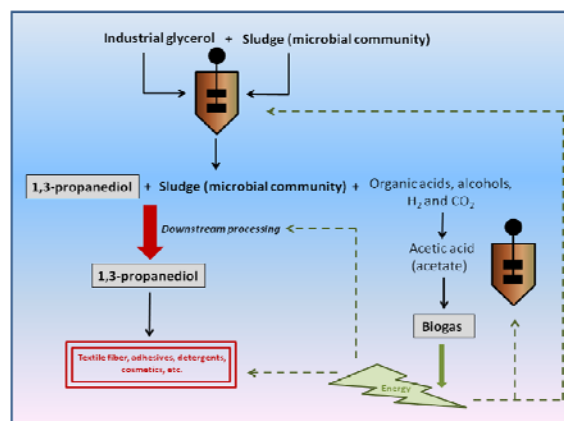


Fig.1 Bioconversion from glycerol to PDO with energy regeneration

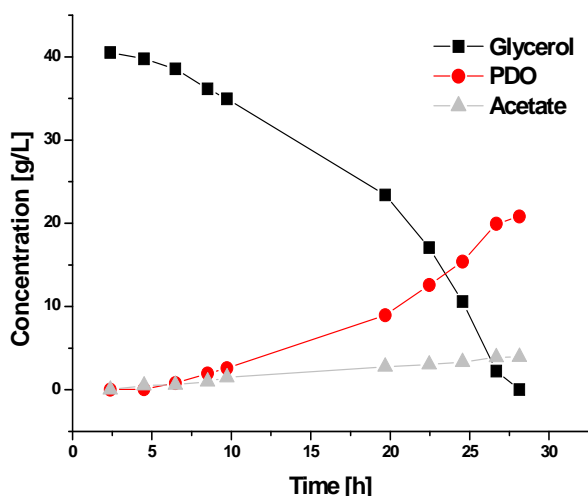


Fig.2 Batch fermentation using industrial glycerol and a natural microbial community as inocula

Preliminary batch experiments (Fig.2) showed the feasibility of PDO production by fermentation of industrial glycerol and using microbial community as inocula. PDO is the main product with a high yield between 0.63 and 0.65 mole PDO per mole glycerol.

It is a challenge to control the dynamics of the microbial community and the process. A better understanding of the process kinetics and interactions of the microorganisms involved is therefore needed, especially for the application in industrial scale. The population of the community is effected by factors such as operation time and dead space in bioreactor. By examining the kinetics and metabolic network, the inhibition by substrate, products and intermediates can be better understood and be avoided for system optimization.

The understanding of metabolic network, dynamics and kinetics of natural microbial communities gained from this work will help its application in other industrial processes, for example the degradation of brewery grain. Until recently, brewer grain is mainly used as animal feed. With a better understanding of bioprocessing with the microbial communities, it is possible to optimize the system and obtain high energy output from the biomass.

References

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