Production of bio-fuels using extractive fermentations

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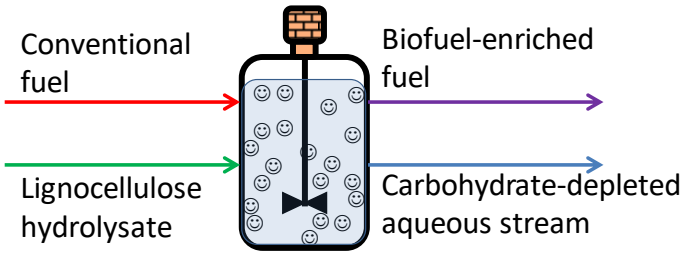
Description

In the framework of developing bioreactors with integrated product separation, bio-fuel production has been studied.
The recovery of 1-butanol from fermentation broth is energy-intensive since typical concentrations in fermentation broth are below 20 g/L. To prevent butanol inhibition and high downstream processing costs, we aimed at producing butyl esters instead of 1-butanol. It is shown that it is possible to perform simultaneously clostridial fermentation, esterification of the formed butanol to butyl butyrate, and extraction of this ester by hexadecane. The very high partition coefficient of butyl butyrate pulls the esterification towards the product side even at fermentation pH and relatively low butanol concentrations. The hexadecane extractant is a model diesel compound and is nontoxic to the cells. If butyl butyrate enriched diesel can directly be used as car fuel, no product recovery is required. A proof-of-principle experiment for the one-pot bio-ester production from glucose led to 5 g/L butyl butyrate in the hexadecane phase. The principle may be extended to a wide range of esters, especially to longer chain ones.

A next step would be to achieve high concentrations of ester directly from lignocellulose hydrolysate.



Publications

1. C. van den Berg, A.S. Heeres, L.A.M. van der Wielen, A.J.J. Straathof, Simultaneous clostridial fermentation, lipase-catalyzed esterification, and ester extraction to enrich diesel with butyl butyrate, Biotechnol. Bioeng. 110 (2012) 137- 142.
2. A. Oudshoorn, C. van der Berg, M. Roelands, A.J.J. Straathof and L.A.M. van der Wielen, Short-cut calculations for integrated product recovery options in fermentative production of bio-bulk chemicals, Process Biochem. 45 (2010) 1605-1615