Aqueous Two-Phase Systems for Extractive Enzymatic Hydrolysis of Biomass

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Description

Sugars derived from lignocellulosic materials are the main carbon sources in bio-based processes aiming to produce renewable fuels and chemicals. However, during the enzymatic conversion of lignocellulosic materials to sugars, the enzymes are inhibited by reaction products (cellobiose and glucose). This effect is even more pronounced in hydrolysis containing high solid content (15-20% or higher water-insoluble solids – WIS), which is desired in order to obtain hydrolysates containing high total reducing sugar concentration [1].

The aim of this project is to develop a new process for sugarcane bagasse hydrolysis using aqueous two-phase system (ATPS). This system will be applied as in-situ extraction aiming to remove the reaction products as they are released. Therefore, one phase will be constituted of the enzymes and substrate (reactive phase), while the sugars will be partitioned in the other phase (extractive phase). As a consequence of product removal, enzymes tend to maintain their maximum activity [2].

The phase-forming components will be screened in high-throughput experiments [3], in order to determine partition coefficients of sugars and enzymes, phase diagrams and volumetric ratios. This project will present optimal ATPS for the separation of sugars and enzymes, overcoming one of the biggest drawbacks regarding the production of second-generation ethanol: the enzymatic inhibition. Subsequently, the process to carry out the hydrolysis will be defined in terms of addition order of the components, substrate/enzymes feeding strategy, and components recycle. In conclusion, it will be possible to design a process that enables high sugar concentration during the hydrolysis reaction, which allows the development of an improved second-generation ethanol and/or bioproducts process.

References

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