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Development of an estimation model for the evaluation of the energy requirement of biomass pretreatments

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The production of fuels, plastics, chemicals and speciality chemicals from lignocellulosic biomasses via any biochemical route requires a significant amount of pretreatment before efficient hydrolysis of the carbohydrate fractions can be achieved. Without pretreatments, low product yields would be achieved, resulting in an uneconomical production process. Though essential to the production process, pretreatments are expensive and energy intensive. Consequently, a lot of research has looked at optimising the sugar yield and reducing costs in order to make the production of products from lignocellulosic biomass competitive. Here, a mathematical model for the evaluation of the energy required during the pretreatment of lignocellulosic biomass for the production of ethanol was developed. The model was developed using the dilute acid pretreatment process reported by National Renewable Energy Laboratory (NREL) as the basis. It was then modified and applied to other common pretreatment processes, such as alkali and steam explosion pretreatments. The energy consumption results of the various pretreatments were examined and compared and some key inferences were deduced.

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Comparison of different kinetics for modeling of all kinds of bioethanol production

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Fermentation is typically modelled by kinetic equations giving the time evolutions for biomass, substrate, and product concentrations. In the present study, production of bioethanol from glucose substrate and S*accharomyces cerevisiae* (*S. cerevisiae*) as a biomass was investigated through a batch fermentation process. Time variation of the *S. cerevisiae* growth, glucose utilization and ethanol productivity was described using different kinetic models and analytically solution. The kinetic constants were determined through the fitting of experimental data with the kinetic model equations. The results demonstrated that the Monod, Logistic and Luedeking-Piret served as the best describing models for *S. cerevisiae* growth, glucose, and ethanol concentrations, respectively. Moreover, determination of substrate concentration according to time via analytical solution of equation was a hallmark result of this research.

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