

Technico-Economical Study of a Rapeseed Based Biorefinery Using High Voltage Electrical Discharges and Ultrasounds as Pretreatment Technologies

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Abstract : Rapeseed plant is an established product in France which is mainly dedicated to oil production. However, the economic potential of residues from this industry (rapeseed hulls, rapeseed cake, rapeseed straw etc.), has not been fully exploited. Currently, only low-grade applications are found in the market. As a consequence, it was deemed of interest to develop a technological platform aiming to convert rapeseed residues into value-added products. Specifically, a focus is given on the conversion of rapeseed straw into valuable molecules (e.g. lignin, glucose). Existing pretreatment technologies have many drawbacks mainly the production of sugar degradation products that limit the effectiveness of saccharification and fermentation steps in the overall scheme of the lignocellulosic biorefinery. In addition, the viability of fractionation strategies is a challenge in an environmental context increasingly standardized. Hence, the need to find cleaner alternatives with comparable efficiency by implementing physical phenomena that could destabilize the structural integrity of biomass without necessarily using chemical solvents. To meet environmental standards increasingly stringent, the present work aims to study the new pretreatment strategies involving lower consumption of chemicals with an attenuation of the severity of the treatment. These strategies consist on coupling physical treatments either high voltage electrical discharges or ultrasounds to conventional chemical pretreatments (soda and organosolv). Ultrasounds treatment is based on the cavitation phenomenon, and high voltage electrical discharges cause an electrical breakdown accompanied by many secondary phenomena. The choice of process was based on a technological feasibility study taking into account the economic profitability of the whole chain after products valorization. Priority was given to sugars valorization into bioethanol and lignin sale.

Keywords : high voltage electrical discharges, organosolv, pretreatment strategies, rapeseed straw, soda, ultrasounds

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