INDUSTRIAL PRODUCTION OF CELLULOSIC ETHANOL: PRE-PROCESSING VIA PRESSURIZED HOT WATER AND EXPLOSIVE DEPRESSURIZATION

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The production of ethanol from sugarcane juice can be considered a well established industrial activity in Brazil. Within this context, an attractive and promising approach to increase ethanol production is the acid or enzymatic hydrolysis of lignocellulosic material obtained from pre-treated bagasse and straw, followed by traditional fermentation and distillation. Theoretical studies revealed that second generation ethanol could double the overall ethanol production without the need to increase plantation areas. Despite this very promissing scenario, cellulosic ethanol is not economically viable and remains restricted to research or small scale demonstration plants. Among many reasons for this, a critical bottleneck is consensual: the lack of an efficient and scalable pre-processing technology to breakdown lignocellulosic material into its constituents, enabling subsequent hydrolysis to yield the sugars necessary for fermentation.

Ideal pre-treatment should produce cellulose and hemicelluloses highly available to hydrolysation, yield non-degenerated pentoses, enhance lignine separation, avoid the formation of inhibitory agents (formic acid for example), needless of additional mechanical processing and should be possible to implement on simple equipment, made with low cost material. These requirements are obviously contradictory and can only be satisfied in a trade-off sense.

The main objective of this research project is to develop a scalable pre-processing technology based on a new concept combining pressurized hot water sorption followed by instantaneous depressurization in order to foam the sugarcane bagasse. We designed a pilot scale pre-processing system capable of continuously handling up to 100kg/h of bagasse. This system is constituted basically of a solid-liquid (water-bagasse) pumping device, a thermo-pressurization imbibition vessel, an expansion device and a separator (vapor-bagasse). Screen tests were conducted in a miniature version of this system (1.5 liters) in order to determine the ideal processing conditions as well as to assess energy consumption and other operation parameters.

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