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Sensitivity Analysis of Process Parameters in a Sugarcane Biorefinery

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Sensitivity analysis is an important step in process modeling. It allows the assessment of impacts model and process parameters exert on process responses. Sensitivity analysis is here applied to a sugarcane biorefinery. In this process, sugarcane juice is fermented by *Saccharomyces cerevisiae* to produce first generation ethanol, while bagasse serves a dual function: it acts both as boiler fuel and second generation ethanol feedstock. Cellulose is enzymatic hydrolyzed after pretreatment of bagasse, and both hexoses and pentoses are fermented, respectively by *Saccharomyces cerevisiae* and *Pichia stipitis*. A cogeneration system is also part of the process, comprised of a high-pressure boiler, two back-pressure turbines and a condensing one. The entire process was modeled using EMSO process simulator. First principle models as well as simpler, stoichiometric models were used for the different equipments.

Factorial design was employed in the sensitivity analysis, considering seven process parameters: sugar recovery in the mills, washing rate of *Saccharomyces cerevisiae*, distillation columns plate efficiency and yields of xylose hydrolysis, cellulose hydrolysis, hexoses and pentose fermentation. The effects of these parameters on the production of ethanol, vinasse and surplus of electric energy were analyzed. Results indicate that the pentose bagasse fraction fermentation to ethanol does not impact significantly on this fuel production. Furthermore, all responses exhibit sensitivity to sugar recovery in the mills and hexose fermentation yield.

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