COMBINED FIRST AND SECOND GENERATION ETHANOL PRODUCTION: THERMAL INTEGRATION AND ENVIRONMENTAL ASPECTS

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The growing number of technologies being developed for the production of lignocellulosic ethanol represents a new trend in the sugarcane sector that needs evaluation. In this work, the commercial simulator Aspen Plus® was used to simulate ethanol and energy production at a conventional autonomous distillery processing 500 ton of sugarcane/h and a steam based cogeneration system. Thermal integration of the autonomous distillery was conducted using the Pinch Point Method. The production of lignocellulosic ethanol was simulated using the surplus bagasse produced at the autonomous distillery after thermal integration. For the second generation ethanol production was considered the steam explosion catalyzed by SO_2 pre-treatment, separation of C5 fraction, enzymatic hydrolyze, product concentration using a multistage evaporator and performance of the fermentation and ethanol separation steps at the autonomous distillery facility. It was considered the use of 50% of the sugarcane trash available at the crop and the hydrolyze waste (50% moisture) as cogeneration fuel complementary to bagasse. All data necessary for the simulation was obtained from literature. The results showed a reduction of 32% at the bagasse consumption after thermal integration to supply the energy requirements of the autonomous distillery. Therefore, a flow of approximately 42 ton/h of bagasse (50% moisture) would be available for lignocellulosic ethanol production. Using this flow it was possible to increase the ethanol production from 77.92 to 83.50 L/ton sugarcane. Water consumption increased 231%, vinasse and phlegm production increased around 10%. After thermal integration of first and second generation ethanol production, considering also the use of sugarcane trash and hydrolyze residue as cogeneration fuel, only 32% of the bagasse available is necessary for cogeneration. Therefore, more bagasse can be used for lignocellulosic ethanol production. Nevertheless, environmental aspects of this technological route should be further analyzed due to the great water consumption impact.