Simulation of integrated 1G bio-ethanol production and 2G multi-product biorefinery

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Abstract

First-generation technology for the production of ethanol is well established in the world market, while second generation biorefineries in their struggle to overmatch their progenitor are also orientated towards ethanol production. Efficient technologies for production of lignocellulosic (or second generation) ethanol, are still under development while challenges concerning its technical, economic and environmental feasibility remain to be solved, putting on ice the concept of a multiproduct biorefinery. Instead of competing with each other, the integration of first and second generation processes may be more economical, efficient and present lower environmental impacts than stand-alone second generation; thus, integrated first and second generation technology can improve the feasibility of lignocellulosic biorefinery and foster its industrial implementation. In this work the introduction of process improvements of the integrated 1G ethanol production process and 2G multiproduct biorefinery are assessed through simulation using Aspen Plus. The second generation biorefinery selected is the one developed in BIOCORE, having CIMV organosolv as its core pretreatment method. Sugarcane bagasse is used as a fuel in conventional bioethanol production, providing heat and power for the plant; therefore, the amount of surplus bagasse available for use as raw material for second generation biorefineries is related to the energy consumption of the 1G bioethanol production process, making imperative the need for energy minimization. Energy integration may reveal suggestions for technological improvement for the second generation processes. Sugars and lignin, byproducts of the second generation bioethanol production process, may be valorized into a variety of products.

Key-words: Biorefinery, Ethanol, Simulation, Integration, Sugarcane