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Convenient product distribution for a lignocellulosic biorefinery: Optimization through sustainable indexes

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Lignocellulosic biomass can be employed to generate diverse chemicals, even though it has been mainly used as fuel. In Mexico, the main source of lignocellulosic materials are agricultural wastes, for example, residues obtained from corn, which is the main agricultural product in the country. Although corn stover is employed as animal feed and corn cob as fuel in rural communities, both residues are underused, which boosts their accumulation as wastes. It is estimated that 4 million tons of corn cob were generated in 2016. Such residue was proposed as raw material in a biorefinery for production of bioethanol, enhancing its applications and decreasing pollution derived from its accumulation. Nevertheless, the preliminary techno-economic analysis showed that the project was not feasible; therefore, generating diverse chemicals like lactic acid, succinic acid, xylitol and lignosulfonates, was considered. These products were selected according to their demand in the country. A multi objective optimization approach was employed to find an optimal product distribution for the biorefinery shown in Figure 1 that cope with economic (EPI), environmental (RSEI) and safety (SI) indexes. Through this strategy, an efficient solution with an EPI of 0.16 is achieved, generating an annual utility of 70 kUSD when xylitol and bioethanol production are favored over succinic acid and lactic acid. This tool can be applied with different feedstocks and products in a biorefinery scheme, with kinetic and yield data for corresponding processes.

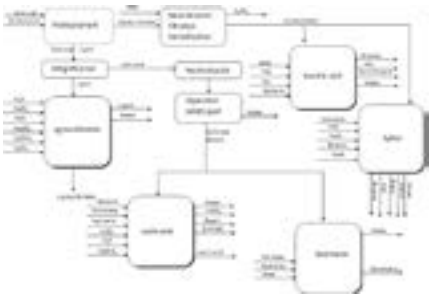

Figure1: *Block diagram of the biorefinery*

Biography

Lorena Pedraza is a full-time professor at Universidad Iberoamericana's Department of Engineering and Chemical Science. Her areas of expertise include fermentation technology, enzymatic catalysis, bioreactors and bioprocesses design. Her current research focuses on the application of biomass in bio-refineries and some examples of those current works include the production of xylitol, lactic acid, and ethanol from corn cob and municipal solid waste. Additionally, along with a multidisciplinary group from Universidad Iberoamericana, Mrs Pedraza is performing an analysis of the economic and sustainability aspects of the bio-refineries through modelling and process optimization. As part of her professional background, Mrs Pedraza was part of a research and development firm where she was in charge of escalating the production of an enzymatic biocatalyst. She is also a member of the Mexican Biotechnology and Bioengineering Society, the Bioenergy Thematic Network, and the Mexican Bioenergy Network.

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