Analysis of the feasibility for obtaining gaseous and liquid biofuels using rice husks as raw material.

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Extended Abstract.

When lignocellulosic biomass is used as an energy source, carbon dioxide (CO₂) is not added to the atmosphere; on the contrary, a concentration equal to that which at a given moment the biomass had captured during its photosynthetic growth processes is returned. While, with the consumption of fossil fuels, an amount of CO₂ is returned to the atmosphere that had been captured by plants and animals that lived millions of years ago, for which a direct addition is realized (Abbasi and Abbasi, 2010). The use of fossil fuels leads to an alteration in the concentration of CO₂ in the actual atmosphere, an effect that is reflected in the climate change that occurs throughout the planet (Doney et al., 2009). The impact of CO₂ on nature has encouraged interest in the use of biomass as a source of both fuels and chemicals. Among the different biomasses available for transformation processes is rice husk, a lignocellulosic waste generated during the processing of rice crops, with the aim of obtaining this cereal for human consumption. Due to its high cellulose, hemicellulose and lignin contents, this waste has a high potential for energy generation, both in gaseous form (synthesis gas, biogas, etc.) and in liquid form (bioethanol, butanol, Jet A1, etc.) (Ahorsu et al., 2018; Daza Serna et al., 2016). This work focused on the analysis of the economic viability of the use of rice husk as a raw material as an energy source, and therefore analyzed its potential for obtaining four different biofuels.

The methodology used to achieve this objective was divided into three parts: (i) conceptual design, (ii) process simulation and (iii) economic analysis. 1. The conceptual design involved the conceptual design for each of the proposed scenarios. In Table 1, the products to be obtained in each scenario are presented. The first three scenarios are stand-alone cases in which only one product (biofuel) is considered. In the remaining scenarios, the concept of biorefinery is used in order to analyze the influence that the use of this concept has on the use of waste such as rice husks. For each scenario, three main stages were used in order to obtain the product of interest: pre-treatment, reaction and finally, separation and purification of the product. 2. The process simulation was performed using Aspen Plus software as the main simulation tool. For the modeling of the liquid phase, the thermodynamic model NRTL (Non Random Two Liquids) was used, for the liquid phase the Hayden O'Conell equation (HOC) was used. 3. The scenario comparison was based on the use of economic analyses as the main comparative tool. The Aspen Process Economic Analyzer (APEA) software is the tool used to perform these analyses. The sizing of each of the process equipment was based on the use of the mass and energy balances obtained in the second stage (simulation). The economic analysis was based on the work realized for (Martínez-Ruano et al., 2018; Serna-Loaiza et al., 2018).

Scenario	Products			
	Ethanol	Jet A1	Biogas	Syngas
1	х			
2			Х	
3				X
4	Х	Х		Х
5	Х		Х	
6	Х	Х	Х	Х

Table 1. Scenarios proposed based on rice husk as raw material

Conclusion.

The potential of rice husks as a raw material for obtaining both gaseous and liquid biofuels was demonstrated, especially when the biorefinery concept is used to make better use of this waste. It also shows the importance of the amount of raw material processed in this type of process.

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