WCCE11 - 11th WORLD CONGRESS OF CHEMICAL ENGINEERING
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Buenos Aires - Argentina - June 4-8, 2023
BUENOS AIRES 2023
JUNE 4 - 8
"The global chemical engineering working for a better future world"

Levulinic acid obtention from lignocellulosic waste of agroforestry-industrial of different origins

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Worldwide, since last decade levulinic acid (LA) was one of the most sought-after chemical precursors. Lignocellulosic waste of agroforestry-industrial origin like rice hulk, sawdust, and cotton stubble are pointed as raw material for this work, at the same time those lignocellulosic wastes are abundant in Argentina´s northeastern. Report about the evaluation of LA obtention reaction using different raw materials obtained in different treatment steps and maintaining the same operation conditions is the main objective of this work. This objective aims to demonstrate the technical feasibility to obtain LA from a lignocellulosic waste biorefinery scheme.

The reaction was running in a cylindrical steel reactor (AISI 316) provided with a manometer and a security valve to ensure the maximum pressure work. The reactor was heated indirectly in a heat-resistant silicone bath. The raw material used were rice hulk (pretreated to extract hemicellulose, lignin, and inorganic compounds), *Prosopis nigra* sawdust (pretreated to extract lignin and others), and cotton stubble (two fractions one rich in the ground cotton husk and other rich in cotton fiber).

The cellulose content was evaluated in each one of these raw materials since this is the main substrate to obtain LA. All raw materials were treated with a sulfuric acid solution 5% w/V, using an 8% solid-liquid rate, and heated to 180°C for 40 minutes (the maximum reaction pressure was 11atm). LA identification and quantification were made in an HPLC, using a sugars and organic acids detection column, a UV detector, and IR to determine unconverted hydrolyzed sugars. The reaction yield was calculated from the LA/cellulose ratio for each of the raw materials.

The LA obtained for each raw material was: fractions rich in ground cotton husk 23,38g/L with a reaction yield LA/cellulose 58.85%, fraction rich in cotton fiber 24,44g/L with a reaction yield LA/cellulose 39,67%, pretreated rice hulk 36,01g/L with a reaction yield LA/cellulose 47,88% and pretreated *Prosopis nigra* sawdust 21,24 g/L with a reaction yield LA/cellulose 47,41%.

Based on the results obtained, it is possible to say the LA obtention reaction shows, for each raw material, high yields compared with other studies reported. This could be possible due to the lignocellulosic waste biorefinery scheme used and the application of pretreatments to the raw materials except for the fraction rich in cotton fiber that shows poorer results.

These results demonstrate the technical feasibility to obtain LA from a lignocellulosic waste biorefinery scheme. In future works, the seeking of optimal reaction conditions and the possibility to use catalysts in order to improve the LA obtention reaction ratio will be accessed.