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DILUTE-ACID HYDROLYSIS OF RICE HULLS FOR ETHANOL PRODUCTION

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Introduction.

Since rice hulls are a crop residue with high availability it should be considered a potential raw material for ethanol production (1). Dilute-acid hydrolysis is a way of obtaining fermentable sugars from polysaccharides contained in lignocellulosic bioresources. The aim of this work was to perform a chemical characterisation of a specific sort of rice hulls available in Cuba and to evaluate dilute-acid hydrolysis for that material.

Methodology.

Rice hulls generated in an artisan mill in Matanzas province, Cuba, were evaluated for ethanol production. The chemical composition of the raw material was analysed according to standard protocols. Dilute-acid hydrolysis was performed at 160, 180, 190, 200 and 210ºC during 10 min using 0.5% H_2SO_4 at a solid-to-liquid ratio of 1:10. The main components of the hydrolysates were identified, and fermentation experiments were performed with strains of *Rhizopus oryzae*, *Mucor indicus* and *Saccharomyces cerevisiae*.

Results and Discussion.

The main components of the artisan-mill rice hulls were cellulose (36.6%), ash (19.6%), lignin (15.5%) and xylan (9.0%). Important amounts of starch (8.7%), due to the presence of grain remains in the hulls, were also found. The starch content, which is usually insignificant in industrial-mill rice hulls, is a specific feature of this sort of the hulls produced in artisan mills (1)

Xylose concentration increased steadily up to 190°C (Fig. 1), and decreased sharply above that temperature due to its thermal degradation to furfural (Fig. 2). At low temperatures some glucose formation, due to starch hydrolysis, was obwerved. Then, between 180 and 200°C, cellulose hydrolysis led to increase in glucose concentration. However, above 200°C, glucose content in the hydrolysates decreased, which was due to its degradation to hydroxymethylfurfural (HMF).

Preliminary evaluation of the enzymatic hydrolysis of the cellulose contained in the solid residue obtained after dilute-acid hydrolysis showed good conversion.

Separated hydrolysis and fermentation (SHF) gave better results than simultaneous saccharification and fermentation (SSF).

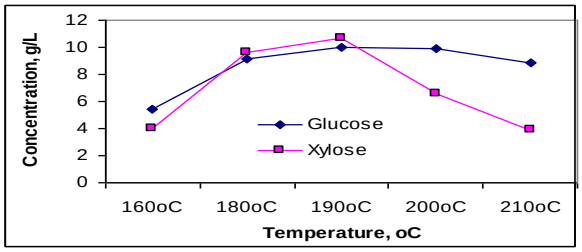

***Figure 1**. Glucose and xylose formation under different hydrolysis temperatures.*

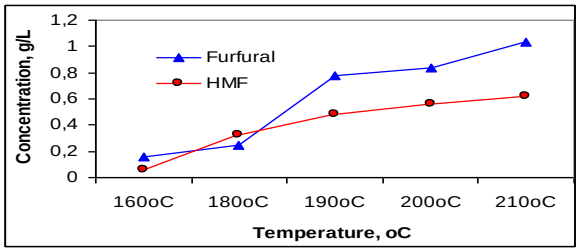

***Figure 2**. Formation of furan aldehydes under different hydrolysis temperatures.*

Conclusions

- The high carbohydrate content of artisan-mill rice hulls makes that material interesting for ethanol production.
- Dilute-acid hydrolysis was an efficient method for releasing simple sugars from glucans and xylans container in rice hulls.
- New experiments on SHF and SSF are required for completing the evaluation of dilute-acid hydrolysis as a pretreatment method for enzymatic hydrolysis of rice hulls.

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References.

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