OPTIMIZATION OF ETHANOLIC FERMENTATION CONDITIONS OF COFFEE MUCILAGE USING *Saccharomyces cerevisiae*

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Introduction. Growing energy demands requires the study of new renewable and environmentally friendly alternative energies. The coffee mucilage is a viscous liquid waste generated from the processing of coffee. This material is presently underutilized or discarded generating environmental problems because of its high organic load. Due to its considerable content of reducing sugars (RS), coffee mucilage is a potential alternative for fermentative production of ethanol.
This study aims to determine the conditions of temperature, pH and initial inoculum concentration that favored coffee mucilage fermentation process in order to produce ethanol. Subsequently a kinetic study associated with RS consumption and ethanol production at laboratory scale was developed.

Methods. Coffee mucilage was obtained from a farm located in the city of Medellin, at an average height above sea level of 1,575 m, with an initial concentration of RS of 45 g/L. The process was conducted in 250 mL flasks with 100 mL of medium, agitated at 150 rpm. The study was carried out based on a Doehlert experimental design (1), for which three factors were assessed; temperature in a range of 28 to 40 ℃, initial pH between 4.6 and 6.0 and initial inoculum concentration between 3 and 9 g/L. Process time was 24 hours. Later a kinetic study using the best conditions defined by the previous study was realized, taking samples along 24 hours. RS analysis was made using 3,5-dinitrosalicylic acid method (DNS) (2) and ethanol was determined by gas chromatography-flame ionization detector (3).

Results. Analysis of variance showed, with a $P < 0.05$, that temperature and initial inoculum concentration had a significant effect on ethanol production, while pH did not. No significant interactions between any of the factors were found.
Optimum conditions of the fermentation process, determined at laboratory scale, respecting temperature and inoculum concentration were 28 ℃ and 3 g/L respectively. Values of pH in a range of 4.6 to 6 showed good results.

The kinetic study showed an ethanol yield ($Y_{p/s}$) = 0.46 g/g and a volumetric productivity (Q_p) = 2.23 g/Lh, at 10 hours of fermentation.

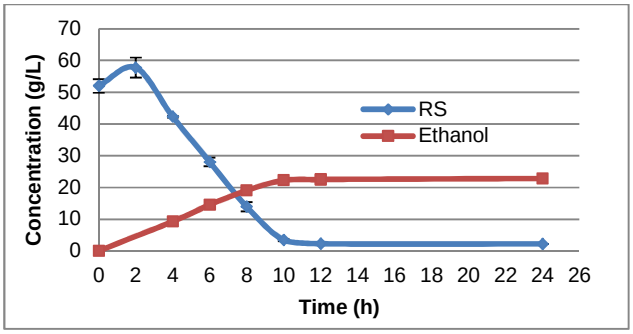

Fig. 1 Fermentation kinetics at laboratory scale.

These values were higher than those found for other agroindustrial wastes (4) and sufficient to make the process viable at industrial scale (5).

Conclusions. Coffee mucilage has potential as an alternative substrate for bioethanol production by fermentation process due to its chemical characteristics and abundance in Colombia. Likewise, technological application of coffee mucilage would mitigate environmental problems caused by its bad disposal.

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