# PERFORMANCE EVALUATION OF SEMI-AUTOMATED BIOREACTOR FOR BIOETHANOL PRODUCTION

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# ABSTRACT

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The bioreactor is one of the media in converting biomasses into bioethanol. The fermentation process in a bioreactor must be anaerobic to ensure the conversion of sugar into ethanol. Anaerobic fermentation means that the process of fermentation is done in the absence of oxygen.

The semi-automated bioreactor was evaluated. There was found to be effective in reducing sugar, from initial sugar concentrations of 30°Bx to 19°Bx for the 6-hr interval of agitation and 30°Bx to 19.7°Bx for 8 and 10-hr interval of agitation, respectively. The results of the study were statistically evaluated using a 3 x 4 factorial in Completely Randomized Design (CRD). The results revealed that with and without agitation give a significant effect on the production of ethanol.

The pH and temperature were all within the safe range for yeast fermentation. The pH was no significant difference between using with and without agitation of a bioreactor in terms of the resulting sugar reduction (brix).

From all the treatment combinations, the interval of agitation with 6-hr gave the highest sugar reduction within just 72-hr yeast fermentation. All other treatment combinations exhibited this trend at the time of fermentation. Results indicate that it would

be most practical to have the distillation after 72-hr yeast fermentation, saving time and resources as well.

The results of the study showed that the semi-automated bioreactor with a 6-hr agitation interval provided favorable conditions appropriate for the conversion of sugarcane molasses into ethanol. The actual distillation of 180 li of fermented broth from the 6-hr, 8-hr, and 10-hr agitation interval, and control produced an actual ethanol yield of 24.25-li, 23.67-li, 23.25-li, and 21-li of 95% hydrous bioethanol, respectively, which gave a fermentation efficiency of 88.05%, 85.95%, 84.42%, and 76.25% for 6-hr, 8-hr, 10-hr agitation interval, and control, respectively.

To save on energy and other resources, it is recommended to use the 6-hr interval of agitating the bioreactor.

The cost per liter of fermented broth for distillation was computed at Php31.24, respectively.

Instead of selling the molasses as raw materials, their conversion into bioethanol using the designed bioreactor can provide value-added income for sugar planters.

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