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Preliminary studies on the production of ethanol from coconut water

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Feasibility of utilizing potential domestic and industrial waste for the production of biofuels is a major research interest nowadays. Coconut water, a domestic waste as well as a major waste material of desiccated coconut industry, is a potential raw material containing about 4.4 % of reducing sugars (at tender level) that can be utilized to produce ethanol by natural fermentation, which has a wide range of direct and indirect uses as an alternative fuel.

This study reports the optimization of conditions that influence conversion of coconut water into ethanol by *Saccharomyces cerevisiae* (yeast) at room temperature. Yeast utilizes the carbohydrates (sugars) in coconut water to produce ethanol, by a complex enzymatic reaction sequence called fermentation, which occurs under anaerobic conditions. In this study, fermentation was carried out under varying concentrations of Nitrogen, Phosphorus, and at different pH values and also for normal coconut water samples as well as for natural fat removed coconut water samples. Nitrogen was supplied to the medium as $(NH_4)_2SO_4$ and Phosphorous as KH_2PO_4. Experiments were further carried out in the presence of some metal ion co-factors such as Cu^{+2}, Zn^{+2}, Mg^{+2}, Ca^{+2} and Fe^{+2}. Yield of ethanol was quantified using a spectrophotometric method where the reduction of yellow colour of $K_2Cr_2O_7$, when reacted with produced ethanol, was measured, and the yield was determined with respect to a standard curve. Fresh coconut water with no additives generally yields only about 0.6% to 0.7% of ethanol when subjected to fermentation, whereas fermentation carried out under optimized conditions could elevate this value in the range of 1% to 3% (w/v). It was evident from the experiment that a maximum yield of ethanol can be obtained at pH 5.0 and at effective Nitrogen and Phosphorous levels of 3.0 g dm^{-3} and 0.7 g dm^{-3} respectively. The results also indicate that, when natural fat content is removed from the sample by extraction prior to the fermentation, ethanol yield can be increased by about 15%, and when metal ion co-factors are added, the enhancement of yield is approximately 42%, compared to the normal. Further studies should be conducted to evaluate the economic feasibility of the use of proposed conditions for the production of ethanol from coconut water.

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