Potential of waste coconut water utilization for bio ethanol production.

by

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Dissertation submitted in partial fulfillment of the requirements for the degree of Master Of Science In Analytical Chemistry, Faculty of Science, University of Colombo, Sri Lanka

November 2011

Abstract

Water of mature coconut is bland in taste and flavour and therefore is a waste product in the desiccated coconut and coconut oil industry. At present a large volume of coconut water is being wasted in the coconut based industries in Sri Lanka where most of it is dumped into rivers or the sea.. This may create serious environmental problems, if it is disposed without a proper treatment. Water pollution due to industrial effluent has become a major environmental problem in the country. To avoid any damage that may be caused to the environment, the effluent from coconut based industries should be either treated to meet environmental standards in the country or converted into a value added product. One of the crucial issues that Sri Lanka is currently facing is energy insecurity which has a huge impact on the country's economy. As it is indicated by the" energy consumption by sector" chart in central bank report 2009, 43% of Sri Lanka's energy demand is met by imported petroleum. As crude oil price reach a new height, the need for developing alternate fuels has become acute. Nonetheless, the prohibitive cost of petroleum imports and increasing global concerns about climate change are encouraging Sri Lanka to put in place measures for exploring alternative sources of energy.

Current studies focused on the production of bio ethanol from mature coconut water. A fermenting strain of *saccharomyces cerevisiae* was utilized as the fermentation agent. Batch fermentation was the chosen mode for the ensuing fermentation process. The fermentation efficiency was optimized with respect to nitrogen (N) concentration of the medium, initial pH value, temperature and inoculums growth time. A series of batch experiments were conducted to investigate the effects of fermentation parameters mentioned above on bio ethanol production. The phosphorous (P) concentration of the medium was maintained at a constant value of 0.77g/l. Ammonium sulphate ($(NH_4)_2SO_4$) was used as the source of nitrogen and potassium dihydrogen phosphate (KH_2PO_4) was used as the source of phosphorous. Five N concentrations were employed which were ranged from 3.0g/l to 4.0g/l, with a 0.25 increament. A separate fermentation process was carried out in duplicate for each N concentration. A series of batch fermentations were designed at initial pH of 3.0 – 5.0, with an increament of 0.5. The influence of fermentation temperature on yield of bio ethanol was studied over a range from 25^0C to 40^0C with an increment of 5^0C. The efficiency of ethanol fermentation was evaluated at different inoculums growth times of 12h, 24h, 36h and 48h.

Each fermentation was performed in duplicate using a batch fermenter of 1L capacity with a shaking speed of $100min^{-1}$. The duration of the fermentation was 48 hrs. Bio mass concentration was analyzed as a measure of turbidity of the fermentation medium and was spectro photo metrically determined using optical density (OD) value. A method which used dinitrosalisylic acid (DNS) was employed for the determination of reducing sugar concentration of the fermentation medium. Dichromate ($K_2Cr_2O_7$) oxidizing method and ebulliometer method were used to determine ethanol concentration in the fermentation medium. An acid hydrolysis was carried out prior to DNS method in order to measure total sugar concentration.. A Control fermentation was carried out parallel to test samples without adding nutrients. The fermentation temperature, initial pH and inoculums growth time of the control run were 30^0C, 4.5 pH, and 24hrs respectively. The current strain of *S .cerevisiae* produced 9.920 mg/ml of ethanol on average from mature coconut water at 30 C, 4.5 pH ,and 24 hours inoculums growth time with the supplement of N 3.5 g/l.