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STUDY THE FACTORS INFLUENCING THE PRODUCTION OF ETHANOL FROM WASTE COCONUT WATER

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Master of Science

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Abstract

Coconut (*Cocos nucifera* L) water is found in abundance in Desiccated Coconut (DC) factories and it is the main constituent in the wastewater from DC industry. DC effluent does not meet the water discharge standards and has to be treated prior to the discharge. Coconut water contains sugars and nutrition but limited in industrial application due to its low concentration. The aim of this work is to explore the possibilities of value addition to waste coconut water from DC industry and cutting down the load on wastewater treatment plants.

Two main coconut cultivating regions (north-west and south) were selected for sample collection. Coconut water volume per coconut was examined and statistical values of coconut consumption from DC factories were used to calculate coconut water discharged daily and annually from DC industry. Average coconut water volume per coconut found to be 124 ml. Total sugar concentration was used to calculate the total amount of sugar available in coconut water from the DC industry.

The total sugar concentration in coconut water is low (North western region 32.6g/l, Southern region 19.5g/l), which will result low efficiency if used as the sugar source in fermentation. Hence, it was decided to improve the sugar concentration of coconut water obtained from the DC industry using evaporation. Evaporation was carried out at three pressure levels (47.4kPa, 101.3kPa and 198.6kPa) into four concentration levels. The effect of evaporation on the total sugar content was evaluated. Main drawback of evaporative concentration of coconut water was the thermal degradation of sugar ranging from 0.12% to 18%. During evaporation acidity and insoluble solids of the coconut water increased.

The concentrated coconut water was fermented into ethanol with a good efficiency. Volume reduction level of 5 was sufficient to achieve sugar consumption efficiencies about 89% and evaporation could be carried out at atmospheric pressure. The fermentation efficiency had marginally dropped with the increase of the volume reduction level and the increase in temperature and pressure used for evaporation process. A significant drop in the fermentation efficiency was observed with high sugar concentrations and in the presence of inhibitors such as HMF and furfural which may be formed at high temperature evaporation to achieve high volume reduction levels.

The annual coconut water wasted in DC industries was estimated to be about 36.3 million. However, the estimated producible pure ethanol amount from an average DC factory was estimated to be 50-60kg per day. Hence concentration followed by fermentation may not be an economical option for DC factories if pure ethanol is produced as the final product. However, there is a high potential for producing alcoholic beverage using waste coconut water from DC industry.

Keywords: coconut water, effluent, sugar, evaporation, fermentation

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Dedication

I dedicate this thesis to all who making efforts to improve the coconut sector, in Sri Lanka.



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List of abbreviations

Abbreviation	Description
AP	Ambient Pressure
BOD	Biochemical Oxygen Demand
CDA	Coconut Development Authority (Sri Lanka)
COD	Chemical Oxygen Demand
EPL	Environment Protection Licence
DC	Desiccated Coconut
HCl	Hydrochloric acid
HP	High Pressure
IS	Insoluble Solids
NaOH	Sodium Hydroxide
VP	Vacuum
VP ₅	Vacuum Pressure and volume reduction level 5
HMF	Hydroxymethylfurfural



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