

ABSTRACT

THE PRODUCTION OF ETHANOL FROM BANANAS

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If fuel grade ethanol production from biomass resources is to be competitive with hydrocarbon fuels it is essential that the raw material cost be minimised. This can be done by utilizing agricultural wastes, one such waste being export market bananas, rejected for poor quality. In the small island states of the Eastern Caribbean, about 20% of their export banana crop is rejected creating a difficult waste disposal problem.

A programme of experimental work was therefore carried out in order to evaluate the feasibility of producing fuel grade ethanol from bananas. This program was divided into three phases, raw material characterization, bench scale fermentation studies and small pilot plant scale ethanol production.

A comprehensive raw material analysis showed that banana pulp sugar content increased from about 6% to about 75% dry weight basis during ripening, while the starch content reduced from about 75% to about 1%. Similarly, peel sugar increased from about 6% to about 45% during ripening while the starch content reduced from about 30% to about 3%. The peel also contained about 15% cellulose and hemicellulose.

Laboratory scale fermentation studies on pureed and sliced ripe bananas using high ethanol tolerance yeasts of the Saccharomyces cerevisiae species showed that an ethanol concentration of about 8 wt % could be produced in about 60 hours. The final ethanol concentration increased with increasing solid/liquid ratio, but there was poor mixing at the higher values due to the high viscosity. There was little difference in the results between the fermentation of blended substrate when compared to the mixing of slices banana with water. An analysis of the kinetics of fermentation showed good agreement with one of the established theories.

In order to confirm the results obtained on the bench scale, one run was carried out on a small scale pilot plant operation. Similar results were obtained, thus demonstrating the potential for bananas as a substrate for ethanol production.