CITRIC ACID PRODUCTION FROM CASSAVA HYDROLYSATES AND MOLASSES USING *Aspergillus niger*

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ABSTRACT

This work investigated the potential of cassava and molasses as feedstocks for the production of citric acid using indigenous *Aspergillus niger*. This was with the view to developing indigenous biotechnological process for its production.

Cassava starch was extracted from freshly harvested tubers and hydrolyzed into glucose and maltose-rich syrups using enzyme hydrolysis method, while molasses was pretreated to serve as sucrose source. The hydrolysates and molasses were used as feedstocks for the cultivation of *A. niger*. Fermentation was carried out under shake flask culture using the gyratory incubator shaker at a temperature of 30 °C and agitation rate of 100 rpm for ten days. Surface culture fermentation of the hydrolysates and molasses was also carried out using ten sets of 250 ml Erlenmeyer flasks for ten days. The initial pH of 4.0 and 3.0 was employed and for optimum citric acid production, different concentrations (glucose-rich syrup: 140, 180 and 235 g/L; maltose-rich syrup: 140 and 330 g/L and sucrose based molasses: 140 and 180 g/L) were used. Samples were withdrawn at 24 hour intervals and analyzed for citric acid. biomass and reducing sugars. The variation of pH profile of the cultures with time was also monitored.

The results showed that the glucose-rich syrup obtained from the hydrolysis of cassava starch was able to support the growth of the microorganism used in this study. Of all the three concentrations investigated, glucose-rich syrup of 180 g/L gave the highest citric acid accumulation (17.6 g/L) on the eight day of fermentation followed by the glucose-rich syrup of 235 g/L with 11.3 g/L of citric acid accumulation on the eighth day of fermentation and lastly, glucose-rich syrup of 140 g/L with 10.1 g/L citric acid production on the fourth day of fermentation. Highest biomass concentrations obtained were 37.1, 36.1, and 32.7 g/L with corresponding glucose-rich syrup of 180, 235 and 140 g/L, respectively. For maltose-rich syrup, the highest citric acid accumulation (2.61 g/L) was obtained from 140 g/L on the third day of shake fermentation which was low when

compared with 6.9 g/L obtained from 140 g/L on the seventh day of surface fermentation. These values were lower than any of results obtained for the various concentrations of glucose-rich syrup investigated in this work. The highest production of biomass observed was 29.6 g/L on the tenth day of surface fermentation. It was observed that 330 g/L maltose-rich syrup was not favourable to citric acid and biomass production; the highest accumulation of citric acid recorded on the eighth day of shake fermentation was 2.1 g/L while highest biomass production obtained was 2.6 g/L on the tenth day of fermentation. Investigations on sucrose based molasses showed that 140 g/L gave highest citric acid of 6.5 g/L on the sixth day and 180 g/L gave 11.6 g/L on the tenth day of fermentation under surface culture. The best biomass concentration throughout this work (46.1 g/L) was obtained from 180 g/L sucrose based molasses on the tenth day.

The study concluded that glucose-rich syrup obtained from cassava starch hydrolysates favoured the accumulation of citric acid than maltose-rich syrup and sucrose from molasses. In addition, surface culture favoured the production of citric acid than shake culture.