

PALMYRAH FRUIT PULP FOR ORGANIC ACIDS AND ETHANOL

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Even though sugar (total sugar 14-16%) in the fruit pulp is a cheap carbon source, its use is neglected. This paper describes the possibility of using the pulp as cheap carbon source for citric acid, lactic acid and ethanol production. Pulp present in the palmyrah fruit was manually extracted with water (PFP extract) with 1.72 fold dilution. This contained 90.8 g l^{-1} sugar at pH 4.0. Pectin present in the PFP extract was removed by either gel formation with 0.24% (w/w) $\text{CaCl}_2 \cdot 2\text{H}_2\text{O}$ at pH 9.0 or hot acid extraction after 30 min heating at 60°C (pH 1.3) and depectinized fruit pulp (DPFP) extract I and DPFP extract II were prepared respectively. Sugar contents in DPFP extracts I and II were 96.3 and 98.2 g l^{-1} respectively. Sugar in the PFP extract, DPFP extracts I & II were used for citric acid production by *Aspergillus niger* CM₁ in liquid surface culture at pH 5.2 and 30°C . Commercially available sucrose was used as control. The fermentation medium contained (g l^{-1}) sugar, 80; NH_4NO_3 , 0.75; KH_2PO_4 , 0.5; $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$, 0.1; peptone, 14.0; $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$, 0.1×10^{-3} ; ferrous ammonium sulphate, 0.1×10^{-3} and $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$, 0.6×10^{-3} and (ml) methanol, 30 and gingeily oil, 2.0. In the fermentation carried out, 6.5 (7th day), 6.0 (7th day), 2.3 (7th day) and 16.9 g l^{-1} (6th day) citric acid was produced in the media containing PFP extract, DPFP extract I, DPFP extract II and the control respectively. The results indicate that the sugar present in palmyrah fruit pulp with or without pectin is not suitable for citric acid production. *Lactobacillus delbrueckii* was cultured at 42°C and pH 6.5 with continuous shaking at 250 rpm. PFP extract was diluted to sugar content of 50 g l^{-1} and supplemented with (g l^{-1}) yeast extract, 10; KH_2PO_4 , 0.5; K_2HPO_4 , 0.5; sodium citrate, 1.0; and salt solution, 1.0 ml (salt solution g l^{-1} $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$, 50; $\text{MnSO}_4 \cdot \text{H}_2\text{O}$, 3.1; $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$, 0.2; and ascorbic acid, 5.0) was used as the fermentation medium. The control medium had sucrose (50 g l^{-1}) instead of PFP extract. The sugar utilization and lactic acid production at 28 h were 35 & 38% and 14.2 & 16.0 g l^{-1} in palmyrah based and sucrose based media respectively. Thus the palmyrah based medium could be modified for lactic acid production. Ethanol produced in PFP extract diluted with distilled water to 100 ml was 16.5 g l^{-1} (36 h) by palmyrah toddy mixed culture (PMC) at 36°C with continuous shaking at 100 rpm. The PFP extract diluted to 100 ml with spent wash and supplemented with sucrose or without sucrose produced 20 (36 h) and 38 g l^{-1} (36 h) ethanol respectively. The DPFP extract I diluted with spent wash to 100 ml and supplemented with sucrose, produced 39 g l^{-1} ethanol (36 h). Thus both PFP extract and DPFP extract I could be used for ethanol production and the spent wash, a distillery waste could be used for enriching the medium.