ABSTRACT

Palmyrah palm (Borassus flabellifer) is found extensively in the northern part of Sri Lanka and it provides many useful products. These products, their uses and their conversion to other useful items are discussed in Chapter 1. Of these products the most important ones are the sap, fruit pulp and shoot flour. The conversion of palmyrah sap to toddy, palm sugar, molasses, jaggery, sugar candy, alcohol and other products is discussed. The problems involved in the manufacture of useful items from the palmyrah product are also discussed.

Isolation and characterisation of yeast strains for fermentation studies are discussed in Chapter 2. Twenty three yeast strains (M_1 - M_{23}) were isolated from different sources such as palmyrah toddy, coconut toddy, black grams and grapes. These were characterised on the basis of their morphological, cultural and physiological characteristics.

Fermentation studies on palmyrah sap and aqueous extract of the fruit pulp are discussed in Chapter 3. The efficiency of the yeast strains (M_1 - M_{23}) isolated were studied. The strains M_1, M_3, M_4, M_6, M_{10}, M_{19} and M_{23} were found to be good strains for fermentation. Of these the strain M_{10} which was identified as Saccharomyces ceriviceae, was found to be the best. This strain converted aqueous sugar solutions to alcohol in over 80% efficiency. The optimum condition for

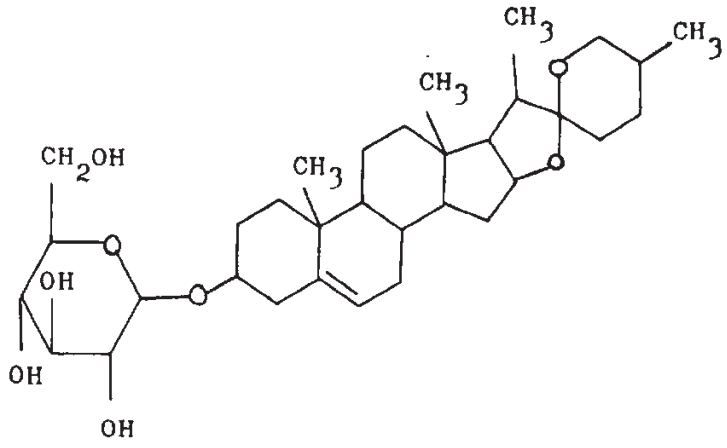
fermentation with the strain M_{10} were determined using artificial nutrient media. The optimum pH, sugar concentration, inoculum size, and concentration of added ammonium sulphate for the efficient fermentation of sugar solutions by the yeast strain M_{10} was found to be 5, 12 - 15%, 1 x 10^7 cells per ml, 0.1% respectively. Temperature was found to have a small effect, but the addition of peptone and yeast extract were also found to have large effect on the yield of alcohol. The use of these optimal conditions increase the efficiency of conversion of sweet toddy from around 55% to about 80%. The yeast strain M_{10} was also found to convert palmyrah molasses to alcohol in high yield (86%). Cost analysis indicated that the combined operation of producing palm sugar from the sweet toddy and alcohol from the byproduct molasses is economically viable. The aqueous extract of the palmyrah fruit pulp was converted to alcohol in high yield (85%) by the strain M_{10}. This is an alternate use for the fruit pulp and this could provide the fermentable material to the alcohol industry during the off season for sap. The alcohol content (4.84%) of the toddy collected in polythene bags containing an inoculum of the yeast strain M_{10} was higher than the alcohol content (4.55%) of the toddy collected in the traditional pots without inoculum.

The results of the studies on the preservation of palmyrah sweet toddy are discussed in Chapter 4. UV irradiation at a dossage of 29,500 microwatt sec cm^{-2} with a flow rate of 5 litres per minute was found to kill completely yeast strains at a cell density of 1 x 10^4 cells ml^{-1}. It was also found that benzoic acid or sodium benzoate at a concentration of 0.1% (w/v) and pH 4.2

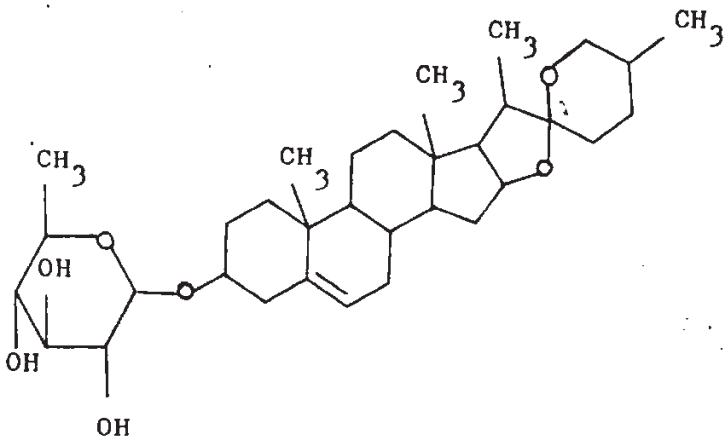
could be used to collect and preserve palmyrah sweet toddy efficiently. Freeze-dried sweet toddy was found to be stable for periods exceeding one year.

The chemical compositions of the palmyrah products are discussed in Chapter 5. Palmyrah leaves were found to have high N, P, K values. Their protein and fibre content are also high. Thus the leaves could be recommended as good green fertilizers and good cattle feed.

Most of the palmyrah products had the essential amino acids. All the products except "nongu" are deficient in sulphur containing amino acids. The lipid content varied from about 0.21% in sweet toddy to about 3.8% in the mature leaf. Hydrocarbons, sterol esters, triglycerides and free fatty acids were found to be the major components in the palmyrah lipids. The triglycerides and fatty acids of the palmyrah lipids had relatively large amounts of unsaturated acids or their derivatives. Among the palmyrah products only the fruit pulp and leaves had vitamin A. Vitamin C was found in the fruit pulp, nongu and leaves.



VII



VIII

Raffinose, glucose, fructose and sucrose were found in most of the palmyrah products. The fruit pulp and the shoot flour also had appreciable amounts of saponins. Compounds VII and VIII were two of the saponins present in fruit pulp and shoot flour. The palmyrah fruit pulp contained appreciable amount of pectins. The acid soluble pectins were the major component in fruit pectins.

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