CHARACTERISATION AND UTILISATION OF ROSELLE, *HIBISCUS SABDARIFFA* L.

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Introduction

Hibiscus sabdariffa L. (roselle) is a tropical annual shrub that produces fruit-like structures (over-developed calyces) containing edible red pigments. From the family *Malvaceae,* it is also called kakadeh in Africa (Sudan) and Florida cranberry in the US. Locally it is known as 'asam paya', 'asam susur' or asam kumbang'. The plant can grow well on bris soil found along the east coast of the country. Water extract of the calyces makes a refreshing, pleasant flavoured drink, or when dried can be used as a colorant in dry beverage and desert mix. The calyces are also suitable materials for the production of jellies, jams, preserves, chutneys, sauces, and wine. The seeds contain appreciable quantities of oil (average 17%) and protein (25%). Waste calyces and seed meals have been found to be suitable materials for animal feed. The objectives of this project were to improve the storage of roselle calyx, to produce a variety of value-added food products and ingredients from calyces, and utilise valuable components of roselle seeds and to utilise and evaluate roselle wastes (pods and seeds) as alternative animal feed.

Materials and Methods

Roselle calyces were obtained from the Terengganu State Agricultural Department. The effect of storage was studied at ambient (27±1^{o}C), low (5±1^{o}C and 10±1^{o}C) and freezing (-20^{o}C) temperatures. The physico-chemical properties i.e the peel colour, total soluble solid (TSS), titratable acidity (TA), pH and vitamin C, of the calyces were monitored weekly for 16 weeks. Products from roselle such as juice concentrate, flakes, tea and spray-dried powder were developed. Two commercial pectinase preparations were used to extract juice from calyces. Extraction efficiency was examined at enzyme concentrations ranging from 0.5 to 2.0% (v/w calyx). Juice properties determined were yield, pH, TA, TSS, colour and viscosity. The ingredients used to prepare roselle leather were roselle puree, corn flour, sucrose, maltodextrin and carboxy-methylcellulose. Spray-dried powder was obtained by adding maltodextrin to roselle juice. Roselle tea was prepared from both fermented and non-fermented calyces. The proximate composition of roselle seeds and pods (both dried and ground) used for feed preparation were analysed using standard methods. The degradability of roselle seeds and pods were tested in the rumen of sheep.

Results and Discussion

Results obtained indicate that freezing was the best storage option for increasing the shelf life of calyces. At ambient temperature, the calyces lasted only a week, while it was 2 and 3 weeks, respectively, for calyces stored at 5 and 10^{o}C. Damage at 5^{o}C was most likely due to chilling injury. Notable changes that occurred in all cases were increases in the TSS and TA, and decreases in the ascorbic acid, fructose, glucose and sucrose concentrations. The pH remained fairly stable at 2.9. Results obtained for juice concentrate production indicate that the addition of enzymes improved yield significantly. No significant change in the colour and TSS occurred. There was a significant drop in the viscosity of the juice when enzyme was used during the extraction process. Results of taste panel evaluation of roselle flakes showed that the product obtained was acceptable, and were similar to imported products prepared from other fruits. The composition of the final product was moisture 18.8%, crude protein 1.3%, crude fibre 1.1%, crude fat 0.3%, ash 0.74%, pH 3.24, titratable acidity 0.09 meq NaOH/gm and water activity 0.75. The best spray drying powder was obtained when 3:2 ratio of juice to maltodextrin was used, and the powder had 2.07% moisture and the fastest solubility rate of 141 seconds. It was also the most preferred/attractive preparation in terms of colour. The yield was moderate (53.1%). The product had a storage stability of 12 weeks at 30^{o}C. Tea prepared from calyces fermented for 40^{o}C for 10 hours gave the best-flavoured tea while calyces fermented at 30^{o}C for 5 hours produced the best-coloured tea. Unfermented tea, dried at 70^{o}C for 6 hours, also produced tea of acceptable colour and flavour. The proximate composition of roselle seeds was 5.5% moisture, 20.1% protein, 19.8% crude fat, 27.7% crude fibre, and 8.0% ash, while the pods contained 4.6% moisture, 7.3% protein, 12.9% crude fat, 45.3% crude fibre, and 5.2% ash. The digestibility of the seeds and pods was tested by fistulating four sheep at the rumen. Samples of seeds and pods were placed in nylon bags and incubated in the rumen of sheep for 2, 4, 8, 12, 24, 48 and 72 h. After incubation, the samples were washed, dried and analysed for dry matter and protein. The results suggests that the seeds had slightly better degradability (about 40 %) as compared to the pods (about 30%) The poorer digestibility of the pods could be due to high lignin content.

Conclusions

To prevent losses due to natural decomposition, excess roselle calyces obtained during good planting seasons may be stored at –20^{o}C. the initial properties were largely maintained at this temperature. Numerous products can be prepared from roselle. These include juice concentrate, flakes, spray-dried powder and tea. Wastes obtained after processing of roselle into food items may be further utilised as animal feed.

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