PALMYRAH SUGAR PRODUCTION IN SRI LANKA

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The stage has still not been reached, when a definite conclusion can be drawn that manufacture of sugar from palmyrah juice is a viable and economic proposition.

In this paper, presented at the SLAAS sessions in December 1982, K. Sivalingam, Planning Officer of the District Planning Office, Jaffna, maintains that the feasibility of manufacturing palmyrah sugar on a commercial scale merits closer examination considering its potential for increasing sugar production, for using a hiterto unutilised resource, creating more employment and improving the socio-economic status of tappers in the area. He attempts to focus the attention of scientists on this subject in the hope of inducing some of them to play a larger role in technology development for the palmyrah industry and more particularly for palmyrah sugar manufacturing.

Introduction

The Ceylon Institute of Scientific and Industrial Research Bulletin No.2 of 1967 detailed the findings of the Ceylon Institute of Scientific and Industrial Research workers in the field of palmyrah sap, fruit, fibre and timber products. This publication formed the basis for experimental work on palmyrah products conducted at the Palmyrah Demonstration and Training Centre established in 1971 by the Industrial Development Board. The introduction of technology initiated by this Centre resulted in the metamorphosis of the palmyrah cottage industry into an authentic small scale industry.

The Divisional Development Council Programme started by the previous Government to organize and manage small scale industries utilized the available technology for setting up small scale industries. The D.D.C. programme encouraged import substitution industries and the technology was geared for the production of consumer items from locally available raw materials. This provided the opportunity for setting up of 60 Jaggery and Sugar Centres in the Jaffna District. The Palm Products and Sales Co-operative Societies formed in 1972 incurred heavy losses due to the large amounts of toddy that had to be destroyed. The D.D.C. programme served to help the Palm Products and Sales Co-operative Societies with loans to organize the production of jaggery and sugar using sweet toddy, thus converting the excess toddy into sweet toddy. The palmyrah jaggery and sugar production which had thrived under the import-substitution phase of 1970 to 1976 had to close down after 1976 due to the low price of imported sugar. However, it must be noted that recent revision of tarrifs would benefit the palm sugar production. The reason for the revival of Palm sugar manufacture are:

- Under-utilisation of the vast sources of the Palmyrah, the estimated population of which is 7 million palms and of which only 2 percent is utilized.
- Under-employment and unemployment amongst the 12,000 tappers of the District.
- Large wastage of toddy due to the limited market.

The economic viability of the palm sugar programme rests on the following factors:

1. The cost of sweet toddy which is the raw material for palmyrah sugar production and constitutes 60% of the total cost of production
2. The cost of fuel mainly fire-wood, which forms 14% of the total cost of production.
3. Enforcement of quality control for the Palm Sugar Industry.
4. The market for molasses obtained as a by-product in sugar production
5. Recovery rate of Sugar under the technology in use.

1. The price of sweet toddy depends on the price of toddy and will tend to remain high until the present laborious tapping methods are overcome. At present the Palmyrah Development Board is in the process of introducing a device for climbing called the Lift System which is estimated to cost about Rs.500/– per tree. A tapper will be able to climb about 100 trees per day with this device instead of the present 10–15 trees and will be able to supply 100 to 150 gallons of palmyrah sweet toddy which is sufficient for the operation of a Treacle Processing Centre. Thus for 10 Treacle Centres which will supply 250 gallons of treacle for the Sugar Centre, 10 tappers would be sufficient. This equipment could be supplied to tappers through the Palm Products and Sales Co-operative Societies which will recover the money from the payment on the supply of toddy and sweet toddy.

2. Use of wood charcoal in addition to fire-wood has been tried as fuel in the process of concentration of sweet toddy. An electrically heated furnace has been designed for the sugar Centre for improvement of quality. These methods have yet to be implemented by the Palm Products Co-operative Societies.

3. Quality Control for the manufacture of palm sugar is a neglected area and standard quality control procedures have to be strictly enforced by the P.P & S.C.SS. The setting up of a quality control laboratory by the Palmyrah Development Board would be a positive step in this direction.

4. The molasses have not been fully utilized up till now and it is expected that the low-wine centres and the Palmyrah Arrack Distillery will utilize this by-product and offer attractive prices for the molasses thus enhancing the viability of sugar production. The molasses has been priced at Rs.20/– per gallon by the Sri Lanka Sugar Corporation.

5. The recovery of palm sugar under the technology presently employed is under observation and the writer of this paper welcomes suggestions for improvement of the technical aspects of the industry.

In the context of the developments outlined above it is necessary that the technological process of palm sugar production is reviewed and areas of future research outlined. This paper attempts to focus the attention of scientists in Universities and other Institutions on this subject and to induce some of them to pay a larger role in technology development for the palmyrah industry in general and palmyrah sugar manufacture in particular.

PALM SUGAR PROGRAMME

The Palm Sugar Programme which envisages the production of palm sugar at five sugar centres in the District commenced in 1982 under the aegis of the District Ministry, Jaffna. Under the programme it is proposed to produce ½ ton of sugar per day of operation at each Sugar Centre. The Centres and their managements are as follows:

1. Sarasalai .. Chavakachcheri P.P. & S.C.S.
2. Manthikai .. Point Pedro P.P. & S.C.S.
3. Vallai .. Atchuvely P.P. & S.C.S.
4. Kodikamam .. Kodikamam P.P. & S.C.S.
5. Chankanai .. Vaddukoddai Electorate P.P. & S.C.S.

The Sarasalai Sugar Centres started to function from March, 1982 and produced about 3000 kg. of palm sugar up to end of June. The Society operated 4 Treacle Centres from which treacle is processed for the Sugar Centre. In addition to palm sugar, production of palm candy also commenced at this Centre during May, 1982. Total sugar production at this Centre for this year is 2500 kg due to underutilization of capacity.

The Manthikai Sugar Centre commenced production from May, 1982. Regular production was delayed due to machine defects and production will be resumed from 1983.

The Vallai Sugar Centre went into production during June and production will commence from Janaury, 1983. The other centres are expected to operate from 1983. Of the investment of Rs. 337,460/- for equipment for each of the Sugar Centres an equipment grant of Rs.100,000/— was made from the Decentralised Budget. The Societies obtained the balance sum as loan from the People's Bank on the recommendation of the District Planning Office, which is coordinating the programme at the District level. Many problems associated with this infant industry have been overcome with the assistance of the Co-operative Department, the P.P. & S.C.SS and the Palmyrah Development Board and it is expected that the programme will be implemented successfully.

Under the Palm Sugar Programme it was planned that the total production of palm sugar at five Sugar Centres will be 2½ tons per day. Over the 200 days of the sweet toddy season about 500 tons of sugar will be produced.

For the 8 lakhs of people of the District the consumption of sugar is about 12,500 tons at a per capita consumption rate of 35 lbs per annum. At an average yield of ½ gallons /tree for 200 days, sugar from the 100 gallons of sweet toddy will be 75 lbs at the rate of ¾ lb of sugar per gallon of sweet toddy, or 50 lbs at the rate of ½ lb of sugar per gallon of sweet toddy. In order to produce the consumption needs of the Jaffna District at present about 560,000 trees calculated at the lower rate of extraction have to be tapped for sweet toddy. This forms about 8% of the seven million palmyrah palms of the District.

The process of Sugar Manufacture

In the C.I.S.I.R. Bulletin 2 of 1967 Mr. K. Ratnasingham outlined the process of Small Scale Sugar manufacture. The implements employed were simple and the methods used were such that the skill could be acquired by the villagers. Except for a crystallizer and a centrifuge the equipment used was common to both sugar and jaggery manufacture. The equipment and process details were worked out for 10 gallons unit and were suited for a cottage level scale.

The sweet toddy was strained through a wire mesh to remove suspended matter and clarified to remove impurities. Clarification of sweet toddy is carried out by the addition of a saturated solution of triple super phosphate to form insoluble calcium phosphate by reaction with lime already present.

The final phosphate was brought to 6.8. The juice was finally 'boiled to crack' and directly filtered through a cloth stretched horizontally. The clarified juice was directly boiled to rab in an open pan. Wooden ladles are used for stirring operations. The strike point of the rab boiled varied from 108° c — 112° c. The rab is transferred to the inner section of the crystallizer and was stirred at intervals of one hour to promote deposition of sucrose on the grains. Generally about 25 to 35 hours are sufficient for the development of grains.

The sugar crystals in the rab are separated from the surrounding molasses in the cycle driven centrifuge. Small quantities of water were used to wash the grains before discharging. Finally the sugar was sun dried and weighed

With proper clarification and good boiling white crystalline sugar can be obtained. After the first crop which is white, the subsequent crops are brown. About ¾ lb of good quality sugar and .5 pint of treacle could be obtained from a gallon of juice. A combined recovery of 8% on the weight of juice from two crops or boilings can be expected.

sugar manufacturing Centre was set up at Polikandy, Point Pedro in 1957 with the assistance of the Rural Development Society of that area. In 1971 these experiments were repeated by me at the Palmyrah Demonstration and Training Centre, Keerimalai set up by the Industrial Development Board, with the assistance of the C.I.S.I.R. Based on these experiments Palm Sugar Production was undertaken at a few jaggery centres during 1976 — 77 under the D.D.C. Programme. However, Jaggery remained the main product due to the higher profit margin compared to sugar.

Innovations were made during this period in the existing technology like the introduction of an electrically operated centrifuge instead of the cycle driven centrifuge used by the C.I.S.I.R. workers. With the inauguration of the present programme of Palm Sugar Production under the aegis of the District Ministry however distinct changes were made in the Organization as well as in the Process of manufacture and in the Equipment.

A. Organization

Each Sugar Centre is planned to process 250 gl. of Treacle per day collected at 65 Brix at each of the 10 Treacle Centres servicing that particular Centres. The syrup is heated to 110 C to a super saturation stage of 85 Brix and put into the crystallizer for crystal formation and growth. The project officer in charge of each sugar centre will supervise the quality of Treacle collected from each Treacle Centre managed by an O.I.C. The General Manager of the Palm Products and Sales Co-operative Society is responsible for the economic viability of the Sugar Centre.

B. Modified Process

The process adopted from the C.I.S.I.R. had to be modified as production is based on the collection of sweet toddy and transport and bulking in quantity for large scale manufacture of sugar is not feasible due to the deterioration of the quality of sweet toddy on account of formentation. Thus the processing is done in two stages with the first stage being done in widely scattered small scale Treacle Centres and the second stage in centralised larger scale Sugar Centres.

The C.I.S.I.R. Process and the modified process adopted presently in the Sugar Centre are given below in the form of flow charts.

FLOW CHART OF C.I.S.I.R. PROCESS FOR PRODUCTION OF PALM SUGAR

Sweet Toddy Testing and Collection
↓
Clarification and Settling
↓
Evaporation and Super Saturation
↓
Crystallisation and Growth
↓
Centrifuging or Curing
↓
Sugar Drying and Packing

FLOW CHART MODIFIED PROCESS FOR PRODUCTION OF PALM SUGAR

AT TREACLE CENTRE

Sweet Toddy Testing and Collection
↓
Clarification
↓
Settling
↓
Evaporation and Syrupsaturation
↓
To 65 — 70 Brix
↓
Transport of Syrup To Sugar Centre

AT SUGAR CENTRE

Super Saturation of Syrup
↓
To 85 Brix.
↓
Crystallization and Growth
↓
Centrifuging or Curing
↓
Sugar Drying and Packing

Equipment

1. The heating of Sugar Syrup is envisaged to be done in an electrical furnace. A prototype furnace was designed at a cost of Rs.8,000/—. The working of the electrical furnace has not been fully studied under working condition and saving in fuel is not therefore known. It is expected that this furnace will be installed at the Sugar Centre after complete study of the furnace. At present the open pan furnace designed by the C.I.S.I.R. is in use.
2. Equipment for Crystallization and separation of Sugar was designed for the Sugar Centre by M/s. Promoters Engineering Company Ltd. on the suggestions of the District Planning Office. This equipment were made out of stainless steel instead of G.I. used previously.

Drawings show the details of the crystallizer and centrifuges designed by the C.I.S.I.R. and the modified designs made by M/s. Promoters Engineering Company Ltd. Due to increase of cost, it was not possible to motorize the crystallizer sets as planned.

The working of the modified Crystallizer and centrifuge are as follows;

A. Centrifuge

Capacity : 30—40 Kg per hour (Batch Type)
Basket Size: 600 m.m. diameter Height: 300 m.
Motion : 5 H. P. x 1440 RPM — 3 phase

B. Crystallizer

Capacity :160 Litres
Size :400 m.m. diameter x 1300 m.m.
Motion :Manual — 15 RPM

Conclusion

It is felt that the stage has not been reached when a definite conclusion can be drawn that manufacture of sugar from palm juice would be a viable and economic proposition. It is necessary to continue production for some more time and get a clearer picture of the whole scheme to form the data base for perfecting and standardising the pattern of a model unit. With added experience it would be possible to throw light on the following aspects of palm sugar production:

a. Optimum and/or minimum size of a viable and economic unit and the respective requirements of area of operations, trees, tappers and transport.

b. The organizational set up for collection and concentration of sweet toddy into syrup: whether it should be processed in self contained units as envisaged by C.I.S.I.R. or as at present in two stages with the factory being serviced by a network of treacle centres. The equipment will depend on the production Organisation chosen.

c. The scope for reduction of sugar losses in processing through better technology and on this basis, the rate of recovery that could be expected from sweet toddy.

d. The scope for reducing fuel consumption.

e. The desirability of purchasing syrup from tappers instead of sweet toddy.

f. Improvements and modifications necessary in the existing designs of plant and equipment.

g. The desirability of setting up integrated projects where manufacture of sugar will be combined with the manufacture of palm sugar candy, confectionary, jams and golden syrup.

Considering the potential for expansion of sugar production, using hitherto underutilized resources, creating more employment, and improving the socio-economic status of tappers, the feasibility of manufacturing palmyrah sugar on a commercial scale merits close examination.

The metamorphosis of a cottage level industry into a modernised small scale industry based on intermediate technology has opened up several areas for research in the context of modernization of the Palmyrah Sector.

BIBILIOGRAPHY

1 Bulletin No.2 of 1967 — Publication of the Ceylon Institute of Scientific and Industrial Research.

2. Palmyrah Palm Arrack feasibility study — Sri Lanka Sugar Corporation — September, 1982.

3. Report of the Palmyrah Industry Committee — March, 1982.

4. Report on Palmyrah Research Station — Dr. S. Mohanadas, Consultant, Palmyrah Development Board — December, 1980.

5. Report on the formation of a Public Limited Liability Company for the Development of the Palmyrah Industry — Mr. K. Loganathan.

6. Monthly Progress Reports of the Assistant Commissioner of Co-operative Development (Palm Products), Jaffna — 1980.

7. Pannai Tholizl Part 11 — Mr. K. Sambandam. Published by Palm Gur and Fibre Marketing Co-operative Federation, Madras.