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Small scale industrial production of clarified juice from local fruits using pectinase enzymes

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Introduction

Fruit juices as defined in the United Kingdom by the fruit juice and fruit nectars regulation 1977, as amended, is 100% pure fruit juice made from fresh fruit concentrates³. The appearance of the juice can be improved by separation of the undesirable tissue constituents and its quality in some cases can be improved by the adjustment of the balance between certain constituents². Pulpy and stony fruits such as banana, mango, pawpaw, guava and apple are clarified using pectinase enzymes³. Treatment with pectinase enzyme, result in marked decrease in viscosity of the otherwise viscous pectinous juice¹. These enzymes are obtainable from fungal solid-state fermentation of materials such as corn pomace readily available in Nigeria.

This study presents the conversion process for clarified juice production, process development and identification of appropriate machinery and equipment for different levels of production and the investment profile of the project.

Materials and methods

The technique of juice clarification using pectinase enzyme obtained from corn pomace was developed our laboratory. The process includes washing, peeling, pulping, enzyme hydrolysis, clarification, blending, bottling and pasteurization. The developed process was scaled up from laboratory to industrial scale. Three levels of 300, 500, and 1000 kg/day production capacities were optimized during the process. An appropriate machinery and equipment for the process as well as the production of the pectinase enzyme used for the clarified juice production was carried out.

The investment profile based on 1 ton/day of fresh fruit was prepared using UNIDO, recommended methods⁴ to establish the profitability of the project.

Results and discussion

Fig 1 presents the process flow chart for clarified juice production using pectinase enzyme. Table 1 presents the developed machinery and equipment and capacity for the three levels of small-scale commercial production optimized for the project. The cost of machinery and equipment for 1 ton/day production capacity including equipment for enzyme production was estimated at N2.8M. The total estimated initial investment cost consisting of fixed capital, working capital and pre-production expense was estimated as N6.2M and the sales revenue to gross profit ratio was 3:1.

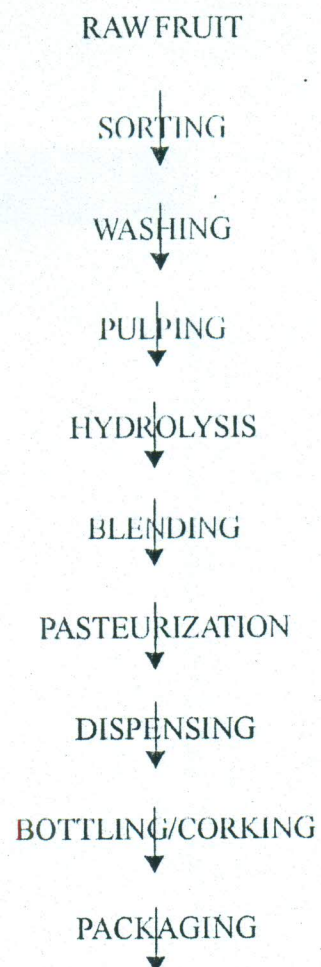


FIG 1:

Process flow chart for clarified fruit production

TABLE 1: Develop machinery and equipment for three levels of commercial production of clarified juice

| PROCESS | EQUIPMENT | CAPACITY | | |
|--------------|-------------------------------------|----------------------|----------------------|-----------------------|
| Washing | | 300-kg/day manual | 500-kg/day manual | 1000 kg/day manual |
| Pulping | Pulper | 300 kg/day | 500 kg/day | 1000 k/day |
| Hydrolysis | Hydrolser | 500 litres | 700 litres | 1200 litres |
| Mixing | Mixer | 500 litres | 1000 litres | 1500 litres |
| Storage | Holding tank | 200 litres/batch | 300 litres/batch | 500 litres/batch |
| Filling | Hydraulic Liquid Filling machine | 200 bottles/batch | 300 bottles/batch | 500 bottles/batch |
| Cocking | corker | manual | manual | manual |
| Pasteurizing | Pasteurizer | 100 bottles/batch | 100 bottles/batch | 200 bottles/batch |

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