

**COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH-
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**A REPORT ON TRAINING IN FRUIT JUICE PROCESSING FOR MICRO AND
SMALL SCALE FOOD COMPANIES**

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Introduction

Fruits play a pivotal role in human nutrition, supplying important nutrients such as vitamins, minerals and fiber. These nutrients are necessary for maintenance of bodily functions and strengthening the immune system. Fruits are also noted for preventing diseases associated with vitamin deficiencies such as scurvy and night blindness. The importance of fruits is further emphasized in its contribution to commerce. Huge amounts of income is generated through fruit processing and consumption.

The popularity of fruit juices in Ghana has increased dramatically over the past decade. Although the market is dominated by imported products, locally made juices have stayed competitive to date. With the aim to add more value to raw fruits, generate income, create employment and contribute to reducing the postharvest losses associated with fruits, many entrepreneurs and food processing companies within the SME sector have venture into fruit juice processing. In line with FRI's mandate of supporting the activities of the Ghanaian Food Industry, training workshops are regularly organized for a wide array of industry player, including entrepreneurs. This report presents the activities covered during the training of SMEs and entrepreneurs who are interested in setting up fruit juice processing facilities. The main objective was to equip them with basic food processing knowledge and the technical skills involved in the fruit juice processing.

The training workshop was organized in 2 modules, which involved theory and practical. The theory module was essentially to orient them and introduce them to the basics of food processing, food safety and good manufacturing practices. This session was made interactive and participatory, with ample time being allowed for questions, comments and general discussions. This approach is key in linking and relating indigenous knowledge in food processing to proven scientific and professional food processing technologies.

The participants were taken through the importance of food processing, various methods available for food processing, beverage processing and the importance of heat treatment operations such as pasteurization. They were also taken through the basics of food packaging, food safety and hygiene, and good manufacturing practices. The trainees were taught how to carefully implement and apply these operations in their food processing facilities.

Practical module

The trainees were taken through a practical demonstration of orange and mango juice processing. This was to enable them relate theory with practice and enhance their skills and capacity to produce the beverage on commercial scale. They were taken through the various unit operations (Figure 1) practically for them to understand the processing of fruits into juices.

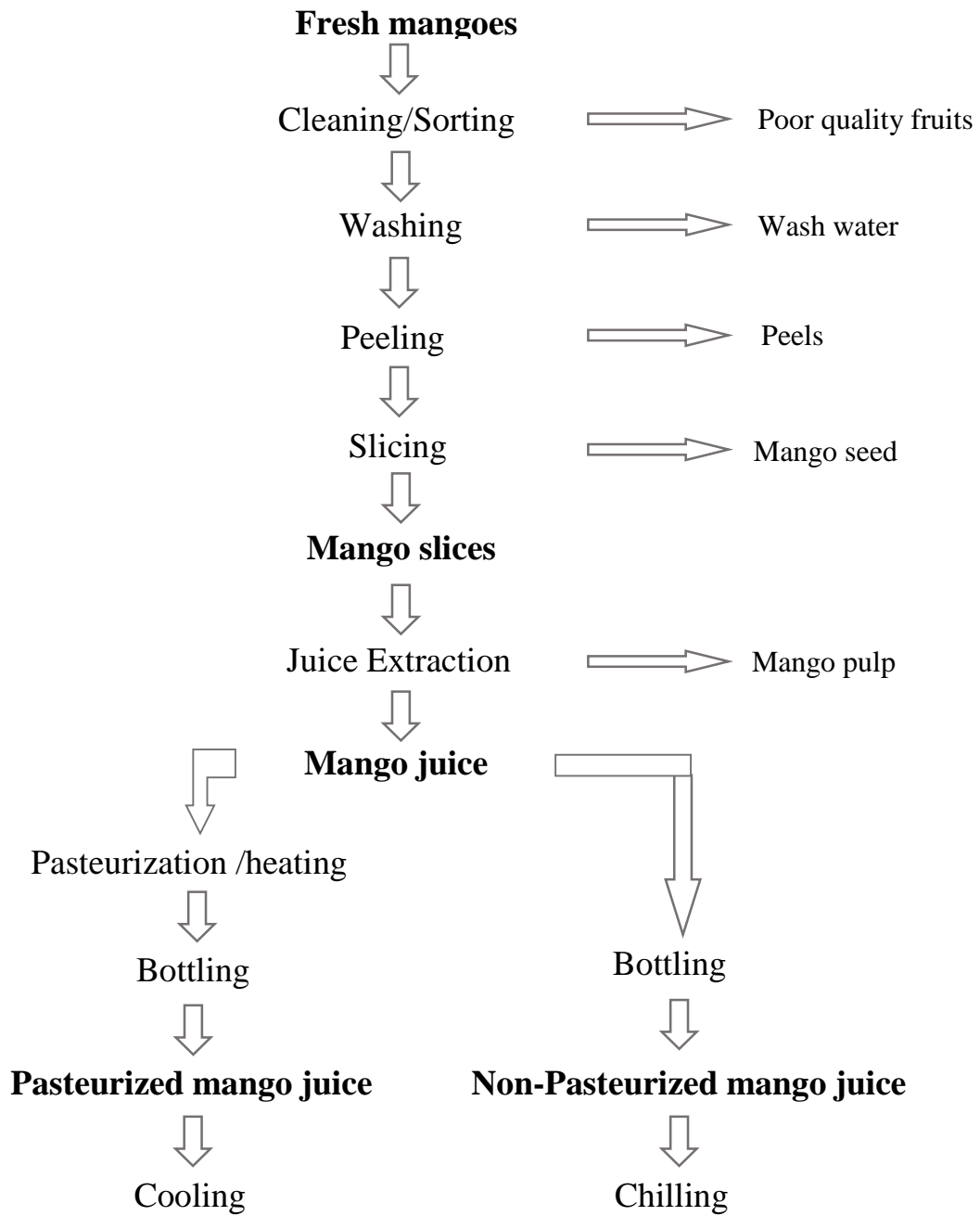


Figure 1: Flow diagram for mango juice processing

Unit operations involved in processing fruit juice processing

Raw material

Oranges and mangoes are the primary ingredients respectively for processing orange and mango juice. Many varieties of mangoes and oranges are grown in Ghana. Although the varieties of these fruits may vary in taste, color and juice content, most of them may be used to produce fruit juice. Varieties of mangoes such as Keitt, Kent, Haden, *Local* (mangoes) and oranges such as Valencia, Obuasi, Mediterranean sweet, Ovaletto, Skkan, Blood orange (Sweet oranges) may be used (Figure 2). Trainees were advised to carefully select the starting materials since it largely dictates the properties and qualities of the finished product. They were told that the basis for selecting fruits for processing is based on variety and maturity. This is because variety and maturity affect the physical and chemical properties of the fruits. Participants were also advised to obtain fruits from reliable sources in order to be sure of fruit quality and also be mindful of pesticide residue on fruits. Above all, mangoes and oranges for processing must be healthy. Other raw materials for processing may include sweeteners and preservatives.



Figure 2: Different varieties of oranges and mangoes

Sorting and washing

Sorting and washing, generally are two essential operations in food processing. While sorting is basically done to select good quality raw material for processing, washing is a mode of cleaning in which potable water is used to rid the raw material of foreign matter. In the production of fruit juices, these two operations should be carefully done in order that beverage of high quality is produced. Washing of fruits

is done with potable water at room temperature. Fruits must be carefully washed to get rid of foreign matter such as sand, cobwebs, etc. Washing is followed by sanitization in either chlorine or sodium metabisulfite solution. This step drastically reduces the microbial load of the fruits.

Peeling/slicing/de-stoning (for mangoes)

Peeling follows washing and sanitizing the fruits. In the case of oranges, the fruits may be directly cut in halves (depending on method of extraction) without peeling. The participants were taught how to effectively peel mangoes, without losing the juice. Peeling must be carefully done, especially for oranges so that peels may not come into contact with juice, as this will impart bitterness. After peeling mangoes, the flesh is sliced off the seed in a process called de-stoning.



Figure 3: Demonstration of de-stoning and slicing mangoes

Extraction

Proper juice extraction is essential to ensure high yield and good quality juice. Extraction may be done using a food processor or a juice extractor (manual or motorized). For mangoes, slices from the de-stoning step are loaded into the juice extractor, which extracts the juice in the form of a puree. In manual extraction of orange juice, the fruits may be sliced in half and each of the halves pressed against stationary or rotating reamers, extracting the juice in the process. Juice extraction is followed by filtration with a fine filter or a cheese cloth. Filtration ensures that the final beverage is clear, with no sediments. However, a sieve with bigger pore sizes may be used in order to arrive at a final product with high fiber content.



Figure 4: Participants being taken through extraction procedures for mango and orange juice

Formulation

The extracted juice may be reformulated to modify its taste, flavor and or color and also to improve on its keeping quality. Here, calculated amounts of juices from other fruits, extracts from local spices, synthetic flavors and sweeteners may be added. Participants were advised against the use of unapproved food additives because these may pose a health risk to consumers. The level of sweetness of the final beverage is also modified to suit the taste of consumers. In order to demonstrate this, participants were taken through the Pearson's Square method of adjusting brix. This is a simple method used for estimating the amount of sucrose needed to attain a desired brix (sweetness).

Pasteurization

When the final juice, with desirable sensory and physical properties has been formulated, it is pasteurized. Even though the juice may have a low pH (especially orange juice) and have a natural protection from bacteria and other microorganisms, pasteurization is needed to extend its shelf life. Participants were given the theoretical bases of pasteurization during the theory session on basic food processing. They were informed that pasteurization is always a critical control point in any food safety system and therefore must be done effectively. The formulated juice was pasteurized at 75 °C and held at this temperature for 15 min. The participants were asked to undertake pasteurization cautiously, sticking to strict temperature-time regimen. Adequate pasteurization is needed for keeping the product safe for consumption and also extending its shelf life. The participants were informed that when using glass bottles, pasteurization could be done before and or after bottling.

Packaging/Bottling

Bottling was done immediately after pasteurization of the beverage, while the beverage was still hot. This approach is used in order to prevent re-contamination of the product. Prior to filling, the participants were taught how to wash and sanitize the packaging materials. This is an essential procedure in ensuring that the bottles are sterile before filling-in the product. They were cautioned against simply rinsing the bottles with water, since this may not be enough to destroy microorganism that may be present in the bottles. They were told that glass bottles may be sterilized with heat or chemical sanitizers (eg. chlorine solution), before filling is done.



Figure 5: Samples of bottled mango juice

3.0 Remarks by participant

Trainees who participated in fruit juice processing were glad to have participated in the workshop to acquire the theoretical and practical knowledge in food processing. They were particularly elated for having gained the requisite technical skills for beverage processing. Having gained technical insight from this workshop, they were hopeful of improving on the quality and shelf-life of their product. They also revealed that they will make sure they implement and observe good manufacturing and hygienic practices in their facilities and along the processing line.

4.0 Training evaluation

Each training workshop was evaluated for its effectiveness using a questionnaire. The trainee revealed that the training met his expectations and expressed their satisfaction about the quality of instructions, discussions held and the hand-on approach used in the workshop. He agreed strongly that the content was valuable and easy to follow, with more time being allowed for questions and discussions. Overall, the training program was rated “very good” by the trainee. He, however remarked that the presentation slides should be made more interactive by including more pictures and animations.