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# Development of Pineapple Peeler-*cum*-Slicer

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Manually peeling and slicing of pineapple is a time consuming and labour intensive process. Pine apple peeler and slicer are required for reducing the size, obtaining uniform thick slices, proper shape finishing and further processing of pineapple quickly. Therefore a peeler-cum-slicer was designed with slicing plate of diameter 7 cm and core diameter of 2.5 cm. It removes the core and produces pineapple rings of uniform thickness & diameter in a single motion. This is a hand operated peeler cum slicer which works satisfactorily with easy operation. Twenty numbers of pineapple fruits can easily be peeled and sliced by skilled worker in one hour with this designed device. The designed peeler-cum-slicer has also proved to have high peeling efficiency (97.2 %) with less wastage percentage (5.3%).

## Introduction

Fruits and vegetables are highly perishable, spoiled primarily due to biochemical changes (enzymatic and/or by the activity of bacteria, yeast and moulds). Microbial activities are controlled or destroyed in order to preserve the fruits and vegetables. In the tropical countries, post-harvest losses in fruits and vegetables are one of the most processing problems. Pineapple (*Ananas comosus*) is a tropical plant with edible multiple fruit consisting of coalesced berries, and the most economically significant plant in the *Bromeliaceae* family. Total production of Pine apple in India was 1438.50 Tonnes (Mistry et al., 2011). Manually peeling and slicing of pineapple are the time consuming and labour intensive process. Thus, machines like pineapple peeler and slicer are very essential for processing an appreciable amount of pineapple per unit time. Different shape and sizes of pineapple such as round, oval and conical are available in markets. Various factors (like variety and maturity level) of food material affect significantly the tissues structure and slicing operation. Pineapple is only source of brome lain, an enzyme used in pharmaceuticals and as meat-tenderising agent (Moyle et al., 2005). Pineapple is a well-known fruit within the tropical fruits over the world, represents largest processed volume and generate several kinds of products like canned; frozen pineapple in slices and pieces; and juice of single strength and concentrate (Reinhardt et.al., 2009).

Sharpness of cutting instrument is a fundamentally important parameter in all cutting applications and strongly influences the forces generated and energy required during the cutting operation, and the surface finish or quality of the cut surface. Saravacos

et al. (2002) stated that little work has been carried out on the energy requirement for a cutting operation of fibrous materials. Limited literatures have published in which few data of cutting forces, which could be used for design of cutting equipments (Brown et al., 2005). Many devices for cutting foods have been invented empirically based on the physical properties of materials, subject to study (Atkins, 2009).

**Importance of Cutting Operations**

Cutting sample (Pine apple) may either be chopped, sliced, shredded, peeled, diced or sectioned according to the requirement. These operations are done mainly by hand in many small-scale industries. The dimensions of the finished product are determined by the end use identified for each produce item. Generally, chopping plate and knives are used to create the desired size and shape for finished products. Research has shown that using a knife of least wedge angle (least cutting angle) reduces physical damage to cut fruits and vegetables (Saravacos et al. 2002) and less stress was observed in the cells of produce cut with a sharp knife.

**Minimizing Quality Loss and Safety during Fresh-cut Processing Operation**

The quality and status of equipment used for peeling and cutting is critical in fresh-cut processing operations. Sharpest cutting tools will extend product shelf-life and enhance the surface finishing. Cutting tool with high wedge angle has been proven to cause excessive cell damage and bruising leading to poor quality. Severe peeling and cutting must be avoided due to physical changes of material. Pear slices cut with a freshly sharpened knife retained their visual quality longer than fruit cut with a dull hand slicer. Barry-Ryan et al. (2007) showed that slicing with a blunt blade enhanced the penetration of fresh-cut carrots by *Escherichia coli* and its subsequent survival during storage.

**Characteristics of Equipment Used for Cutting Operation**

Equipment used for cutting operation should be designed and constructed in such a way that it is easy to clean and maintain for minimizing the potential for microbial contamination of the fresh products. Design and operation of food cutting equipments have traditionally been based on adaptation of systems used for processing materials like metals. High grade stainless steel is the most important type of steel used in direct contact with food in constructing food process equipment. Most of food equipment, generally made with two types of stainless steel, they are; 1) AISI 304 and 2) AISI 316.

**Development of Equipment for Pineapple Processing**

In our study, 20 Kew varieties of pineapples were purchased from the market and their diameters were measured. The pineapples were then cut by a stainless steel knife and the thickness of the peel and diameter of central core were also measured (Table 1.). The values were then averaged out to determine the dimensions of peeler–cum-slicer, we planned to design.

**Table 1. Dimensions (cm) of manual peeler-*cum*-slicer**

| S.N. | Length | External diameter | Internal diameter | Thickness |
|---|---|---|---|---|
| 1 | 22.05 | 7.50 | 2.50 | 1.45 |
| 2 | 22.10 | 7.45 | 2.41 | 1.50 |
| 3 | 21.75 | 7.41 | 2.47 | 1.55 |
| 4 | 20.20 | 7.45 | 2.50 | 1.45 |
| 5 | 21.25 | 7.50 | 2.40 | 1.45 |
| 6 | 22.70 | 7.40 | 2.42 | 1.50 |
| 7 | 22.35 | 7.41 | 2.35 | 1.60 |
| 8 | 22.60 | 7.50 | 2.30 | 1.55 |
| 9 | 22.65 | 7.48 | 2.38 | 1.65 |
| 10 | 21.30 | 7.55 | 2.20 | 1.45 |
| 11 | 23.00 | 7.35 | 2.46 | 1.50 |
| 12 | 21.60 | 7.60 | 2.48 | 1.55 |
| 13 | 21.40 | 7.20 | 2.57 | 1.60 |
| 14 | 20.50 | 7.25 | 2.60 | 1.55 |
| 15 | 22.75 | 7.30 | 2.20 | 1.40 |
| 16 | 21.80 | 7.45 | 2.40 | 1.45 |
| 17 | 22.30 | 7.25 | 2.35 | 1.50 |
| 18 | 20.90 | 7.30 | 2.44 | 1.40 |
| 19 | 21.85 | 7.45 | 2.35 | 1.45 |
| 20 | 21.00 | 7.15 | 2.35 | 1.50 |
| **Average** | **21.77** | **7.39** | **2.40** | **1.50** |

## Different Parts of Peeler-*cum*-Slicer

Our Peeler-*cum*-Slicer consists of a central shaft and slicing plate. For constructing a central shaft, stainless steel pipe of 22 cm length (taking round off figure of average length of pineapple (21.77 cm) for the design aspect) and 2.5 cm diameter was used. One end of the pipe was kept serrated for easy of penetration. A stainless steel plate of 7.0 cm diameter was used for preparing slicing plate which is attached to the pipe in helical manner. The open end of the ring is sharpened and has a gap of 1.5 cm between them forming a groove for cutting the pineapple rings (Fig.-1 A). A handle is attached to the peeler for easy twisting by hand. The Peeler-*cum*-Slicer is pressed against the pineapple and twisted to cut the peel by the side plate (Fig.-2 B & C). The pineapple core cut by the pipe end and inserted inside the pipe as the peeler rotated forward and finally removed from the pipe. The capacity, peeling efficiency and wastage percentage were determined and compared with that of traditional punches used for removal of peel and core from pineapple.

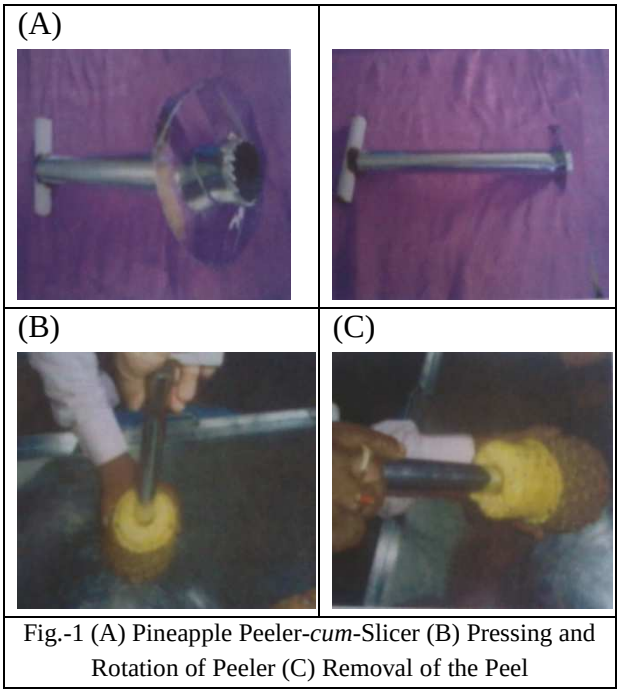


Fig.-1 (A) Pineapple Peeler-*cum*-Slicer (B) Pressing and Rotation of Peeler (C) Removal of the Peel

## Testing of Pineapple Peeler-*cum*-Slicer

The diameter of pineapples (Kew variety) was found to be varying from 7.15 to 7.6 cm and core diameter varying from 2.2 to 2.6 cm (Table 1.). Average values of diameter of whole pineapple and core were recorded as 7.39 and 2.4 cm, respectively (Table 1.). Therefore, taking nearest round figure to these averages, the designed slicing plate diameter was decided to be 7.0 cm and core diameter of slicing plate to be 2.5 cm. Accordingly, the peeler cum slicer was developed and tested for peeling and slicing of pineapple. Once the slicer penetrates into the whole fruits (cut from both ends), it cuts and opens the internal core and external peel in its forward movement at a time. It removes the core and produces pineapple

rings of uniform thickness & diameter in a single motion. The hand operated peeler cum slicer works satisfactorily. Twenty numbers of pineapple fruits can be easily peeled and sliced by skilled worker in one hour by using the developed device as compared to 10 numbers in case of punchers. The peeling efficiency of the peeler cum slicer was also more (97.2 %) with less wastage percentage (5.3%). The slices obtained were of uniform thickness of 15 mm causing uniform osmo-dehydration and drying subsequently. In case of manual cutting and punching, the slice thickness was not uniform. Moreover, the peeling and slicing operations are done simultaneously in the designed peeler cum slicer, thus, increasing its capacity. The peels, slices and cores of pineapple cut in peeler-cum-slicer are shown (Fig.-2).

Fig.-2 Peels, Slices and Cores of the Pineapple

**Conclusion**

The designed peeler cum slicer described in this article is very efficient, time saving, easy to operate and economical for the farmers. It can produce slicing plates of diameter 7 cm and core 2.5 cm, respectively with peeling efficiency as high as 97.2% and wastage as low as 5.3%. Twenty pineapples can easily be sliced only in 1 hour which indicates that it is very much time saving compared to traditional peeling and slicing.

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