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Processing and Handling of Tropical Fresh-cut Fruits

1. Huge size
2. High price particularly early in the season
3. Difficulties in cutting
4. Risk in obtaining poor quality pulp
5. Weight reduction for transportation and avoiding plant quarantine
6. Overcome waste disposable problems at the importer ends.

The needs for tropical fruits to be marketed in fresh-cut/ready to eat is greater as compared to the temperate fruits.

JACKFRUIT

Unique for its size with outer blunt spinel skin.

Depending on fruit size, there may be as many as 50 to 100 edible bulbs embedded in a single fruit interspersed between thin bands of fibers-epidermal layers.

Durian

The fruit is distinctive for its large size, unique odor, and formidable thorn-covered husk. Flesh - creamy-yellow to saffron color depending on the species.

The pulp soften, turns slimy and deteriorates rapidly, resulting in off-flavours and astringent odour being produced.

Pineapple

Pineapple is one of the popular fruits served in fresh-cut form world wide.

At ambient temperature and without protective treatments, cut pineapple turns slimy and deteriorates rapidly, resulting in the development of off flavours and odours within a day.

Fresh cut products are prepared and marketed without an effective microbial killing control steps.

New unforeseen food safety issues have emerged as major concerns in the fresh-cut processing industry of perishable produce leads to the requirements of special handling during processing, transportation and storage at the market outlets.
The protective layers has been removed. *Creates the opportunity for the contamination and spoilage by pathogenic organism.

Accelerates rate of respiration
*Causing mechanical damage
*Disrupts cell membranes
*Exposed fruit to microbial contamination
*Mechanical shock to tissue
*Alter gas diffusion

Presentation:
Approaches for processing and handing of fresh-cut jackfruit, durian and pineapple for local and export markets.

**Issues involved in maintaining both quality and safety during market distribution.

HANDLING OPERATIONS

Fruit maturity
Selection of the optimum fruit maturity for fresh-cut processing is essential:
To provide the best combination of eating quality and postharvest life.
Maturity at cutting will determine the optimum temperature for storage.
However, maturity requirement varies depending on fruit types.

R&D

• Basic research
• Intensive research – upscaling
• Simulation studies and actual export trials by different modes of transportation

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Depending on the variety, jackfruit mature about 180 to 270 days after flowering. Matured fruit will show the following sign:
- Fruit colour changes from green to pale green.
- A dull, hollow sound is produced when the fruit is tapped by the finger.
- Fruit spinel become well developed and wide spaced.
- The last leaf of the peduncle yellows.
- An aromatic odour develops.

Fresh-cut processing to matured fruits

Matured fruit pulp durian remain hard after cutting. Thus fresh-cut processing only been conducted to the ripe fruits.
For good eating quality, Josapine pineapple should achieve index 3-4 (20% of the eyes are yellowish orange).

Ripening/Precooling

Ensure of even fruit ripening prior to cutting
Facilitate isolating the fruitlets & less condensation to the stored product

Processing & Handling Operations

The first device facilitating the cutting process while the second tool is used to assist in exposing the edible bulb upward, the edible bulbs loosen, which helps the operator to speed up the isolating process.

The devices are very effective as it reduces mechanical injuries to the edible bulbs. Furthermore, it also speeds up the overall cutting and isolating the edible bulbs during the minimal processing operations.
MALAYSIAN AGRICULTURAL RESEARCH AND DEVELOPMENT INSTITUTE [Horticulture Research Centre]

Fig 2: Effect of pre frozen treatment and packing system to the fresh-cut durian stored at different retail outlets (Hong Kong) & control samples stored at MARDI (Malaysia) - 2014

Effect of prefrozen time and packaging on total soluble solid of chilled durian

Fig 2: Effect of pre frozen treatment and packing system to the fresh-cut durian stored at different retail outlets (Hong Kong) & control samples stored at MARDI (Malaysia) - 2014
Pre-treatments reduce microbial spoilage, excessive tissue softening and browning are needed for quality improvement of fresh-cut pineapple.

The cut pieces need to be immersed in the pre-treatment solution at the final stage of the handling operations.

*Flesh firmness of the cut pineapple can be maintained by using calcium salts (Latifah et al., 1999)  
*Oxidative browning can be overcome by using ascorbic acid (Latifah et al., 2000).  
*The used of citric acid appeared to be beneficial for lowering the microbial growth during storage of fresh-cut pineapple at 10°C (Latifah et al., 2011). *The use of citric acid had also reduced the activity of polyphenol oxidase as observed during storage at 10°C (Nur Azlin et al., 2011).
Fig. 3: Changes in the VRBA (Violet Red Bile Agar) of the fresh-cut pineapple treated with different concentration of citric acid during storage at 10 and 2 °C.

MAP packing system
Modified atmosphere packaging (MAP) by using seal on (a) or shrink wrapping (b) packing system suitable to maintain the freshness of fresh-cut fruit (2-3 weeks at 2 °C, one week at 10 °C and two days at 25 °C).

Quality & Safety
1. Physical changes (wt loss, colour)
2. Physiological (respiration & enzymes activity)
3. Microbial growth (mould & yeast, coliform)
Measuring the respiration rate

Evaluation of colour - L, a & b

Quality evaluation of fresh cut durian – Hong Kong 2014

Microbial counts

Must be low & within acceptable limit based on the Malaysian Food Regulation

Fig 4: Total plate count of fresh-cut durian packed using seal pack (200g) and shrink wrap (400g), at different pre frozen treatment (1, 5 & 3 wks), stored at different retail outlets in Hong Kong. Control samples stored at MARDI (Malaysia).

Signs of deterioration in fresh cuts produce

- Bruised - packaging too tight/rough handling
- Wilting - excessive drying/water loss
- Mushiness - excessive tissue softening
- Development of off colour - enzymatic browning
- Undesirable odour/fermented aroma - accumulation of ethanol
Export trials before technology transfer for commercialization

To evaluate effectiveness of handling operations at all stages:
- farm, product preparation
- product distribution
- product quality at the importer ends

Present export market of Malaysian fruits are to countries which do not impose stringent SPS measures

- Importing countries include: Hong Kong, Singapore, Brunei, Indonesia, Middle East (Saudi Arabia, UAE), EU Countries

Many developed countries impose stringent phytosanitary requirements for import of fresh fruits (e.g. Australia, Japan, USA, New Zealand, China, Taiwan)

- SPS measures are imposed against quarantine pests
- Procedures (rule making process for market access approval are lengthy eq:
  USA: 3 – 4 years,
  Australia: 3 - 5 years

<table>
<thead>
<tr>
<th>Fruit Type</th>
<th>Quarantine Pest</th>
<th>Market Access</th>
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</thead>
<tbody>
<tr>
<td>Papaya</td>
<td>Fruit fly</td>
<td>China, US, NZ, Korea</td>
</tr>
<tr>
<td>Pineapple</td>
<td>Mealy bug</td>
<td>US, China</td>
</tr>
<tr>
<td>Rambutan</td>
<td>Mealy bug, Fruit fly</td>
<td>US, Korea, Japan,</td>
</tr>
<tr>
<td>Jackfruit</td>
<td>Mealybug, fruit fly</td>
<td>Australia, US, China, Taiwan</td>
</tr>
<tr>
<td>Starfruit</td>
<td>Fruit fly</td>
<td>US, EU, Canada, Korea, China, China</td>
</tr>
</tbody>
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Quarantine Treatment Requirement

<table>
<thead>
<tr>
<th>Quarantine treatment</th>
<th>Fruit Type (Whole)</th>
<th>Importing country</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fumigation</td>
<td>Pineapple, Jackfruit</td>
<td>Australia, China</td>
</tr>
<tr>
<td>Vapour heat</td>
<td>Papaya, mango</td>
<td>Australia, Japan</td>
</tr>
<tr>
<td>Hot water</td>
<td>Papaya</td>
<td>China</td>
</tr>
<tr>
<td>Quick freezing</td>
<td>Durian</td>
<td>Australia, China</td>
</tr>
<tr>
<td>Cold treatment</td>
<td>Carambola</td>
<td>China</td>
</tr>
<tr>
<td>Irradiation</td>
<td>Papaya, mango, rambutan, pineapple</td>
<td>USA</td>
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Fumigation On going R&D activities

- Evaluate effective quarantine treatments to the whole fruits
- Problems encountered - affect physical, chemical, physiological attributes and overall acceptance (taste & texture).
- Example jackfruit - blackening of the skin, uneven ripening, reduction in the fruit sweetness.

Market access - MP fruits

Australia  
China  
New Zealand  
Taiwan

Australia & New Zealand (ok)
Australia (ok)

FRESH-CUT FRUITS
- Facing various challenges due to the nature of the product itself.

PRODUCT PROMOTIONS

Fresh-cut durian - Sydney 2013
Fresh-cut durian Hong Kong - 2014

Fresh-cut processing allows each fruits to be carefully examined right to the fruit centre.
Thus fresh-cut processing is been accepted as tool for a quarantine treatment to enhance market access.
TV programmes

LOCAL EVENTS/ ROAD SHOWS

ASIA FRUIT LOGISTICA 2014- HONG KONG

INSTORE PROMOTION- SWEDEN (APRIL 2015)

Milano 2015 (Milan, Italy)
Program : presentation/video/poster/leaflets

Seed 4- Malaysian Pavilion (7-13/7/2015)

Demo- how to cut the jackfruit and isolate the fruitlets

Product testing
Consumer demand for convenience and added value means that fresh-cut products will play a significant role in the fruit industry in the future.

A great challenge to deliver the prime quality products with extended shelf life to the consumers especially for export markets.

In order to achieve highest quality and longest shelf life, suitable PROCESSING & PACKAGING technology should be employed.

As for today, technology on fresh-cut processing developed by MARDI from research and development activities became a breakthrough innovation, first for the world markets as proven through the series of successful export trials and commercialization activities thereafter.

However, the issues of safety for the fresh-cut must be emphasis seriously since even a minor mistake could lead to disaster and the demise of an emerging industry.

Acknowledgements

The authors would like to acknowledge Ministry of Agriculture and Agro based Industries (MOA) and Malaysian Agricultural Research and Development Institute (MARDI) for the financial supports. Also to all Postharvest Staffs involved direct or indirectly during the R&D activities. Sincere thanks also to all our collaborators involve in the project local and abroad during the export trials.