Author: Cristina Serra Meya
Date: 27/06/17

Stability and Safety of Fresh-cut Fruits

Universitat Autònoma de Barcelona

1. Objectives

- Studying the microbiota of fresh-cut fruits and the risks associated with their consumption.
- Describing the processing of fresh-cut fruits and its effects on stability and safety.
- Analysing and comparing the different preservation techniques to extend the shelf-life of fresh-cut fruits.

2. Definition of fresh-cut products

The International Fresh-cut Produce Association defines fresh-cut products as fruits or vegetables that have been peeled or cut into a 100% usable product, which are packaged to offer consumers high nutrition, convenience and flavour, whilst still maintaining freshness.

3. Microbiota and bacterial pathogens of fresh-cut fruits

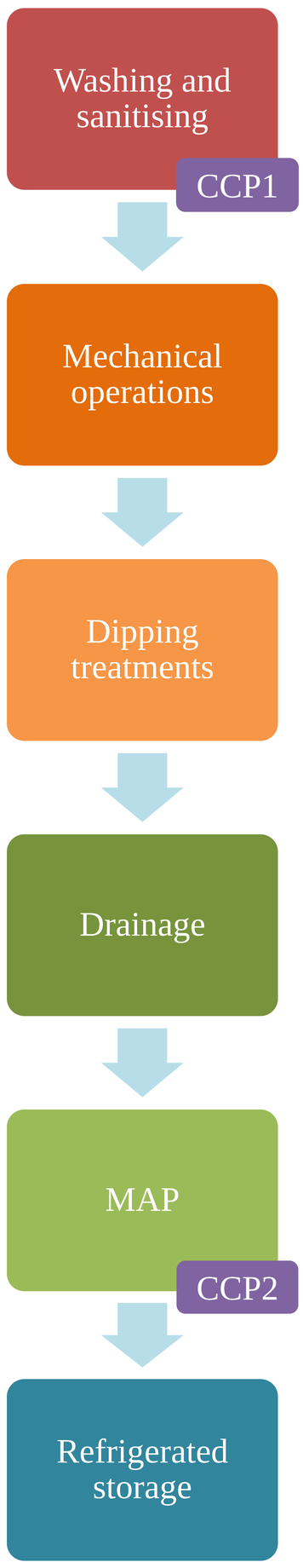
Due to processing, the microbiota of fruits, composed mainly of fungi and yeast, is replaced by bacteria. Examples of alimentary toxiinfeccions associated with the consumption of fruits are listed in *Table 1*.

Table 1. Alimentary toxiinfeccions associated with the consumption of fruits in United States (USA) and Europe (UE) (2008-2012).

Bacteria	Year	Fruit	Loca-tion	Origen	Cases	Hospi-talized /dead
Salmonella litchfield	2008	Cantaloupes	USA	Honduras	15	16/0
S. newport	2011	Watermelons	UE	Brazil	63	14/3
S. panama	2011	Papayas	USA	Guatemala	20	3/0
S. *agona*	2011	Cantaloupes	USA	Mexico	106	10/0
Listeria monocyto-genes	2012	Cantaloupes	USA	Colorado	147	143/33
S. typhimu-rium i *S. newport*	2012	Cantaloupes	USA	Indiana	261	94/3
S. braen-derup	2012	Mangoes	USA	Mexico	127	33/0

Sources: CDC 2008, Byrne et al. 2014, CDC 2011a, CDC 2011b, CDC 2012a, CDC 2012b and CDC 2012c.

4. Processing of fresh-cut fruits



Washing and sanitizing consist of an initial rinse of potable water for the removal of pesticide residues and plant debris, followed by a dipping in chlorinated water with sodium hypochlorite (NaOCl) to reduce microbial loads on the fruit surface.

Mechanical operations including peeling, coring, cutting and/or slicing, facilitate microbial spoilage, enzymatic browning, softening, development of off-flavour and off-odour, and an increase in the respiration rate and ethylene production.

In dipping treatments antibrowning, antisoftening and/or antimicrobial agents are added. Ascorbic acid or it combined with citric acid is added to prevent enzymatic browning and calcium chloride ($CaCl_2$) to prevent softening.

Drainage is necessary to eliminate the excess of water that can promote growth of microorganisms. It is also important to avoid cross-contamination throughout the processing line between steps of the same process.

Modified atmosphere packaging (MAP) extends the shelf-life of fresh-cut fruits and consists in altering the atmosphere inside the package using an active or passive system. Edible coatings are an alternative or complementary to MAP.

Temperature control is important to achieve effective MAP system. Refrigeration temperatures (≤ 4°C) are essential to prevent maturation of fresh-cut fruits and microbial deterioration.

Figure 1. Flux diagram of fresh-cut fruit processing.

5. Food security of fresh-cut fruits

The compliance of good production practices and the implementation of Hazard Analysis Critical Control Points (HACCP) are essential for safety. Washing and sanitizing, and MAP are Critical Control Points (CCP) of the processing of fresh-cut fruits.

6. Conclusions

- The processing of fresh-cut fruits renders highly perishable products because it induces physiologic and biochemical disorders, and enhances microbiological spoilage, resulting in color, texture and flavor degeneration.
- MAP is not an effective controller, as a single preservative strategy, for pathogenic bacteria growth. Hurdle technology is a combination of different preservation techniques to achieve a synergic effect and may be the most effective approach to guarantee food safety.
- Research on fresh-cut fruits is still needed to obtain microbiologically safe products, keep their nutritional value and their original sensory quality. The application of edible coating to deliver active substances is one of the major advances reached so far to increase the shelf-life of fresh-cut produce. A new generation on edible coatings is being currently developed, allowing the incorporation and/or controlled release of active compounds using nanotechnological solutions, where functional ingredients and antimicrobials agents can be incorporated by nanoencapsulation.