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POSTHARVEST AND MINIMAL PROCESSING TECHNOLOGIES APPLICABLE TO ORGANIC FRUITS

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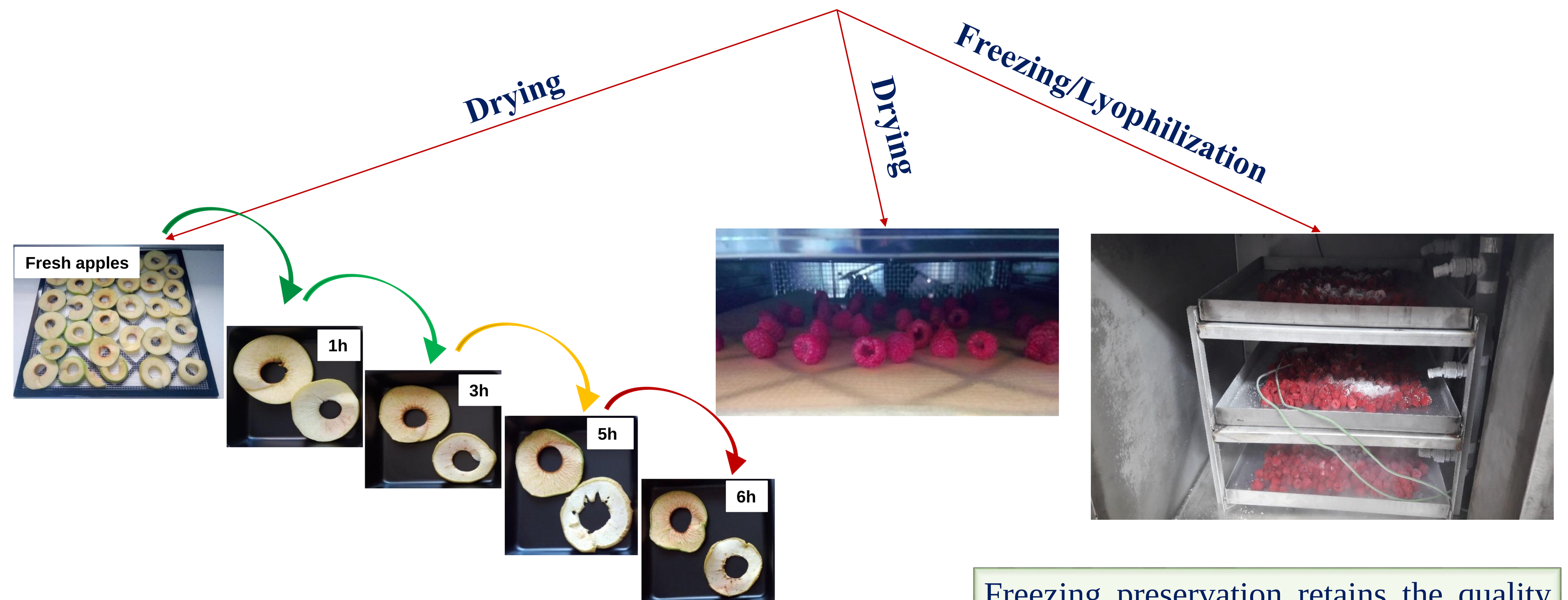
Abstract

In last years the demand of fruits obtained in organic conditions has rapidly increased among consumers due to their acceptance that are nutritional, high quality, sustainably produced and friendly with the environment. Compared to conventional system, in the organic agriculture occur additional challenges in processing and preserving of fruits, because many preservatives and additives are not allowed (EC, 2008). Different postharvest technologies are designed to extend shelf life of fruit, fresh or processed, as a component that adds value to organic production and reduces losses in its peak periods. Furthermore, information on the impact of storage and processing technologies on the main quality parameters that specifically characterize organic food is limited (Crichton, 2017; Kahl, 2014). In this way this paper has as main objective to debate the actual knowledge on some postharvest technologies such as modified atmosphere packaging (MAP), storage under controlled atmosphere conditions (CA) and some minimal processing technologies like drying and freezing, technologies that can be applicable to organic fruits. Because these technologies are simple to be approached and managed, have became increasingly applied in fruits storage, providing increased shelf life for low costs. Otherwise, drying prevents both food spoilage and decay, allowing foods to be stored at room temperature for long periods with minimal deterioration and simplify the handling of the products through their reduction of weight and packaging volume (Moscetti et al., 2018). Considering all these advantages, they might prove to be one of the most dominant preservation techniques in the twenty-first century (Kirtil and Oztop, 2016).

Keywords: postharvest, shelf life, organic, fruits, technology

Worldwide, roughly one-third of fresh fruit and vegetables are lost because their quality has dropped below an acceptance limit and, in light of the increasing world population, this is totally unacceptable (Jedermann et al., 2015). Organic standards include a well-defined set of practices and a list of technical tools that are permitted by regulation (Ceglie et al., 2016). Most synthetic inputs are prohibited for both producing and handling agricultural and processed food products labeled as organic. Postharvest handling of organic commodities raises a number of issues both in terms of allowed procedures and of their effectiveness in maintaining quality of the produce (ILIĆ et all., 2018).

MINIMAL PROCESSING TECHNOLOGIES APPLICABLE FOR ORGANIC FRUIT



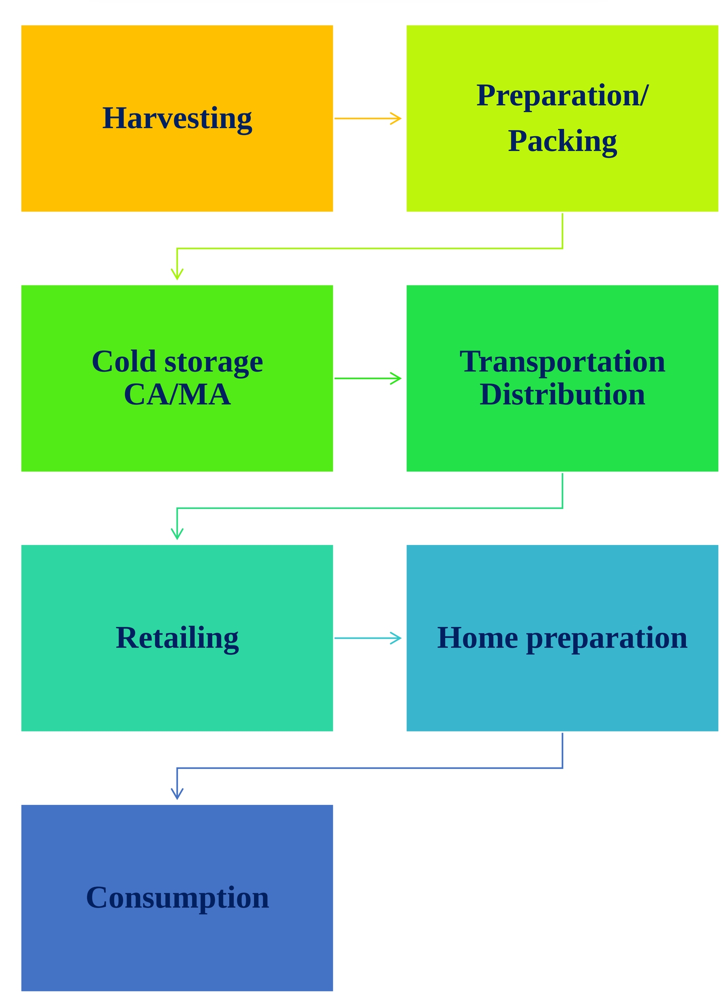
Among postharvest operations, drying is one of the oldest, typical, effective and viable preservation processes throughout the world. It consists of three main interlinked steps that can be summarized as: (1) product formulation or treatment selection, (2) dehydration process and (3) quality and properties assessment (Aghbashlo et al., 2015). Drying prevents both food spoilage and decay through moisture removal due to simultaneous heat and mass transfer, allowing foods to be stored for long periods with minimal deterioration occurring (Nadian et al., 2015). Moreover, drying is particularly effective in enabling storability of food at room temperature and in simplifying the handling of the products through their reduction of weight and packaging volume (Liu et al., 2016).

Freezing preservation retains the quality of agricultural products over long storage periods. As a method of long-term preservation for fruits and vegetables, freezing is generally regarded as superior to canning and dehydration, with respect to retention in sensory attributes and nutritive properties (FAO). The safety and nutrition quality of frozen products are emphasized when high quality raw materials are used, good manufacturing practices are employed in the preservation process, and the products are kept in accordance with specified temperatures.

Optimal postharvest treatments for fresh fruits seek to slow down the physiological processes of senescence and maturation, to reduce/inhibit development of physiological disorders, and to minimize the risk of microbial growth and contamination. Storage diseases are responsible for substantial postharvest losses. Currently, the most important means of maintaining quality and prolonging the shelf life of organic produce is low temperature storage, as organic producers have no access to chemical programs, unlike the growers and storage operators of regular crops (ILIĆ et all., 2018).

POSTHARVEST TECHNOLOGIES APPLICABLE FOR ORGANIC FRUIT

Typical post harvest operations



Modified atmosphere (MA) storage refers to a change in the atmosphere around the product, typically a reduction of oxygen levels from 21% in ambient air, and an increase in carbon dioxide from 0.03% in ambient air. MA can be developed passively by product respiration or by active means where desired gas composition is injected into a bag, often in a package (MA packaging; MAP). Subsequently, the atmosphere in the bags is then a function of factors such as product type and temperature that affect respiration rates, permeability of the plastic film to oxygen and carbon dioxide diffusion, and the ratio of product to the bag.

Controlled atmosphere (CA) is a subset of MA, but as the name suggests, the atmosphere around the product is controlled. The control is by use of equipment such as nitrogen generators and carbon dioxide scrubbers. Each commodity has a safe range of oxygen and carbon dioxide based on the tolerance of each to low oxygen and high carbon dioxide, and these levels can be affected by growing region and by variety. Reducing oxygen concentrations around fruits slows down respiration (carbon dioxide production) rates until a point known as the anaerobic compensation point is reached, when carbon dioxide production is dramatically increase. This is associated with fermentation and injurious accumulations of acetaldehyde and ethanol that result in damage.

Summary of recommended CA or MA conditions during transport and/or storage of selected fruits , adapted after Watkins and Nock, 2012

Commodity	Temperature (°C)	CA	
		%O_2	%CO_2
Apple	0-5	1-2	0-3
Apricot	0-5	2-3	2-3
Blackberry	0-5	5-10	10-20
Blueberry	0-5	2-5	12-20
Cherry, sweet	0-5	3-10	10-15
Cranberry	2-5	1-2	0-5
Grape	0-5	2-5	1-3
Kiwifruit	0-5	1-2	3-5
Nectarine	0-5	1-2	3-5
Pear, European	0-5	1-3	0-3
Plum	0-5	1-2	0-5
Raspberry	0-5	5-10	15-20
Strawberry	0-5	5-10	15-20

Maximum storage life (days) in normal atmosphere storage (NA) and controlled atmosphere (CA), adapted after El-Ramady, 2015

Commodity	Maximum storage time (days)	
	Normal atmosphere storage	Controlled atmosphere
Apple (various)	200	300
Banana	14-21	42-56
Cherry (sweet)	14.21	28-35
Lime (Persian)	14-28	Juice loss, peel thickens
Mango (Haden)	14-21	No benefit
Papaya (Solo)	12	12+ (slight benefit)
Pear (Bartlett)	60	100
Strawberry	7	7+ (off-flavor)

Conclusions

- according to the Commission Regulation (EC) No 889/2008 all of these minimal processing technologies are applicable for organic fruit
- the most suitable methods for preserving organic fruits should be studied in order to preserve bioactive compounds, depending on the species and variety

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