Vol. 5 Issue- 4, December 2024 (e-ISSN: 2582-8223)

JUST AGRICULTURE
multidisciplinary e-Newsletter

Advances in Food Processing and Preservation in Horticultural Crops

Ashutosh Kumar Singh
Assistant Professor, Sangam University Bhilwara, Rjajasthan

ARTICLE ID: 01

Introduction:

An essential component of the global food business, the fruit processing sector has changed significantly over time, particularly in India, where it accounts for a sizeable amount of the country's agricultural economy. In order to increase the shelf life of fruits and make them available all year round, this sector uses a variety of processes, including cleaning, sorting, grading, cutting, drying, and packing. Rich agro-biodiversity and a variety of climates in India produce a vast array of fruits that are turned into juices, concentrates, jams, dried fruits, and other goods with added value. This industry's development is intimately related to both shifting customer demands and technological breakthroughs. Fruit processing was crude at first, mostly concentrating on fermentation and sun-drying. However, the sector witnessed the rise of increasingly advanced methods as the demand for processed fruits grew due to urbanization and population growth (Ugwuanyi & Okpara, 2019). Fruit processing and packaging in India have a long history that dates back to manual, traditional processes. The first methods of preserving fruit were fermentation, smoking, and sun-drying.

Irradiation

One of the most significant ionizing radiations that is generating attention in food preservation is electromagnetic waves, particularly gamma-rays. Food is often gamma-irradiated by being exposed to gamma rays from a cobalt-60 or cesium-137 source within hermetically sealed, shielded chambers. Gamma rays, which are emitted by the irradiation source, can enter microorganisms and structures. The microbial DNA is damaged in this process, rendering the cell inactive. Foods that have been exposed to radiation do not turn radioactive and are regarded as safe.

Ultraviolet radiation

UV radiation is increasingly being used in the fruit and vegetable preservation chain for its primary purpose of inactivating microorganisms to reduce product contamination. There are several wavelength categories for UV radiation, including UV-A (315 to 400 nm), UV-B (280 to 315 nm), and UV-C (100–280 nm). UV radiation is a form of electromagnetic radiation with a wavelength of 100–400 nm. Because nonionizing UV-C radiation has the ability to sanitize and may be applied to both whole and little processed items, it is the most popular method for decontaminating fruits and vegetables.

Cooling

The primary method for storing and preserving perishable goods is cooling since it lowers ethylene production and respiratory activity while also effectively lowering the microbial burden of the treated goods. As a result, effective cooling systems must be operational at all basic processing steps.

Thermal treatments

High-temperature processes known as thermal or heat treatments are frequently employed in place of chemicals to control infections. Heat is an excellent method for food preservation, particularly minimally processed foods, because it works well against both surface-level and deeply ingrained microbes to preserve food. Heat, on the other hand, can harm fruits and vegetables' physical and nutritional qualities by lowering their levels of thermosensitive vitamins and damaging the product, which emphasizes how crucial it is to utilize the technique correctly.

High pressure

Using pressures of roughly 1000 to 7000 atm (100 to 700 MPa), high pressure is a new nontraditional and nonthermal technology that keeps small molecules like vitamins and aromatic compounds intact while removing the microbial load and delaying the enzymatic reactions that cause food to spoil. Water serves as a pressure transfer medium during high-pressure treatment, which is carried out in a closed chamber (pressure vessel). Foods that are liquid or solid and already packaged are subjected to pressures between 400 and 700 MPa using the hydrostatic technique, which applies pressure uniformly on all sides.

Modified atmosphere packaging

For over 90 years, MAP has been used extensively postharvest to maintain the quality of minimally processed and fresh goods and increase their shelf life under optimal processing and storage conditions. Promoting an atmosphere with low O2 and high CO2 levels is one of the primary goals of atmospheric modification in order to reduce respiration, metabolism, oxidative stress, tissue senescence, and ethylene formation. Both passive and active methods may be used to create a changed environment, with passive MAP being more cost-effective than active MAP. The permeability of the polymer film utilized, the packed product's metabolism, and the storage circumstances all influence the dynamic process that makes up the gaseous equilibrium inside packaging with a passive modified environment. In order to provide a desirable starting combination of oxygen, carbon dioxide, and nitrogen (N2), packaging with an active modified environment relies on either replacing or displacing gases within the container or using gas scavengers or absorbers.

Controlled atmosphere storage

Through the process of CAS, the concentrations of ambient gases are strictly regulated by adjusting the gas levels as needed. Therefore, a hermetically sealed storage space with O2 and CO2 analyzers as well as gas removal and injection systems is necessary for the regulated atmosphere. Using an adsorption by pressure oscillation gas separation system that absorbs O2 through a membrane with a filtering system, this approach lowers the O2 pressure by infusing N2, while increasing the CO2 pressure by injecting this gas. In this instance, the packing or storage chamber is depressurized to liberate the bound O2, while the N2-rich gas is exported. In other words, the hollow fiber membrane system works by heating compressed air before forcing it through hollow fibers composed of semipermeable membranes. This allows CO2, O2, and N2 to be continually removed from the storage space in a selected manner.

Vacuum packaging

One kind of MAP is the vacuum packing of MPFVs. The advantages of vacuum packing over conventional packaging include a gas barrier, the avoidance of product discolouration, and microbiological growth and oxidation-reduction.

Edible films and coatings

Because of its advantages over synthetic films—such as their biocompatibility, biodegradability, and adaptability to chemical and biological changes—interest in EFs and ECs has grown recently. Polymeric substances known as edible polymers are ones that don't negatively impact the health of people, animals, or microbes when ingested. They have a good ability to form films and have good oxygen and aroma barrier properties. They may be made from polysaccharides, proteins, and lipids, or from a mixture of polysaccharides and proteins.

Active packaging

Active packaging serves the dual purposes of extending the shelf life, safety, and quality of food products as well as enhancing their sensory qualities and protecting them from the elements. Antimicrobial films, oxygen- and moisture-regulating packaging, and taste and odor absorbers and/or releasers are the most popular forms of active packaging.

Smart packaging

Smart packaging is regarded as a contemporary packaging technology that can keep an eye on environmental and/or food conditions and communicate that information to the customer. Sensors and indicators based on chemical, enzymatic, immunochemical, or mechanical responses make up these packaging systems. They may be broadly divided into two categories: indicator packages and data carrier packages, both of which give customers information about items. Packages bearing a radio frequency identification (RFID) tag or bar code are considered data carriers. Together with other technologies that support product quality, RFID tags may eventually be used for the secure storage of minimally processed baby-leaf vegetables.

Conclusion:

Thermal treatments, irradiation, high pressure, UV light, and electrolyzed water are the primary physical preservation techniques that may be applied in the food sector. Technical developments in the creation of packaging that engages with customers and goods, encouraging positive changes, are a new frontier in the MPFV industry in addition to the physical techniques mentioned. For any raw material that will undergo little processing, the best approach must be carefully chosen, taking into consideration aspects such as customer acceptance, economic feasibility of each technology, and sustainability. Thus, each physical preservation method's primary benefits, drawbacks, and uses were compiled.

References:

Adedeji, A. A., Ekramirad, N., Rady, A., Hamidisepehr, A., Donohue, K. D., Villanueva, R. T., ... & Li, M. (2020). Non-destructive technologies for detecting insect infestation in fruits and vegetables under postharvest conditions: A critical review. Foods, 9(7), 927.

I. Ahmed, H. Lin, L. Zou, A.L. Brody, Z.X. Li, I.M. Qazi (2017). A comprehensive review on the application of active packaging technologies to muscle foods Food Control, 82 (2017), pp. 163-178, Temiz, A., & Ayhan, D. K. (2017). Enzymes in minimally processed fruits and vegetables. Minimally processed refrigerated fruits and vegetables, 93-151.