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Emerging non-thermal technologies in food preservation

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Food is deemed unsafe if it constitutes either a physical, chemical or biological hazard to the consumer. Ensuring the production of microbiologically safe products is a necessity for every food or beverage operation. But for some products, traditional heat-dependent pathogen-reduction methods such as thermization, pasteurization and in-container sterilization can adversely affect taste, nutritional value and appearance. New trends in food processing, product development and quality assurance are promoting intense research on alternative methods for food preservation. Most foods are thermally preserved by subjecting the products to boiling (or even higher) temperatures for a few seconds to several minutes. These high-energy treatments usually diminish cooking flavors, and cause loss of vitamins, essential nutrients, and food flavors in the product. To overcome or minimize such disadvantages, the concept of non thermal treatments was born.

Non-thermal processing is a value-added technique with diverse benefits, including increased shelf life and improved taste through the preservation of amino acids. One major use for non-thermal processing is as an alternative sterilization method for processors that want to maintain a product's taste and appearance without sacrificing food safety.

Non-thermal food processing/preservation methods interest food and food packaging scientists, manufacturers and consumers because they exert a minimal impact on the nutritional and sensory properties of foods, and extend shelf life by inhibiting or killing microorganisms. They are also considered to be more energy efficient and to preserve better quality attributes than conventional thermally based processes. Non-thermal processes also meet industry needs by offering value-added products, new market opportunities and added safety margins. This study reviewed non-thermal processing technologies currently available or developmental for the inactivation of microorganisms and thus microbiological shelf life in foods, and to identify packaging interactions that might result. Developments in non-thermal technologies have been advanced by both industry and academia in an attempt to meet the challenge of producing safe processed food of a high quality. There is no doubt that high quality food can be produced through the use of non-thermal processing technologies.

Manufacturers seeking microbiological sterilization through non-thermal means may choose from a number of methods including high-pressure, ultraviolet, irradiation, pulsed light and ultrasonic processing depending on sterilization requirements, product type, line configuration and other considerations.

High Pressure Processing (HPP) is a way to process foods without using heat. It has the potential to produce high-quality, fresh, nutritious, safe-to-eat foods without using chemical preservatives. High-pressure processing (HPP), meanwhile, is a suitable replacement for heat sterilization for many products with high levels of water activity.

Irradiation treatment exposes food products to a controlled amount of radiant energy in the form of gamma rays, electron beams or X-ray waves to kill harmful bacteria such as *E. coli* O157:H7, Campylobacter, Listeria and Salmonella. The technology can also control insects and parasites, reduce spoilage and inhibit ripening and sprouting.

PEF (Pulsed electric field) processing offers high quality fresh-like liquid foods with excellent flavor, nutritional value, and shelf-life. Since it preserves foods without using heat, foods treated this way retain their fresh aroma, taste, and appearance. Application of PEF technology has been successfully demonstrated for the pasteurization of foods such as juices, milk, yogurt, soups,

and liquid eggs.

Ultrafiltration is employed to preferentially pass an ultrafiltration (UF) permeate containing flavor and aroma components while retaining spoilage microorganisms in a UF retentate. The UF retentate is then treated to inactivate a sufficient number of spoilage microorganisms to inhibit spoilage of the juice under storage conditions.

The application of non-thermal technologies to foods is more likely to result in stress or injury than to cause the death of microorganisms. An abundance of injured microbial cells in non-thermally-processed food may create new challenges to food processors and regulatory agencies. The detection of low levels of pathogens in food is a difficult task particularly when cells are injured. The safety of the non-thermally processed product is compromised if food and storage conditions favour the recovery of injured cells. Stress of pathogens by non-thermal technologies is a concern and the adaptation of cells to such stress may constitute a microbial hazard. Non-thermal technologies therefore introduce new challenges, and thus warrant the implementation of new safety strategies

Conclusion : Novel preservation technologies are an interesting option to produce high quality food products with an extended shelf life. The starting point of an evaluation of the possibilities of novel technologies will therefore be the effect on quality combined with the safety of the product after processing. Interest in non-thermal food processing technologies has increased appreciably in the past decade. Current limitations of emerging non-thermal technologies can be overcome when they are combined with conventional preservation methods. Especially using higher or lower temperatures than room temperature is an interesting option to increase the effectiveness of novel technologies.

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