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NOVEL TECHNOLOGY – PULSED LIGHT TREATMENT IN FOOD SECTOR

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ABSTRACT

Numerous technologies for food processing and preservation were created in response to growing consumer awareness, the desire for minimally processed foods, and environmental concerns. Customers' demands for less processed foods and growing market competition have compelled processors to use more sophisticated non-thermal techniques as consumers' concerns about the environmental impact and quality of processed foods they eat have grown. The purpose of this minireview is to outline the basic principle, benefits, drawbacks, and implementation of PL in the food industry.

1. INTRODUCTION

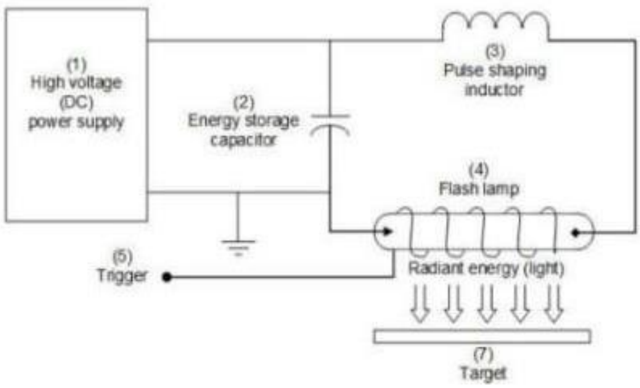
Among other pertinent non-thermal technologies including high-pressure processing, pulsed electric fields, irradiation, and high electrical voltage discharges, pulsed light (PL) is a novel non-thermal method for food preservation. While the Food and Drug Administration authorised the use of pulsed light technology in foods in 1996 (Stoica M et al., 2013). The term "pulsed light" first appeared in 1980. A new, environmentally friendly, nonthermal technique called pulsed light (PL) uses brief bursts of light to kill microbes, sanitise food surfaces, and prolong shelf life (Heinz V et al., 2001). The electromagnetic spectrum of this non-thermal method is comparable to that of sunlight, with wavelengths ranging from ultraviolet to nearinfrared (Barbosa-Canovas et al., 2000)

Since continuous UV light per second is well known for its germicidal action, this technique is mostly used today in the food packaging industry for decontamination purposes (Kowalkski, 2009). By using concentrated light energy, PL technique exposes the sample to powerful light pulses. Typically, one to twenty flashes per second are utilised for food processing (Abida J et al., 2014). As a result, this technology is mostly utilised for surface equipment, packaging materials, and food surfaces for sterilisation or decontamination (Ringus DL and Moraru CI, 2013, Hierro E et al.,2012).

Explaining the idea, contributing elements, benefits, drawbacks, and implementation of PL in the food industry is the aim of this minireview.

2. PRINCIPLE

As part of the PL process, electric pulses are converted to light pulses by the switches that transfer pulsed electrical energy to the xenon gas-containing flash lamp. Upon passing through the gas, the electrical current linked to the pulse electrical energy imparts its energy to the xenon atoms. Consequently, the xenon atoms become excited and leap to higher energy levels. They then return to their lower energy states, releasing energy in the form of light pulses to the atmosphere. These light pulses prolong the shelf life of food, destroy microbes, and disinfect food surfaces.



Functional diagram of a high – intensity pulsed – light system (Adapted from Xenon Corp., 2005)

3. ELEMENTS INFLUENCING PL

The effectiveness of a PL treatment is influenced by three main aspects. They're

1. The kind of matrices handled, including food, surfaces in touch with food, or solid/liquid culture media,
2. The level of microbiological contamination and its quality,
3. The parameters of the process, like the light intensity and the treatment chamber's geometry.

MATRIX TYPES

The diameter of the body (or fluid) and transparency/opacity can be used to explain this. It is also important to consider that fresh meat has the added benefit of being devoid of microorganisms in the inner layers of intact muscle tissue (Gill and Penney, 1977). higher penetration depth and higher decontamination, especially in layers outside the matrix surface, are made possible by optimizing for low reflection, high absorption, and transmission coefficients (Palmieri and Cacace, 2005; Gomez-Lopez et al., 2007).

BENEFITS OF PL

Compared to mercury vapour lamps used in ultraviolet (UV) treatment, xenon-flash lamps used in pulsed light treatment are more environmentally friendly (Gomez-Lopez et al., 2007). Although the brief burst of light is 20,000 times brighter than sunshine, the quality and nutrient content are preserved because there is no heat effect (Brown, 2008).

DRAWBACKS OF PL

Certain microorganism strains, such as Listeria monocytogenes, may be resistant to the pulsed light treatment (Caminiti et al., 2011a). Although pulsed white light is not strictly nonthermal, its brief duration means that the thermal action has little negative impact on the nutrients (Ohlsson and Bengtsson, 2002). This method of microorganism decontamination is limited in its use because it works best on the surface of solid meals and liquid foods.

4. APPLICATIONS

One of the new non-thermal processing techniques for inactivating germs is pulsed light technology, which may one day be used as a substitute for pasteurizing food items. It has been suggested that pulsed electric fields are used to pasteurize liquid products like milk, yoghurt, and liquid eggs. Given the effectiveness of pulsed light on a variety of food products, numerous investigations are being carried out to commercialize the process. In addition to ensuring food products are microbiologically safe, other factors of relevance include flavour freshness, economic viability, longer shelf life, and enhancement of functional and textural qualities Mohamed (ME, Eissa AHA, 2015, Abida J et al., 2014) Fresh cut strawberries were of higher quality when paired with a stabilizing dip. The fungal contamination was also postponed and the straw berries' hue remained maintained.

Antioxidant activity and total phenolics remained unchanged under treatment, while vitamin C and anthocyanins decreased by 20– 30%. Maintaining fruit characteristics was most effectively accomplished with doses of 4 and 8 J/cm2. (Avalos-Llano kr et al., 2018)

5. CONCLUSION

PL is a new, rapid, non-thermal, environmentally friendly technology that effectively reduces microbes and inactivates surfaces and foods. Without altering the original structure of the treated foods, PL can be integrated into current processing lines and may be utilized in the food sector for safety reasons.

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