

Application of cold plasma in food processing

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A plasma is a partly ionised gas that contains ions and electrons as well as excited radicals and molecules. After the solid, liquid and gaseous phases, plasma is frequently referred to as the fourth state of matter. It can be of two types namely thermal plasma and non-thermal plasma. By electrifying or employing electromagnetic waves on gas at low pressure, cold plasma can be created. Stationary, DC (direct current) or AC (alternating current) electrical fields can produce cold plasma discharges. Applications of cold plasma in food processing involve the impact of cold plasma on the microbial population. Plasma ions and cell interactions are primarily responsible for the effect of plasma therapy on microbial cells. In novel non-thermal food processing technology, inactivation of microorganisms is done by cold plasma replacing chlorine in the washing process to sanitise fruits, vegetables and leafy greens. Studies have revealed that cold plasma is effective against mycotoxins and moulds as it targets multiple sites of a fungal cell, thus resulting in cell death due to loss of structure and function. Plasma treatment also exhibits chemical breakdown of mycotoxins thus resulting in the degradation products that are less toxic. Cold plasma treatment exhibits a positive influence on physico-chemical and antioxidant properties of several food products during storage, and their qualitative characteristics, such as soluble solid concentration, titratable acidity, dry matter and colour changes. Also, it can inactivate endogenous enzymes, such as polyphenol oxidase and peroxidase that cause the browning reaction of fruits and vegetables. Cold plasma treatment has been utilised in the surface modification of seeds which has resulted in a 50% increase in seed germination rate. Plasma etching on starch granules has increased the energy and facilitated the hydrophilicity of starch granules, thus acting as an alternative in modifying the properties of starch. In addition, plasma technology has a lot of potential in the food packaging industry as it improves adhesion, polymerisation and printability. It is also found to be effective in sanitising equipment in order to inactivate foodborne germs from fresh produce and packing materials. In the recent age, cold plasma has emerged as a unique technology for decontamination of food products and decontamination of packaging materials, surface modification of seeds to improve their properties, prevention of enzymatic browning in fruits and vegetables and wastewater treatment. It is gaining popularity due to its distinct properties, such as treatment at low or ambient temperatures for a short length of time, which aids in the preservation of food products, thus maintaining their integrity and quality, thereby extending the shelf-life.

Keywords: Non-thermal plasma, Food security, Food safety, Plasma etching, Pasteurisation, Food processing, Cold plasma

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