Cold Atmospheric Plasma Processing for Quality Retention and Shelf-life Extension of Plant Foods

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Cold atmospheric plasma (CAP) has emerged as a potential alternative to traditional methods for food decontamination, minimally affecting food quality. Depending on food treated, CAP could be applied on foods directly through activated gas flow, semi-directly through reactive oxygen and nitrogen species (RONs) diffusion on the surface of the food or indirectly through food immersion in plasma activated water (PAW) in which RONs are generated.
?n a closed rectangular reactor, Surface Dielectric Barrier Discharge was applied (2-3 kV, 32-42 kHz, 5-20 min) for fresh strawberries (Fragaria Ananassa cv ELSANTA), fresh pistachio (cv. Aegina) and a ready-to-eat (RTE) rocket salad. A CAP jet (0.5-3 kV, 80-85 kHz, 0-30 min, Helium 0.5-5 L/min) was used to i) activate water (PAW) to be used as a RTE salad washing agent and ii) to directly process freshly squeezed orange juice. For all products, their main quality parameters were evaluated immediately after processing or/and during their shelf-life.
SDBD led to total viable count (TVC) inactivation in strawberries by ~1.0 logCFU/g, resulting in lower microbial load during storage compared to Control. The quality was enhanced as derived from the increased trends in antioxidant activity and ascorbic acid, while the activity of pectin-methylesterase (PME) remained lower compared to Control. Correspondingly, TVC load of pistachio was reduced by ~0.7 logCFU/g after CAP, resulting also in no aflatoxin detection, in contrary to Control. A TVC reduction of ~0.5-1 log CFU/g was observed for the RTE rocket, depending on the processing conditions. Processing time of 10 min was considered as the optimum, for a satisfactory TVC reduction and quality retention. Direct CAP resulted in orange juices PME inactivation, with increased rates at higher voltages, leading to residual activities ranging from 15-35%. Regarding CAP indirect use, increase of the immersion time of RTE rocket in PAW led to TVC decrease (by up to 2.0 logCFU/g) and partial degradation of the color and texture. Immersion time of 10 min was considered as the optimum for a satisfactory reduction of microbial load and quality retention.
The results obtained validate the efficiency of CAP in producing plant foods of high quality and longer shelf-life.