

Title Use of neutral electrolysed water (EW) for quality maintenance and shelf-life extension of minimally processed lettuce

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Abstract

Experiments were conducted to determine the effectiveness of different treatments based on the use of neutral electrolysed water (EW) on fresh-cut lettuce. EW was diluted to obtain different free chlorine concentrations (120, 60 and 12 ppm) and to compare with standard washing treatment of 120 ppm chlorine solution. Shelf-life quality and safety markers were studied at the beginning and at the end of the 7-day-storage at 4 °C. The use of EW decreased the respiration rate of the samples which might be related with the observed reduction in microbial spoilage. The use of EW also increased the activity of a browning-related enzyme (polyphenoloxydase) although sensory results showed all samples as acceptable at the end of the 7 day-storage. Perhaps longer storage time might increase the risk to browning development in the samples treated with EW. The highest EW concentration (120 ppm free chlorine) was the most effective treatment in reducing sample microbial load; however this treatment also affected the final produce with effects such as loss of turgor, plasmolysis and a reduction in mineral content.

Results suggest an intermediate EW concentration with 60 ppm free chlorine could be an alternative to 120 ppm chlorine (from sodium hypochlorite) for sanitizing fresh-cut vegetables, reducing to half the amount of chlorine used and maintaining the antimicrobial effectiveness and without differences affecting the quality. However further studies will be necessary in order to observe the effect of the oxidising capacity of EW on other quality and safety markers as pathogens and nutritional content.

Industrial relevance

Chlorine solutions have been widely used to sanitise fruit and vegetables in the fresh-cut industry. However, the association of chlorine with the possible formation of carcinogenic chlorinated compounds in water has called into question the use of chlorine in food processing. The efficacy in controlling the microbial load and browning of samples treated with electrolysed water shows it as a promising decontaminant agent for fresh-cut lettuce. Due to the high oxidising potential of the EW quality requirements must be balanced to obtain the optimal treatment conditions keeping satisfying safety levels. The use of EW-60 showed similar safety and quality (browning) results as the use of chlorine or double EW concentration (EW-120). However the treatment

EW-120 affected negatively the textural properties. The study suggests the use of EW-60 as an alternative to sodium hypochlorite solution with 120 ppm available chlorine, obtaining similar safety and quality results and reducing the amount of chlorine needed. Further investigations in the effect of EW on lettuce, such as those on pathogens or nutritional markers (e.g. carotenoids and vitamin C) are recommended in order to explore this alternative that might reduce the increasingly concerning use of chlorine to decontaminate this type of product.