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COLD ATMOSFERIC PLASMA TREATMENT ON FRESH-CUT MELON: EFFECTS ON SAFETY AND QUALITY

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INTRODUCTION

Non-thermal technologies as Cold Atmospheric Plasma (CAP) can be used to decontaminate and stabilize food products by inactivating spoilage bacteria and fungi. CAP is generated by applying electrical discharges at ambient temperature to gasses, with generation of different reactive species, i.e. reactive oxygen and nitrogen species (RONS), which cause bacterial damages and inactivation (Fernández & Thompson, 2012).

The consumption of ready-to-eat fruits has strongly increased along with the frequency of outbreaks and cases of foodborne illness connected to raw contaminated foods. Non thermal treatments such as CAP can be used to reduce such risks.

In this study, the effects of CAP treatments on the naturally occurring microbiota and the pH and °Brix values of fresh-cut melons were examined.

MATERIAL AND METHOD

Fresh-cut melon samples were exposed to CAP treatments with two different gas regimes, one with high levels of ozone (**O_3**) and the other one with high levels of nitrogen oxides (**NOx**) for 0, 2, 5, 10, and 20 min. The same treatments were also applied to samples deliberately contaminated with *Escherichia coli* 555, *Salmonella* enteritidis 155 or *Listeria monocytogenes* 56LY (inoculum rates ~4 Log CFU/g). The reduction of spoilage and pathogenic species was assessed and compared to the control samples through two independent repetitions. Also pH, °Brix and colour were evaluated after each treatment.

CONCLUSION

- As for microbial inactivation, nitrogen oxides (NOx) treatments showed the greatest efficacy against both natural microbiota and pathogens.
- Despite exposure to reactive species, the fruit matrix revealed no differences in colour and °Brix values, except for pH.
- In conclusion, CAP technology can be a valuable ally for extending the shelf life of ready-to-eat products.

DISCUSSION

No differences were detected for colour and °Brix values also after the longest CAP treatment times. On the other hand, the **pH** was significantly decreased, in particular after the **NOx** treatments (Fig. 1).

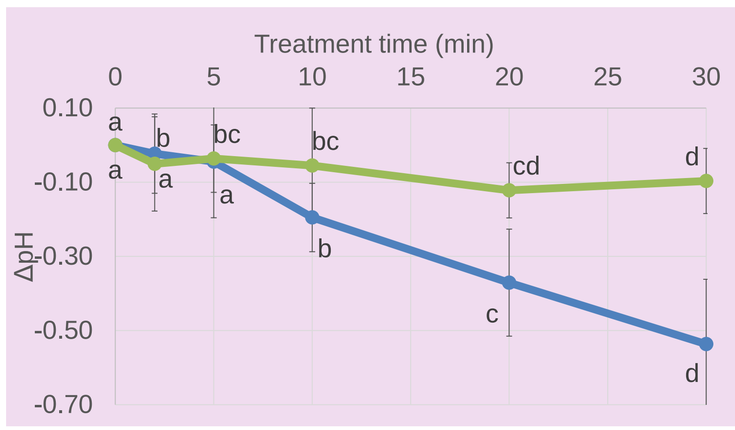

Fig. 1. ΔpH after CAP treatments under NOx and O_3 regimes ($p<0.05$).

As for the effects on natural microbiota, plasma exposure resulted in microbial reductions up to approximately 1-1.5 Log CFU/g. Different sensitivities were found for the various microbial groups. In particular, after 20 and 30 min of **NOx** treatment, total mesophilic bacteria exhibited statistically significant decreases (Fig. 2A). On the other hand, a 1 Log reduction was detected for lactobacilli already after 10 min of **NOx** treatment (Fig. 2B). Moreover, when compared to the 30 min **O_3** treatment, the 30 min **NOx** resulted in a greater cell load reduction for lactobacilli (~0.5 vs ~1.1 Log CFU/g). As for the pathogens, significant reductions of 1.5 - 2 Log CFU/g were observed after 20 and 30 min **NOx** treatments, and approx. 1 - 1.5 Log CFU/g for **O_3** treatment regardless the tested pathogen (Fig.3).

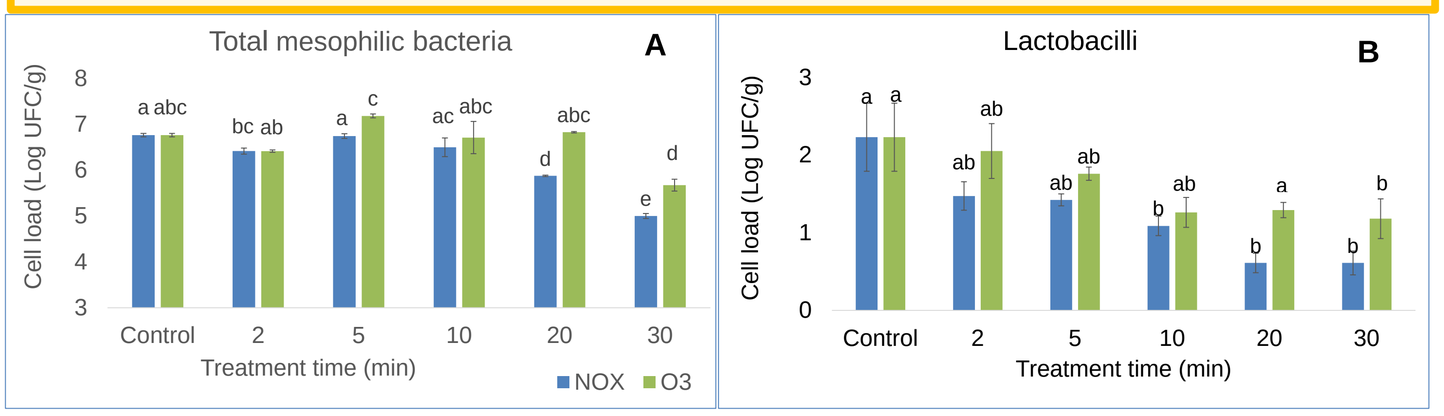

Fig. 2. Counts of total mesophilic bacteria (A) and lactobacilli (B) after CAP treatments under NOx and O_3 regimes ($p<0.05$ among treatment times within the same regime).

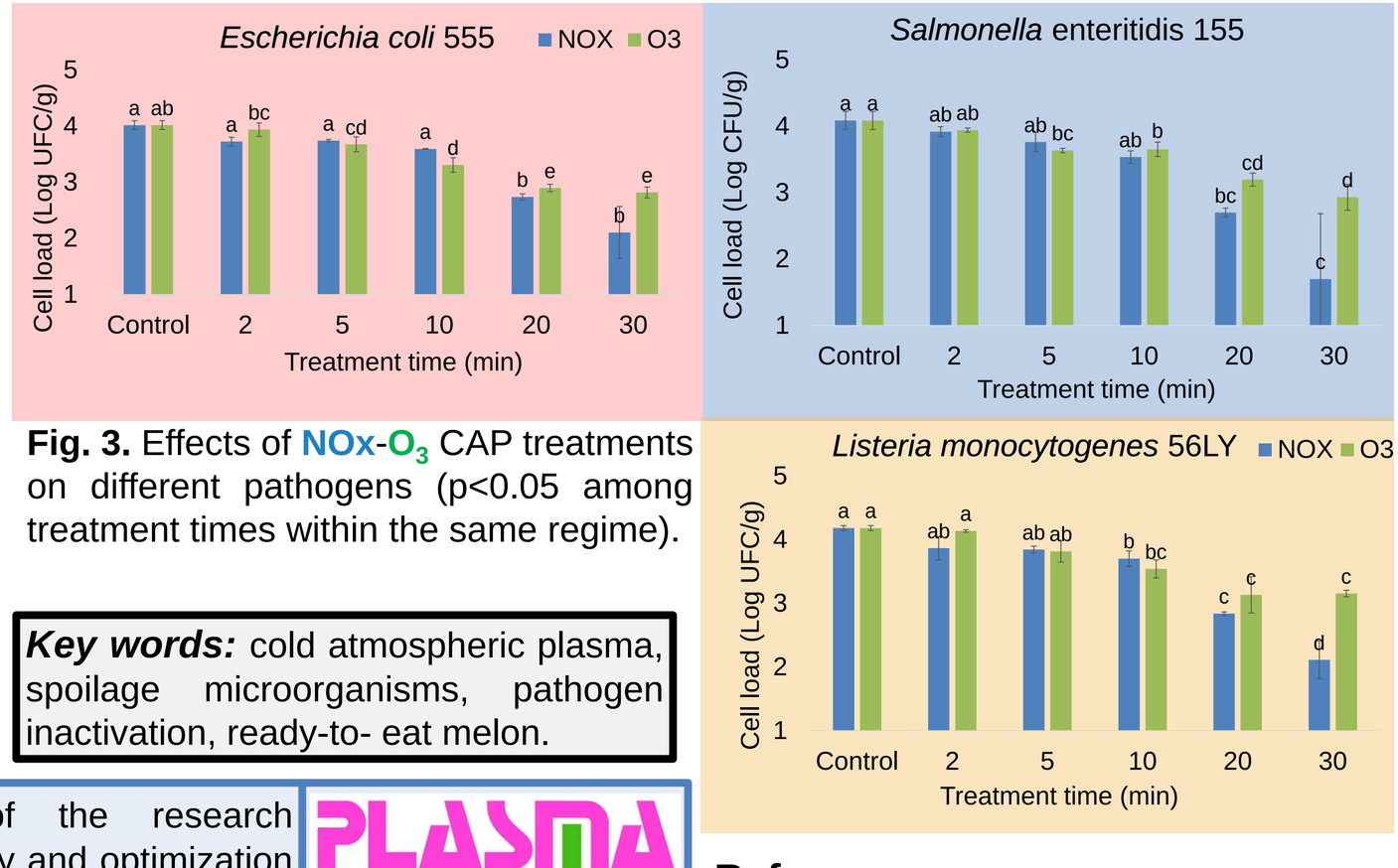

Fig. 3. Effects of **NOx**-**O_3** CAP treatments on different pathogens ($p<0.05$ among treatment times within the same regime).

Key words: cold atmospheric plasma, spoilage microorganisms, pathogen inactivation, ready-to- eat melon.

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Reference: Fernández, A., & Thompson, A. (2012). The inactivation of Salmonella by cold atmospheric plasma treatment. *Food Research International*, *45*(2), 678-684.