EFFECT OF UV-C IRRADIATION AND LACTIC ACID APPLICATION ON THE INACTIVATION OF INOCULATED *LISTERIA MONOCYTOGENES* IN VACUUM-PACKAGED BEEF MEAT

C. Rufo[1], G. Brugnini[1*], S. Rodríguez-Cortés[1], and Inocuidad, Alimentos y Nutrición,

[1]*Instituto Polo Tecnológico, Facultad de Química, Universidad de la Republica, Montevideo, Uruguay*,

*caterinarufod@gmail.com

I. OBJECTIVES

The combined effect of lactic acid application and short-wave ultraviolet radiation (UV-C) radiation to reduce *Listeria monocytogenes* on beef meat cuts was evaluated, using a *L. monocytogenes* strain isolated from a local abattoir.

II. MATERIALS AND METHODS

The effect of different doses of UV-C and lactic acid application on *L. monocytogenes* survival was analyzed using a two-factor central composite design with 5 central points using Design-Expert® (Stat-Ease Inc., Minneapolis, MN). The independent variables were lactic acid concentration (from 0% to 5% m/v) and UV-C dose (from 0 to 802 mWs/cm^2), and the dependent variables were *L. monocytogenes* counts and meat color. For this purpose, 21 pieces of 10 g each were cut from a freshly produced vacuum-packed eye round and inoculated with 5.8 log CFU of the *L. monocytogenes* strain LM100A1. After 10 min, inoculated meat pieces were sprayed with 1.5 mL of lactic acid according to the experimental design and vacuum packaged using Cryovac T7335B bags. Then, variable doses of UV-C were applied to the vacuum-packaged meat according to the design. A second set of samples was prepared for color measurements. After treatments, samples were homogenized in sterile bags with 90 mL of Butterfield buffer, and appropriate dilutions were plated by duplicate on agar Palcam and incubated at 37°C for 48 h. *L. monocytogenes* colonies were counted and expressed as CFU/g. Results were log transformed for analysis and expressed as log reduction of LM100A1 per gram of meat compared to the sample with no treatments. Twenty-four hours post treatments, color measurements were performed 30 min after opening the packages, with a colorimeter (Chromium Minolta C10 meter from Konica Minolta) in the color space L^*, a^*, b^*. Color measurements were expressed as Chroma value, calculated as $C^* = \sqrt{(a^2 + b^2)}$.

III. RESULTS

Analysis of variance indicated that a quadratic model was the best-fitted model ($P < 0.0001$) that explains the reduction of LM100A1 in meat with a 95% confidence due to lactic acid and UV-C treatments. Furthermore, the similarity between R^2 and the adjusted R^2 value showed the adequacy of the model to predict the corresponding response ($R^2 = 0.9038$, adjusted $R^2 = 0.8718$). Both application of lactic acid and UV-C in the ranges studied have a positive effect on reduction of LM100A1, while lactic acid application is the only significant variable ($P < 0.05$) that affected meat color. According to the model obtained, the maximum reduction on LM100A1 without significant ($P < 0.05$) color changes compared to control was 1.55 ± 0.41 log CFU/g with the application of 2.6% m/v of lactic acid and a UV-C dose of 802 mWs/cm^2. The optimal conditions were experimentally verified, and a reduction of 1.24 log CFU/g was obtained. This value is within the 95% confidence interval of the predicted outcome by the model.

IV. CONCLUSION

The combined application of lactic acid and UV-C radiation under the tested conditions proved to be a useful strategy to reduce contamination against *L. monocytogenes* in meat without significantly affecting meat color. Studies are underway to evaluate the efficacy of combined application of lactic acid and UV-C against other meat pathogens.

Keywords: beef meat, lactic acid, *Listeria monocytogenes*, predictive model, UV-C irradiation