O6.7 Development of anti-biofilm coatings applied by Non-Equilibrium Atmospheric Plasma on stainless steel

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Biofilm mediated microbial persistence of pathogenic and spoilage bacteria is a serious problem in food industries. Due to the difficulty of removing mature biofilms, great efforts are being made to find new strategies to prevent bacterial adherence to surfaces, the first step for biofilm development.

In this study, the anti-biofilm activity was achieved through the modification of surface physicochemical properties. Coatings with different chemical nature and morphology were applied by Non-Equilibrium Atmospheric Plasma on stainless steel (SS) AISI 316, the SS most commonly used in food industry equipment. For the coating optimization, the anti-biofilm activity was assessed for Listeria monocytogenes CECT911 and Escherichia coli CECT515. The biofilm formation was measured after an incubation of 24 hours at 37ºC by crystal violet staining, including always a parallel control of uncoated SS.

The best anti-biofilm activities were obtained for L. monocytogenes with two coatings consisting of a base coating of (3-Aminopropyl)triethoxysilane and a functional coating of tetraethyl orthosilicate (APTES + TEOS) or acrylic acid (APTES + AA), achieving relative biofilm productions (when compared with those for the uncoated SS) of 55% and 26%, respectively. The anti-biofilm activity of these coatings was assessed for three strains of L. monocytogenes, two of them isolated from a meat industry, after incubation under the following conditions: 24h/37ºC, 48h/37ºC, 6 days/12ºC and 12 days/12ºC. A morphological and chemical characterization of the coatings was also performed by atomic force microscopy (AFM), scanning electron microscopy (SEM), X-ray photoelectron spectroscopy (XPS) and water contact angle (WCA) measurement.

The results obtained showed an increased anti-biofilm activity at 12ºC, a temperature commonly found in food processing environments, for the three Listeria strains on the coating APTES + AA. The coatings with the highest anti-biofilm activity showed lower surface roughness (AFM, SEM analysis) and higher hydrophilicity (WCA measurements). This suggests that the formation of a hydration layer prevents the adherence of the bacteria, an effect that seems to be enhanced by low temperature conditions, when the wettability of