

PREVENTION OF BIOFILM FORMATION ON FOOD CONTACT SURFACES BY NANOSCALE PLASMA COATINGS

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ABSTRACT

Microbial biofilm formation can lead to a series of important safety problems in food industry because, once formed, the microbial cells are much harder to remove compared to plankton cells and can lead to circulating contamination. Low temperature plasma coating technology is a novel and effective method to prevent biofilm formation.

In this study, the anti-biofilm activity of trimethylsilane (TMS) coating and its adapted recipe TMS+O₂ (1:4) on common food contact surfaces: stainless steel (SS) and high-density polyethylene (HDPE) against biofilms formed by common foodborne pathogens.

Results showed that TMS coating on SS succeed in reducing the cell count of *S. aureus* cocktail biofilm by around 2 log CFU/wafer (99% reduction) and *L. monocytogenes* by 1.5 log CFU/wafer. TMS+O₂ coating on SS also achieved a 2 log CFU/wafer reduction in *S. aureus* cocktail biofilm, and a 2 log CFU/wafer reduction in *L. monocytogenes* cocktail biofilm. On HDPE surfaces, TMS+O₂ decreased the cell count by around 1 log CFU/wafer in *E. coli* O157:H7 cocktail. For different single strains, their efficacy fluctuated and sometimes the total count even increased slightly. However, most of the time, these coatings worked well or at least did not increase the cell count in our study. Factors like bacterial strain (*E. coli* O157:H7, *S. aureus* or *L. monocytogenes*), coating surface (SS or HDPE), coating composition (TMS or TMS+O₂), as well as the medium (Tryptic Soy Broth (TSB) or Brain Heart Infusion (BHI)) can all affect the anti-biofilm efficacy of this TMS coating. The mechanism was thought to be related to surface energy and surface contact angle change which can help reduce the initial attachment of bacterial. No change of relative gene expression level was detected which confirmed the theory that this method would not lead to resistant strains.