Cold Plasma: Sterilizing Dairy Biofilms

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Bacterial biofilms in dairy processing equipment are difficult to sterilize and contribute to spoilage and significant economic losses. Cold plasma, which generates ions and free radicals capable of destroying bacterial cells and DNA, was investigated as a potential sterilization method for dairy biofilms formed by Lactobacillus. Biofilms were grown by submerging glass rods in a yogurt culture for a standardized period. The biofilm-coated rods were then exposed to a cold plasma jet enhanced with vapors of ethanol, acetone, water, and hydrogen peroxide to increase free radical production. To assess sterilization effectiveness, treated and untreated control rods were inoculated into sterile milk solution. Bacterial growth was monitored using a colorimeter and bromocresol purple pH indicator, with culture time serving as the primary measure of sterilization success. Cold plasma-treated biofilms produced significantly longer culture times compared to untreated controls (6.1 hours vs. 9.3 hours), indicating substantial inhibition of bacterial activity. However, some treated samples still produced measurable lactic acid and color changes in the pH indicator, suggesting incomplete sterilization in a subset of trials. These results demonstrate that cold plasma is an effective but not yet complete sterilization method for dairy biofilms, and further optimization of plasma exposure time and vapor concentration may improve outcomes. This technology shows promise as a chemical-free sterilization approach for the dairy processing industry.

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