

Plasma Surface Modification for Anti-Bacterial Materials Development

Abstract

Bacterial adhesion and biofilm formation on material surfaces are major challenges in biomedical devices, healthcare systems, and industrial applications. Surface properties such as wettability, roughness, and surface chemistry strongly influence bacterial attachment. Plasma surface modification is an effective and environmentally friendly technique that can alter surface characteristics without affecting the bulk properties of materials.

The proposed project aims to study the effect of plasma surface modification on metallic and polymeric materials and to investigate its influence on bacterial adhesion behavior. Materials such as stainless steel and selected polymers will be subjected to low-temperature plasma treatment under different process conditions. The treated and untreated surfaces will then be characterized using techniques such as water contact angle measurement and scanning electron microscopy (SEM) to understand the changes in surface wettability and morphology induced by plasma exposure.

Following surface characterization, bacterial adhesion studies will be carried out using common bacterial strains such as *E. coli* or *S. aureus*. The adhesion behavior of bacteria on untreated and plasma-treated surfaces will be compared to evaluate the effectiveness of plasma modification in reducing bacterial attachment. The study will help establish a correlation between plasma-induced surface changes and antibacterial performance.

This two-month project will provide undergraduate students with hands-on exposure to plasma processing, surface characterization techniques, and basic antibacterial studies. The work is expected to help students understand the fundamentals of plasma-material interactions and their applications in antibacterial surface development.

Academic Project Requirements:

1) Required No. of student(s) for academic project: 1

2) Name of course with branch/discipline: B.Sc. Other

3) Academic Project duration:

(a) Total academic project duration: 8 Weeks

(b) Student's presence at IPR for academic project work: 4 Full working Days per week

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