Bacterial adhesion on the titanium and stainless-steel surfaces undergone two different treatment methods: polishing and ultrafast laser treatment

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ABSTRACT

Bacterial adhesion has become a significant problem in many industries causing billions of dollars for its complicated removal treatment and maintenance. In this study, metal surfaces undergone treatment with ultrafast laser with varies power. The microstructure produced on its original surfaces were expected to prevent the adhesion of *Escherichia coli* (*E. coli*) ATCC 8739 and *Staphylococcus aureus* (*S. aureus*) ATCC 6838. The laser treatment was performed at 380 fs pulse duration, 515 µm central wavelength and a repetition rate of 200 kHz. Stainless steel AISI 316L was treated with an average laser power of 0.04 W (SS-0.04) and 0.11 W (SS-0.11), while Grade 5 titanium alloy was tested with high laser power 0.11 W (T-0.11). The adhesion was observed after 16 hours and the number of adhering bacteria was counted per cm^2. The result achieved shows that, increasing the average laser power is leading to an enhanced *S. aureus* adhesion while *E. coli* adhesion is reduced which is due to the hydrophobicity interaction and difference in surface texture. Meanwhile, the laser treatment showed significant reduction of the bacterial adhesion on its surface compared to the polished surfaces. Thus, ultrafast laser texturing can be suggested as a promising method to reduce the bacterial adhesion, which reduced the adhesion of >80% for *E. coli* and >20% for *S. aureus*.

KEYWORDS:

Bacterial adhesion; Titanium and stainless-steel; Polishing and ultrafast laser treatment