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Bacterial cell numbers and community structures of seawater biofilms depend on the attachment substratum

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ABSTRACT

Seawater is increasingly being used as a source for various industrial applications. For such applications, biofilm growth creates various problems including but not limited to pipe biocorrosion. In this study, it is hypothesized that the material type is preferred by certain bacterial populations in the seawater to attach and establish biofilms. By comparing differences in the total cell counts and microbial communities attached to high-density polyethylene (HDPE), polycarbonate, stainless steel (SS316) and titanium, the appropriate material can be used to minimize biofilm growth. All four materials have hydrophilic surfaces, but polycarbonate exhibits higher surface roughness. There were no significant differences in the cell numbers attached to polycarbonate, HDPE and titanium. Instead, there were significantly fewer cells attached to SS316. However, there was a higher relative abundance of genera associated with opportunistic pathogens on SS316. Copy numbers of genes representing Desulfobacteraceae and Desulfobulbaceae, both of which are sulfate-reducing bacteria (SRB), were approximately 10-fold higher in biofilms sampled from SS316. The enrichment of SRB in the biofilm associated with SS316 indicates that this material may be prone to biocorrosion. This study highlights the need for industries to consider the choice of material used in seawater applications to minimize microbial-associated problems.

Keywords: Biofouling; Biocorrosion; Titanium; Stainless steel; Polyethylene; Polycarbonate; Sulfate-reducing bacteria

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