Abstract

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# Zinc-Based Additives for Biofouling and Mic Protection: Fabrication Method for Long-Term Efficacy

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## Abstract

Microbiologically influenced corrosion (MIC) and biofouling both begin with an initial layer of bacteria accumulating on a hard surface exposed to the natural environment. These bacteria quickly form a biofilm which becomes the feeding source for marine life fouling and the root of both of these highly damaging, expensive types of corrosion. Preventative methods for biofilm development is an ongoing field of study due to critical necessity in many industries including healthcare, aerospace, and oil and gas. Today, biofilm inhibitors for the oil and gas industry may include regular cleaning or scraping of the affected surface, electrochemical processes, or biocide injections which have a negative impact on the environment and provide only temporary relief from MIC. This constant need for MIC and fouling remediation creates a great demand and thus market potential for long-term, more environmentally conscious methods to mitigate and control biofilm development. This study investigates the incorporation of well-known biocidal materials as well as one commercial additive into the fabrication process of underwater structures and surfaces. High Density Polyethylene (HDPE) and fiber reinforced plastic (FRP) with antimicrobial additive were processed. Experiments were conducted per ASTM E2149-13a and F895 to evaluate antibacterial efficacy in the laboratory. Field tests were constructed per ASTM D3623 - 78a for material evaluation in offshore fouling conditions. The manufactured materials were tested against gram-positive and gram-negative bacteria, and fouling microorganisms to analyze the effectiveness of biofilm prevention. Results showed positive efficacy of biocidal additives incorporated through the fabrication process in all cases including copper, multiple forms of zinc, and titanium dioxide. The commercially available additive produced the largest zone of inhibition and highest reduction of colony forming units in dynamic flow conditions.

Fouling tests show that the incorporation of the additive into HDPE and FRP provides a surface protection and thus serves as an agent for material preservation. Results from this study demonstrate innovative and effective methods for surface protection from MIC and biofouling by incorporating antimicrobial additives into the structural matrix during the manufacturing process

## Biography

Paige Dodge is a Research Engineer for BTG Products. Buffalo Technology Group (BTG Products) was established to commercialize a novel antimicrobial technology developed at West Texas A&M University. The technology was first developed as a Department of Defense project to combat dangerous bacteria such as anthrax. After successfully completing the project, the BTG team began to develop alternative solutions to many commercial and consumer threats from SRB bacteria in oil pipelines to common household mold. BTG's mission is to produce highly effective products to fight against the many problems that arise from harmful microorganisms. Her work has resulted in three patents in the US.