

Research on Antimicrobial Corrosion-Resistant Coatings for Ship Ballast Tanks

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Abstract: The ballast tank of a ship is a compartment used to maintain the balance and stability of the vessel, ensuring it maintains a certain draft depth. It requires frequent ballasting and discharging of seawater, which is typically rich in microorganisms. The repeated inflow and outflow of water lead to sediment buildup at the bottom of the tank, creating a relatively stable environment that promotes microbial growth, thereby accelerating the corrosion of materials in the ballast tank due to microbial influence. By incorporating bactericidal quaternary ammonium salts (QAS) into the epoxy anticorrosion coating and adjusting their proportion in the resin, the coating achieves its bactericidal effect through the interaction between QAS and the cell membranes. By chemically bonding the quaternary ammonium salt to the polymer matrix in the coating, the loss of antimicrobial active ingredients can be effectively avoided. The antimicrobial coating tests conducted in the laboratory showed that the coating exhibited an inhibition rate of over 99% against typical Gram-positive bacteria *Staphylococcus aureus* and Gram-negative bacteria *Escherichia coli*. It also demonstrated an inhibition rate of over 99% against the typical anaerobic corrosion bacterium *Sulfate-Reducing Bacteria* (SRB). The introduction of QAS into the anticorrosion coating effectively resists microbial growth, thereby reducing the occurrence of microbial corrosion and mitigating corrosion issues in ballast tanks caused by microorganisms.

Keywords: Ballast tank, Microbial corrosion, Quaternary ammonium salts, Inhibition rate