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Inhibition performance of benzotriazole-based composite inhibitor against carbon steel corrosion in stone processing wastewater

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ABSTRACT

The cutting saw blade with diamond blade and carbon steel matrix is widely used in stone cutting because of its high strength, impact resistance and good thermal stability. However, the carbon steel matrix is easy to corrode in the circulating cooling water, which shortens its service life. In this study, a new highly efficient benzotriazole-based (BMN) composite inhibitor was synthesized and investigated against the corrosion of carbon steel in stone processing wastewater. The corrosion inhibition properties and mechanism of prepared BMN for carbon steel in real stone processing wastewater were evaluated and deduced using the experimental weight loss, electrochemical and surface morphology characterization techniques. Weight loss methods results showed that a high inhibition efficiency of 99.59% in stone processing wastewater was achieved at ambient temperature, with the stirring speed 200 rpm, the immersion time 7 d, and the BMN concentration is 50 mL·L^{-1}. Electrochemical impedance spectroscopy indicated that resistance from the surface films (R_2) and charge transfer resistance (R_3) were enhanced with increase in BMN concentration. Polarisation results revealed the BMN acted as an anodic inhibitor, owing to the addition of BMN resulted in the significant change of anodic Tafel slopes (β_a). Scanning electron microscopy results indicated BMN formed a protective film on the surface of carbon steel through adsorption. In short, the prepared BMN composite inhibitor exhibited superior anti-corrosion performance for saw blade corrosion in stone processing wastewater, which had great application potential in industries.

Keywords: Stone processing wastewater; Benzotriazole; Corrosion inhibitor; Electrochemical tests; Corrosion mechanism

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