
Comparative Study on the Corrosion Inhibition Efficiency of 2-Hydroxyethyl Trimethyl Ammonium Chloride (HETMAC) and 2-Hydroxyethyl Trimethyl Ammonium Acetate for 6082 Aluminum Alloy in Saline Environments

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Abstract

This study evaluates the effectiveness of two quaternary ammonium salts, i.e., 2-hydroxyethyl-trimethyl-ammonium chloride (HETMAC) and 2-hydroxyethyl-tri-methyl-ammonium acetate (HETMAA), as corrosion inhibitors for 6082 aluminium alloy exposed to a 3.5% NaCl solution. The performance of these inhibitors was assessed using potentiodynamic polarization and electrochemical impedance spectroscopy (EIS) techniques. Both HETMAC and HETMAA exhibited moderate corrosion inhibition of aluminium in saline solution, with their maximum efficiency observed at a 5 mM concentration. However, the data obtained from the Tafel extrapolation of the potentiodynamic curves clearly show a significant difference in the corrosion inhibition efficiency of the two quaternary ammonium salts (i.e., 31.35% for HETMAC and 70.51% for HETMAA). Both corrosion inhibitor act as mixed type inhibitors, HETMAA has dominance on anodic site and HETMAC has dominance on anodic site. The difference in the corrosion inhibition performance is due to the presence of acetate anion present in HETMAA compound compared to chlorine anion in HETMAC compound. EIS measurements revealed a notable increase in charge transfer resistance upon the addition of the inhibitors compare to blank solution, indicating the formation of a protective layer on the 6082 aluminium alloy surface. HETMAA enhances the corrosion resistance of 6082 aluminium alloy. These findings suggest that HETMAA is the preferred inhibitor for protection of aluminium 6082 in saline environment compared to HETMAC.

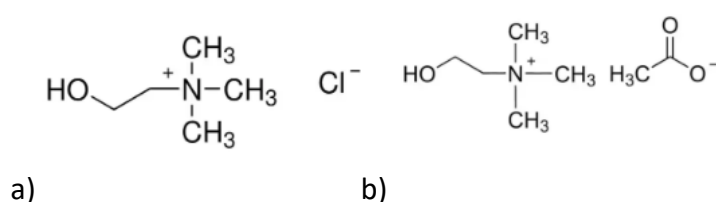


Figure 1: The chemical structures of: a) 2-hydroxyethyl-trimethyl-ammonium chloride (HETMAC) and b) 2-hydroxyethyl-tri-methyl-ammonium acetate (HETMAA).