Synthesis of Polymers Containing Residues of Biogenic Amino Acid Methionine, Methionine Sulfoxide and Methionine Sulfone and Their Application as Inhibitors of Mild Steel Corrosion

Mohammad Abu Jafar Mazumder

Chemistry Department, King Fahd University of Petroleum and Minerals, Dhahran 31261, Saudi Arabia

E-mail: jafar@kfupm.edu.sa

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Ethyl ester hydrochloride of L-methionine **I** was converted to its *N,N*-diallyl derivative **II** which upon treatment with HCl led to *N,N*-diallyl methionine ethyl ester hydrochloride **III**. Cationic monomer **III** underwent cyclopolymerization to give polymer sulfide **IV**, embedded with five-membered pyrrolidine rings, which upon oxidation in the presence of 1 and 2 equivalents of H₂O₂ afforded polymer sulfoxide **V** and polymer sulfone **VI**, respectively. The thermal stability, intrinsic viscosity and critical micelle concentrations of these polymers were determined. The inhibition efficiency obtained from gravimetric weight loss, were corroborated by the findings of potentiodynamic polarization and electrochemical impedance spectroscopy. The critical micelle concentration of the polymers **IV-VI** has been determined to be ≈ 6 ppm. At a concentration of ≈ 5.5 ppm in 1.0 M HCl, the polymers **IV-VI** imparted remarkable corrosion inhibition efficiency (IE) of 86, 87 and 83%, respectively; while in the presence of 22.8 ppm of polymer sulfoxide **V**, an IE of 97% was achieved. The potentiodynamic polarization and EIS studies suggested that the polymer chains form a protective layer and quarantine the metal surface from the corrosive environment. The XPS and SEM-EDX supported the adsorption and the film forming ability of the studied polymer compounds on the metal surface.

Keywords: Cyclopolymerization; Methionine sulfide; Methionine sulfoxide; Methionine sulfone; Mild steel; Corrosion inhibition.

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