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ECO-FRIENDLY CORROSION PROTECTION OF STAINLESS-STEEL GRADE 202 USING CHITOSAN-BASED FORMULATIONS

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Stainless steel (SS) Grade 202 possesses high corrosion resistance towards mild acidic environments, because of the interference caused by forming a passive film of chromium oxide on the surface of SS. Nevertheless, the corrosion stability of SS Grade 202 in certain acidic environments, especially under aggressive conditions is questionable. On the other hand, although the corrosion inhibitory action of certain species such as phosphate on SS Grade 202 has been well documented, the effect of various chemical constituents under moderate and aggressive acidic conditions has not been given due attention despite the wide use of SS Grade 202 in industrial applications. As such, variation of corrosion inhibition efficiency of SS Grade 202 at different concentrations of HCl, and the impact of these acid solutions with added chloride ions along with the effect of chitosan, a corrosion inhibitor, was investigated in this study. Fourier transform infrared spectroscopy analysis depicts the characteristic functional groups of chitosan, a wide band at 3249 cm^{-1} (O-H and N-H stretching vibration) and strong bands at 1365 cm^{-1} (C-N stretching) and 1217 cm^{-1} (C-O-C glycosidic linkage), verifying its chemical structure for corrosion inhibition of SS Grade 202. Mass loss measurements depict that SS Grade 202 exhibits 50% reduction in mass loss as compared to the uninhibited system, when 5.0 mL of 1.0% (w/v) chitosan prepared in 0.17 mol L^{-1} acetic acid is added to 0.25 mol L^{-1} HCl solution. Further study reveals that the increase in the dosage of the inhibitor significantly enhances the corrosion inhibition efficiency. In the presence of 10 mL of 5.0% chitosan/acetic acid solution, the corrosion rate decreases by 90.8% when compared to the uninhibited system. It is suggested that chitosan composites be synergistically combined with polymers to form future-generation green coatings taking advantage of the inherent greenness and corrosion inhibitive properties of chitosan.

Keywords: Chitosan, Corrosion rate, Inhibition, Stainless steel