RESCON 2025 PS 40

CORROSION INHIBITION OF GRADE 202 STAINLESS STEEL BY $NaHCO_3$ IN HCl MEDIUM

P.D.T.A. Dewappriya, M.H.N. Revon and N. Priyantha*

Department of Chemistry, University of Peradeniya, Peradeniya, Sri Lanka.
*namalpriyantha@sci.pdn.ac.lk

Corrosion, the degradation of metals due to electrochemical or chemical interaction with the environment, has been a problem since the beginning of metal usage. Corrosion of metals adversely affects many operations, such as water supplies, energy production systems and construction of metallic structures, owing to the requirement of the use of metals and alloys having long lifetimes. Despite stainless steel (SS) facing corrosion challenges in harsh conditions, it exhibits excellent corrosion resistance in mild environments when compared to other alloys, primarily because of the chromium oxide barrier that is formed through oxidation of chromium present in SS. To enhance the longevity of SS, eco-friendly corrosion inhibitors made from cost-effective material have been utilised. Nevertheless, there has been limited exploration into the effects of different dissolved salts on the corrosion inhibition properties of Grade 202 SS. This study thus focused on the application of a multi-technique approach for the investigation of corrosion inhibition of Grade 202 SS in acidified $NaHCO_3$ systems. Gravimetric measurements indicate superior corrosion inhibition in aqueous 0.50 mol L^{-1} $NaHCO_3$ solutions prepared in HCl acid solutions, and further, increase in the concentration of $NaHCO_3$ is found to improve the inhibition efficiency. Electrochemical impedance spectroscopy (EIS), through Nyquist plots, demonstrates that the polarisation resistance, which is inversely proportional to corrosion rate and directly proportional to the extent of corrosion inhibition, significantly increases in aqueous $NaHCO_3$ systems in the presence of HCl, a corrosion promoter. Linear polarisation studies, leading to diminished corrosion rates in aqueous $NaHCO_3$, further support the findings of EIS. Introduction of $NaHCO_3$ solutions to minimise corrosion of stainless-steel objects in industrial applications which use HCl acid is thus convinced.

Keywords: Corrosion, Impedance, Linear polarisation, Mass loss measurements, $NaHCO_3$