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Use of Aqueous Na_2CO_3 Systems for Inhibition of Corrosion of Grade 202 Stainless-steel

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Corrosion is a process that promotes damaging attack on a metal by chemical or electrochemical reaction with the environment it is exposed to. Corrosion has been driven its concern due to costly maintenance, and hence, inhibitors are needed to avoid this undesirable situation. Inhibitors slow down the corrosion rate through various means, out of which the formation of a passive film is common. Although stainless steel (SS) has corrosion risk in aggressive environments, it is known for its strong corrosion resistance in mild environments comparative to other alloys, mainly due to the presence of chromium which forms a barrier of its oxide. To improve the life-time of SS, sustainable corrosion inhibitors with cost-effective constituents have been employed. However, detailed investigation of the reactivity of various dissolved salts on the corrosion inhibition action of Grade 202 SS has not been much elaborated. This study is thus focused on a multi-technique approach to investigate the effect of acidic conditions on the corrosion inhibition of aqueous Na_2CO_3 systems. Mass loss measurements indicate that 0.25 mol L^{-1} Na_2CO_3 acts as a corrosion inhibitor with the inhibition efficiency of 99.82% in the presence of 0.25 mol L^{-1} HCl, which was further increased when the concentration of Na_2CO_3 is increased, achieving a superior corrosion inhibition efficiency. Electrochemical impedance spectroscopy indicates that the polarization resistance, which is inversely related to the corrosion rate, increases with the increase in the concentration of Na_2CO_3 at the fixed concentration of HCl, supporting mass loss measurements. Moreover, open circuit potentials of Grade 202 SS are increased when the concentration of Na_2CO_3 is increased, further supporting. Comparison of the corrosion inhibitory action of Na_2CO_3 in the presence of HCl, HNO_3, and CH_3COOH indicates that the extent of inhibition follows the order, $HCl < HNO_3 < CH_3COOH$.

Keywords:
Corrosion, impedance, inhibition, mass loss measurements, Na_2CO_3

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