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Modelling of corrosion of mild steel in strong acidic media through mass loss measurements

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Corrosion has been problematic especially in industrial activities, and hence, various corrosion inhibitory activities have been implemented, most of which are with synthetic chemicals. Mass loss measurements are used as reliable means for overall quantitative estimation of the extent of corrosion. Nevertheless, modelling of corrosion of mild steel, which is important to predict the extent of corrosion in various environments, including industrial setting, has not been elaborated. As such, this study focused on the use of mass loss measurements of rectangular mild steel specimens of dimensions 30.0 mm × 10.0 mm × 2.0 mm to formulate a mathematical model for its corrosion in H_2SO_4 and HCl media within the concentration ranges of 0.10 – 2.00 mol L^{-1} and 0.20 – 4.00 mol L^{-1}, respectively. Negative exponential decay of the mass of mild steel specimens in both media recorded over a period of one week with leveling off at longer exposure times, leads to model the mass (m) as a function of time given by, $m = A + Be^{-kt}$ where t is time of exposure, and k is rate constant of corrosion. The parameters A and B depend on the initial acid concentration, type of acid and the initial mass of the specimen. The extent of corrosion of mild steel is significantly lowered in the presence of Indian almond (*Terminalia catappa)* dry leaf powder as a green corrosion inhibitor, which leads to decreased decay pattern. Hence, the above relationship modeled for mass loss in the absence of the inhibitor can be revised to describe the inhibitory corrosion action. Extension of this model for prediction of corrosion of mild steel in different media and of stainless steel in the absence and presence of inhibitors will be a viable future direction.

Key words:

Corrosion rate; Exponential decay; Green inhibitors; Mild steel