

O-Toluidine as Corrosion Inhibitor for Zinc in Sulphuric Acid Medium

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ABSTRACT: The inhibition of the corrosion of zinc in sulphuric acid solution by *o*-toluidine has been studied using weight loss, Potentiodynamic Polarization, Electrochemical Impedance Spectroscopic (EIS) and SEM techniques. Corrosion rate increases with the increase in acid concentration and temperature. As inhibitor concentration increases corrosion rate decreases while percentage of inhibition efficiency (I.E.) increases. At constant inhibitor concentration corrosion rate and I.E. increases with increase in acid concentration. *o*-toluidine showed maximum I.E. of 91.46% at 60 mM in 0.5 M H₂SO₄ acid at 301 K. The value of free energy of adsorption (ΔG_{ads}^0), heat of adsorption (Q_{ads}), energy of activation (E_a), enthalpy of adsorption (ΔH_{ads}^0) and entropy of adsorption (ΔS_{ads}^0) were calculated. The inhibition effect is discussed in view of *o*-toluidine molecules adsorbed on the metal surface and it obeys Langmuir adsorption isotherm. Polarization curve indicates that inhibitor act as mixed type. The results obtained showed that the *o*-toluidine could serve as an effective inhibitor for corrosion of zinc in sulphuric acid.

KEYWORDS: Zinc, H₂SO₄, *o*-Toluidine, Corrosion Inhibition, Weight loss, Polarization, EIS, SEM.

I. INTRODUCTION

The problem of corrosion is of considerable importance due to increase in uses of metals and alloys. Zinc metal has a number of characteristics that make it a well-suited corrosion protective coating for iron and steel products. Sulphuric acid (H₂SO₄) is a strong acid and is used as a cleaner for rust, algae and scale from condensers and cooling tower [1]. Sulphuric acid is a very important commodity chemical, and indeed a nation's sulphuric acid production is a good indicator of its industrial strength. Corrosion of zinc in various acid media was studied by different researchers [2-7]. Many workers [8-12] have studied toluidine isomers as corrosion inhibitors in different acid media. The aim of the present study is to investigate the corrosion inhibition effect of *o*-toluidine for zinc in various concentration of H₂SO₄ medium by weight loss, effect of temperature, polarization, EIS and SEM techniques.

II. EXPERIMENTAL

2.1. Preparation of sample and solution

The zinc specimens with a chemical composition of 99.39% Zn, 0.49% Mn and 0.12% Co were used in the present study. The metal sheet, test specimens of size 5.0 x 2.5 x 0.2 cm having an effective area of 0.3013 dm² were used. The specimens were cleaned by washing with distilled water, degreased by acetone, washed once more with doubled distilled water and finally dried and weighted by using electronic balance. Sulphuric acid was used as corrosive solution having concentration of 0.1, 0.3 and 0.5 M prepared by diluting analytical grade of H₂SO₄ purchased from Merck using double distilled water.