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Diethylamine as Corrosion inhibitor for Zinc in Sulfamic Acid

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Abstract:
The inhibitive action of diethylamine on corrosion of zinc in sulfamic acid solution was investigated by weight loss and potentiodynamic polarization methods. Corrosion rate increases with the increase in acid concentration and with the temperature. As temperature increases, percentage of inhibitor decreases. At constant acid concentration, the inhibition efficiency (I.E.) of diethylamine increases with increase in inhibitors concentration. I.E. increases with the increase in acid concentration.

In Present study, the I.E. of diethylamine increases with the inhibitor concentration. It was found to be highest 95.5% with respect to 15 mM inhibitor concentration in 1.0 M sulfamic acid. The mode of inhibitor action appears to be physiorption following the Langmuir adsorption isotherm. Tafel plots of polarization study indicates that diethylamine act as mixed type inhibitors.

Key Words: Corrosion, zinc, sulfamic acid, diethylamine, polarization.

1. Introduction

Corrosion is an important process playing significant role in safety and economics, mostly for metals. A corrosion inhibitor is a chemical compound adsorbed on Zn surface to give film in order to isolate the surface of the metal from reaction with the environment or by lowering the ions which attack the metal surface [1, 2]. Zinc metal is one of the good significant non-ferrous metals, which founds wide applications in metallic covering. Zinc metal dissolves in solution with pH upper than 12.5 and lesser than 6, while between pH 6 to 12.5 the dissolution is very lower [3]. Sulfamic acid (NH_3O_3S) is a strong acid and is used as a cleaner for rust, algae and scale from condensers and cooling tower. According to Hackerman et al.[4] the inhibitive properties of a series of secondary aliphatic and cyclic amines in acid media are controlled by the percentage of π - orbital of free electron on the nitrogen atom of these compounds. Ethylamines were used as corrosion inhibitor for zinc in (HNO_3 + HCl) binary acid mixture [5], in phosphoric acid [6], in nitric acid [7], in (HNO_3 + H_2SO_4) binary acid mixture [8], in (HNO_3+H_3PO_4) acid mixture [9] and in sulphuric acid [10]. The present study was undertaken to evaluate diethylamine as corrosion inhibitors for zinc in sulfamic acid.

2. Experimental

2.1. Preparation of samples and solutions

Rectangular specimens (5.5 X 2.5 X 0.2 cm) of zinc having an area of 0.3074 dm^2 are used for the determination of the corrosion rate. The chemical composition of test specimen was found to be 98.5% Zn, 0.03% Pb, 0.02% Cd and 0.01% Fe. All the specimens were cleaned by buffing to obtain a mirror like finish. Sulfamicacid was used as corrosive solution having concentration of 0.1,0.5, 1.0 M prepared by diluting analytical grade of sulfamic acid purchased from Merck using double distilled water.