Portugaliae Electrochimica Acta 26/6 (2008) 479-492

PORTUGALIAE ELECTROCHIMICA ACTA
ISSN 1647-1571

The Inhibitory Effect of Diethanolamine on Corrosion of Mild Steel in 0.5 M Sulphuric Acidic Medium

M. Ramananda Singh, Kalpana Bhrara and Gurmeet Singh*

Department of Chemistry, University of Delhi, Delhi-110007, India

Received 2 April 2008; accepted 2 October 2008

Abstract

The inhibitory effect of diethanolamine (DEA) on corrosion of mild steel in 0.5 M H_2SO_4 was investigated by various corrosion monitoring techniques. Galvanostatic polarization study revealed that this compound is a very good inhibitor. The inhibition efficiency (I%) varies in the range of 88.7% to 55.3 % for a concentration range of 10^{-3} M to 10^{-7} M at 303 K, respectively. A study of corrosion potential (E_{corr}) reveals that DEA is a mixed type inhibitor. DEA inhibited mild steel corrosion due to physical adsorption of the inhibitor on the metal surface. The study at higher temperatures indicates that the inhibition efficiency decreases with the increase in temperature. The adsorption of DEA on the mild steel surface in 0.5 M H_2SO_4 follows the Frumkin's adsorption isotherm. The results of potentiostatic polarization study revealed that DEA is a strong passivating additive. The results of infra red (IR) spectroscopy, scanning electron microscopy (SEM) and quantum chemical study supplement the results of the electrochemical techniques.

***Keywords**:* corrosion inhibitions, inhibitor, diethanolamine, sulphuric acid, galvanostatic polarization, potentiostatic polarization, IR spectroscopy, scanning electron microscopy and quantum chemical calculation.

Introduction

The investigation of inhibition of corrosion of iron is a matter of high theoretical as well as practical interest [1]. Acids are widely used in many industries. Some of the important areas of application are industrial acid cleaning, acid pickling, acid descaling and oil well acidizing [2]. Due to the aggressiveness of acids, inhibitors are used to reduce the rate of dissolution of metals.

* Corresponding author. E-mail address: gurmeet123@yahoo.co.in; ramananda2002@yahoo.co.in