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Synthesized Schiff base acted as eco-friendly inhibitor for mild steel in 1N H_2SO_4

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ABSTRACT

2,2'-((1Z,1'Z)-(((propane-1,3-diylbis(oxy))bis(2,1-phenylene))bis(methanylyliden-e))bis(azanyly lidene))diethanol (2-PPM) was synthesized. This compound evaluated as novel corrosion inhibitor for mild steel in 1N H_2SO_4 solution. Polarization study showed that the compound was mixed type inhibitor. Electrochemical impedance study showed that the presence of this compound decreases the double layer capacitance and increases the charge transfer resistance.Weight loss study showed that, the corrosion inhibition property of 2-PPM on the external area of mild steel samples in the solution is mainly depends on the inhibitor concentration and immersion period. Further, the maximum protection efficiency obtained by weight loss technique was 65 %. SEM and AFM results fully support the chemical and electrochemical results.

1. Introduction

Mild steel has very low carbon amount that makes it appropriate for multiple utilizations like steel marketing, pipelines, construction, sheets, container, and metallic vessels. It corrodes hardly when subjected to an acidic media and made a great economic loss [1]. H_2SO_4 was generally exploited to liquidate scales and rust in steel equipments. Organic ligands having functional groups or heteroatoms like O, S, N, or connected multiple bonds can be adsorbed quickly on the mild steel [2-5]. Some researchers have studied the derivatives of Schiff-base as a good corrosion inhibitor [6-9]. Sorkhabi et al. had investigated different physical and chemical properties of three Shiff base in HCl [10]. Emregület al. has reported LOH and LACOH as a corrosion inhibitor in HCl medium on mild steel [11]. Shokry et al. have found out the concentration of Schiff bases that obtained from o-hydroxy of diamines and aromatic aldehydes of o-methoxy by electrochemical methods and surface examination method [12]. Daoud et al. have analyzed the effects of L on mild steel X52 in 1 M Sulfuric Acid acid [13]. Sliem et al. have investigated the corrosion inhibition properties of a synthesized aminothiazole Schiff base on mild steel in Sulfuric Acid acid [14]. Current research in the study of corrosion science is focused on the exploration of new nontoxic corrosion inhibitor. The organic compound possessing N, S, P and O atoms, functional groups, phenyl rings and pi-electrons adsorb on the mild steel surface via chemical or physical adsorption phenomena [15-19]. The organic compounds with high molecular weight having high surface coverage, which prove to be robust corrosion inhibition property [20-22]. A number of organic compounds exhibit good corrosion inhibition property but their application as corrosion inhibitor for different metals in industries is banned due to the toxic and expensive nature [23,24]. Generally, Schiff base compounds have heteroatoms in their ligand that is expected to show the good corrosion inhibition property. This property can be examined with electrochemical, which contain some kind sensors [25-30]. Herein reporting the systematic and detailed examination of application of 2,2'-((1Z,1'Z)-(((propane-1,3-diylbis(oxy))bis(2,1 phenylene))bis(methanylylidene))bis (azanylylidene))diethanol on the mild steel in 1N H_2SO_4 solution. The weight loss, Tafel curves, impedance spectroscopy, and SEM results are presented.

2. Materials and methods

Ligand 2,2'-((1Z,1'Z)-(((propane-1,3-diylbis(oxy)) bis(2,1-phenylene))bis(methanylylidene))bis(azanyly lidene))diethanol (Fig.1) was prepared according to literature method [31, 32]. 2-[3-(2-formyl

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