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TECHNICAL ARTICLE—PEER-REVIEWED

Benign Approach of Plant-Derived Inhibitor: Assessing Their Anticorrosive Activity on Mild Steel in Acidic Media

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Abstract The dissolution behavior of mild steel in 2 M H_2SO_4 with various concentrations of *Borassus Flabellifer* Seed Food (BFSF), *Musa Paradisiaca* Dry Leaf (MPDL), and *Saccharum Officinarum Bagasse* (SOB) was evaluated using both mass loss and electrochemical methods. It is evident from the results that the biomaterial extracts could be precious inhibitors for the corrosion of mild steel in sulfuric acid media. The inhibition efficiency of the tested inhibitors enhanced with increase in BFSF, MPDL, and SOB concentrations but diminished with increasing temperature. The free energy of the adsorption, apparent activation energy, enthalpy, and entropy of the dissolution process were discussed at 35–60 °C. Impedance curves showed that the charge transfer resistance increased and double-layer capacitance decreased with increase in concentration of tested inhibitors. Scanning electron microscope images revealed that the damage of mild steel surface has diminished in the presence of BFSF, MPDL, and SOB

Keywords Alloy steel · Biomaterial · Sulfuric acid · Mass loss · Adsorption

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Introduction

Corrosion is a very common phenomenon that has a wide range of implications in municipal, industrial, building, and private settings. The economic cost of corrosion worldwide is enormous and runs into billions of dollars. It was estimated that one ton of steel turns into rust every 90s [1]. Generally, metals and alloys are important components in petroleum production, refining, acid pickling, and oil well acidizing and acid descaling process, and so on. During the processes, metals readily react with corrosive media leading to more severe corrosion of metals and alloys. Hence, special attention must be paid for the selection of inhibitors for such practical applications [2]. During the past decade, various strategies are followed to minimize the corrosion of metals including selection of the metal, purity of the metal, alloying, sacrificial cathodic protection, paints, electroplating, electroless plating, and hot dipping. One of the techniques for mitigating corrosion is the use of inhibitors [3, 4]. Subsequently, most of the synthetic organic compounds are not only expensive but also toxic to the environment [5, 6]. Due to the toxicity of some corrosion inhibitors, there is an urgent need for preparation of eco-friendly corrosion inhibitors [7]. A biological approach based on marine algae, bio-derived components, leaf extracts is chosen as it would not toxic, renewable, readily available, low cost, and eco-friendly [8–11]. The leaf extracts of *Kleinia grandiflora*, *Feronia elephantum*, *Cassia senna*, and *Tiliacora accuminata* have been studied as corrosion inhibitor in acidic media [12–15]. In the present work, renewable biomaterials such as *Borassus Flabellifer* Seed Food (BFSF), *Musa Paradisiaca* Dry Leaf (MPDL), and *Saccharum Officinarum Bagasse* (SOB) are chosen to be corrosion inhibitors. *Palmyra* palms are widely