Chapter 14
Pharmaceutical Drugs as Prominent Corrosion Inhibitors

Berdimurodov Elyor
https://orcid.org/0000-0003-0610-8218
National University of Uzbekistan Named After Mirzo Ulugbek, Uzbekistan

Eliboev Ilyos
Faculty of Chemistry, National University of Uzbekistan, Uzbekistan

Abduvali Kholikov
Faculty of Chemistry, National University of Uzbekistan, Uzbekistan

Khamdam Akbarov
Faculty of Chemistry, National University of Uzbekistan, Uzbekistan

Dakeshwar Kumar Verma
Department of Chemistry, Government Digvijay Autonomous Postgraduate College, India

Mohamed Rbaa
Laboratory of Organic Chemistry, Catalysis, and Environment, Faculty of Sciences, Ibn Tofail University, Morocco

Omar Dagdag
Centre for Materials Science, College of Science, Engineering, and Technology, University of South Africa, South Africa

Berdimuradov Khasan
Faculty of Industrial Viticulture and Food Production Technology, Shahrisabz Branch of Tashkent Institute of Chemical Technology, Uzbekistan

ABSTRACT

Corrosion of metals is a large problem in the gas-oil, petrochemical, metallurgy, automobile, and electronic industries. To protect metals from corrosion destruction, corrosion inhibitors are the most effective ways of corrosion protection. Among corrosion inhibitors, pharmaceutical drugs are most effective, water-soluble, eco-friendly, low-cost, good adsorbent, polar structural molecule, biodegradable or persistent, lipophilic, hydrophilic, non-volatile, recyclable, and effective at low concentrations and high temperatures. In this chapter, the main inhibition characteristics of pharmaceutical drugs for various metal types in the acidic, saline, and other corrosion medium were reviewed and discussed. This chapter revealed herein would be helpful as a reference for both industrial and academic researchers.

DOI: 10.4018/978-1-6684-7689-5.ch014

1. INTRODUCTION

1.1. Issues, Controversies, Problems

Metallic materials such as steel, copper and aluminium are the most used metallic materials in the gas and oil industries (Berdimurodov, Kholikov, Akbarov, Guo, Kaya, Katin, Verma, Rbaa, Dagdag, et al., 2022)(Haldhar et al., 2021)(Berdimurodov, Kholikov, Akbarov, Guo, Kaya, Katin, Verma, Rbaa, & Dagdag, 2022). This is due to their being cost-effective, having good mechanical properties for operations. These metallic materials are corroded in the aggressive environment, which is acidic, saline, alkaline and neutral solutions (Bahgat Radwan et al., 2021)(Zhu et al., 2022)(Berdimurodov, Kholikov, Akbarov, Guo, et al., 2021). The corrosive ions such as chloride, sulfat, hydrogen, hydroxyl and other aggressive ions easily reacted with the steel, copper and aluminium to form the corrosion products, which are metal salts, hydroxyl, chloride and sulfat compounds (Shahmoradi et al., 2021)(Berdimurodov, Kholikov, Akbarov, Obot, et al., 2021)(Berdimurodov, Kholikov, Akbarov, Guo, Kaya, Kumar Verma, et al., 2022). These corrosion products are deposited on the metal surface. As a result of metal corrosion, the natural properties of the metal are dramatically reduced. This is an environmentally and economically problem in the chemical, petrochemical, electronic, metallurgy, automobile and other main industries (Verma et al., 2021)(Berdimurodov, Kholikov, Akbarov, & Guo, 2021).

1.2. Solutions and Recommendations

Corrosion of metals is a large problem in the gas-oil, petrochemical, metallurgy, automobile and electronic industries. To protect metals from corrosion destruction, corrosion inhibitors are the most effective ways of corrosion protection. Corrosion inhibitors are organic compounds are applied to defend metallic materials from corrosion problems. They are added in the aqueous phase, then adsorbed on the metal surface to defend the metals from the corrosion inhibitor. The corrosion inhibitor contained more electron-rich functional groups, heteroatoms, aliphatic and aromatic rings, which are attributed to increase in the inhibition and adsorption centres of corrosion inhibitors. The inhibitor adsorbed on the metal surface through the chemical and physical adsorption mechanism. In the chemical interaction, the delocalised electrons in the electron-rich regions of the inhibitor molecule are shared or transferred to the vacant d-orbitals of metal; as a result, the covalent bonds are formed between the metal surface and inhibitor molecule. The covalent bonds are rigid and strong; the aggressive corrosion ions can not effects these covalent bonds. In comparison, they electrostatically interacted with the metal surface. Some nitrogen atoms are protonated to form the positive cites in the inhibitor structure while the metal surface was negatively charged by the adsorption of anionic corrosive ions. Therefore, the metal surface was protected by the formation protective layer. The chemical and electrostatically interactions between the corrosion inhibitor and metal surface are attributed to an increase in the inhibition performance.

1.3. Pharmaceutical Drugs as Prominent and Green Corrosion Inhibitors

Currently, pharmaceutical drugs are interestingly (Popoola, 2019) used as prominent corrosion inhibitors for copper, steel and aluminium based metallic materials. This is due to the corrosion inhibitors based on the pharmaceutical drugs are eco-friendly, low-cost, water-soluble, good adsorbent, polar structural molecule, biodegradable or persistent, lipophilic, hydrophilic, non-volatile, recyclable and effective at