

# Chapter 10


## Overview of the Properties, Applicability, and Recent Advancements of Some Natural Products Used as Potential Inhibitors in Various Corrosive Systems

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### **ABSTRACT**

*This chapter provides an overview of recent advances in using eco-friendly plant extracts as green corrosion inhibitors for metals and alloys in corrosive mediums, with a focus on literature from the past five years. Characterization techniques, including gravimetric analysis, electrochemical impedance spectroscopy, kinetic and adsorption parameters, computational analysis, and surface morphologies techniques, are discussed to provide insights into the inhibition mechanism and the morphological configuration. This chapter will give the audience a better understanding of the properties, applicability, and recent developments in the utilization of natural products as corrosion inhibitors in several corrosive systems.*

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## **INTRODUCTION**

Corrosion is the gradual degradation of metal materials caused by their chemical reaction with the environment. The process results in the formation of metal oxides or other corrosion products, which can weaken and damage the metal (Echihi et al., 2021; GK et al., 2021; Marciales et al., 2018; Puscaselu et al., 2020; Salleh et al., 2021). The adverse impacts of corrosion can be both economic and environmental, affecting various industries and infrastructure systems. Economic impacts of corrosion include the cost of repairing or replacing damaged equipment, lost production due to downtime, and the cost of corrosion prevention measures. The annual cost of corrosion (COC) worldwide is predicted to be trillions of dollars. For example, the COC in the U.S. petroleum industry alone is predicted to be \$7 billion per year (Khouchlaa et al., 2021; R. T. Loto et al., 2018, 2021b). The cost of corrosion in the transportation sector, including automobiles, bridges, and highways, is also significant. In addition to the economic costs, corrosion also has significant environmental impacts. Corrosion products, including metal oxides and other by-products, can contaminate soil and water, affecting plants, wildlife, and human health. For example, the corrosion of metal pipes can release lead and other heavy metals into the drinking water supply, posing a serious health risk. Corrosion also contributes to the release of greenhouse gases, including carbon dioxide and methane, which contribute to climate change (Bashir et al., 2019; Bashir, Lgaz, et al., 2020; Bashir, Thakur, et al., 2020b; Thakur et al., 2023; Thakur, Kaya, Abousalem, & Kumar, 2022; Thakur, Kumar, Kaya, Marzouki, Zhang, et al., 2022; Thakur, Kumar, Sharma, Ganjoo, & Assad, 2022; Thakur, Sharma, Ganjoo, Assad, & Kumar, 2022; Thakur & Kumar, 2021). One of the most significant environmental impacts of corrosion is its effect on infrastructure systems. Bridges, buildings, pipelines, and other structures can be weakened and eventually fail as a result of corrosion. This can result in structural collapses and other accidents, causing injury and loss of life. The collapse of the I-35W bridge in Minneapolis, Minnesota in 2007, for example, was attributed in part to corrosion in the steel support beams. The maritime industry is also affected by corrosion, as ships and other vessels are subject to constant exposure to corrosive saltwater and other environmental factors (Ali, 2021; Cao et al., 2021; Solomon & Umoren, 2016). The corrosion of ships and offshore structures can result in leaks and other problems, compromising the structural integrity of the vessels and potentially putting lives at risk. Corrosion also has serious impacts on the energy sector. Oil and gas pipelines, for example, can corrode and leak, leading to spills and other environmental problems. In addition, the corrosion of power generation equipment, including turbines and generators, can result in decreased efficiency and increased downtime, leading to increased costs and reduced energy production. Some common examples of accidents that can result from corrosion include:

- Bridge failures: Corrosion can weaken the structural components of bridges, leading to collapse and accidents.
- Pipeline failures: Corroded pipelines can result in oil or gas leaks, leading to environmental hazards and potentially explosive situations.
- Chemical plant accidents: Corroded equipment in chemical plants can lead to leaks, fires, and explosions.
- Transportation accidents: Corroded vehicles, ships, and airplanes can experience mechanical failures and equipment malfunctions, potentially leading to accidents.

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