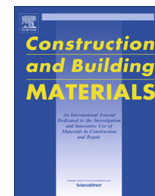


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1. Implications of eco-addition inhibitor to mitigate corrosion in reinforced steel embedded in concrete, **Construction and Building Materials.**, 213 (2019) 246-256.
2. Corrosion resistance of *Cissus quadrangularis* extracts on metal in aggressive medium: Gravimetric and Surface examinations, **Rasayan Journal of Chemistry.**, 12 (2019) 1326-1339.
3. Evaluation of inhibition effect of *Rosadamascena* leaves extract as an eco-friendly inhibitor for mitigating corrosion on mild steel in 0.5 M sulphuric acid medium, **International Journal of Scientific Research and Reviews.**, 8 (2019) 3421-3436.

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Implications of eco-addition inhibitor to mitigate corrosion in reinforced steel embedded in concrete

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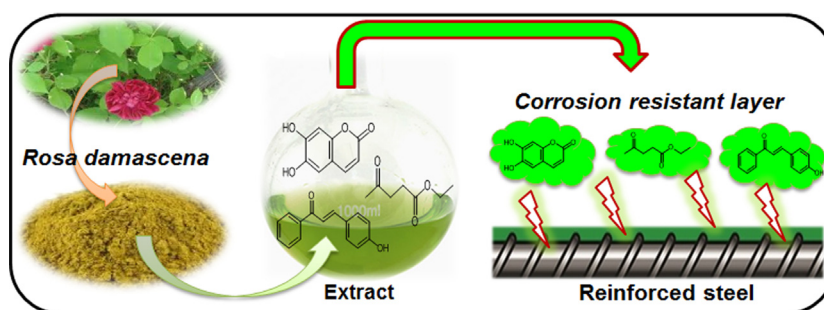
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HIGHLIGHTS

- A cost effective inhibitor for extenuating corrosion in rebar.
- *Rosa damascena* indubitably diminishes corrosion of rebar in aggressive environment.
- Regression coefficient nearer to unity discloses the best fit for Langmuir adsorption.
- Electrochemical studies evinced the shielding effect and mixed nature of inhibitor.
- SEM images exposed the creation of protective layer.

GRAPHICAL ABSTRACT



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ABSTRACT

The deleterious and entanglement of synthetic inhibitors provokes a platform for assessment of *Rosa damascena* (*R. damascena*) leaves as a green corrosion inhibitor on reinforced steel rebar. The inhibitory action was realised by electrochemical impedance spectroscopy and polarisation studies in simulated pore solution. Electrochemical measurements showed that the charge transfer resistance increases as the concentration of acid and ethanol extracts of *R. damascena* increases. Tafel polarisation curves divulge that the potential is shifted towards positive side evincing the nobility of the inhibitor. The experimental model for adsorption obeyed Langmuir adsorption isotherm disclosing the physisorption behaviour. The maximum protection efficiency is 82% at a concentration of 12 v/v %. SEM images stipulates the chelating effect of phytochemical constituents containing hetero atoms such as O, N, aromatic rings and π -electrons interacting with iron ions resulting in the shielding of the metal from corrosion.

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1. Introduction

Steel rebar is a global material used for constructions and other infrastructural activities due to their reliability, durability, versatility and acceptability [1]. Usually, steel rebar is embedded in con-

crete to withstand the high load. It is designed in such a way that it provides an enhanced bond with concrete. Due to various factors influenced in the environment, steel rebar is not able to withstand in strength up to the expected level. Globally, the major degradation factor in steel reinforced concrete is corrosion. The corroding steel bar populates more volume ensuing in expansion thus generating hoop stress inducing spalling, cracking, loss of structural integrity etc., due to depassivation [2]. The depassivation of rebar may be due to usage of de-icing salts in temperate regions, presence of contamination in concrete, aggressive activity of the

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CORROSION RESISTANCE OF *Cissus quadrangularis* EXTRACTS ON METAL IN AGGRESSIVE MEDIUM: GRAVIMETRIC AND SURFACE EXAMINATIONS

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ABSTRACT

The corrosion resistance of *Cissus quadrangularis* in acid and ethanol medium have been investigated by diverse techniques. It has been noticed that as the concentration (2 to 12v/v %) of *C. quadrangularis* rises the efficiency of the inhibitor also increases. The maximum inhibition efficiencies of 89.45 % and 75.54 % were attained for acid and ethanol extracts respectively. The emergence of a protective layer on the mild steel surface was assessed by electrochemical impedance studies. The influence of the active ingredients in the extracts was examined by GC-MS analysis. The inhibitor adsorption ensued in the protective layer on the surface was analyzed using SEM and AFM.

Keywords: *C. quadrangularis*, GC-MS, Electrochemical Techniques, Adsorption Isotherm, SEM, AFM

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INTRODUCTION

Mild steel is the dominant metal that has wide application in industries. It is highly affected due to corrosion because of the usage of acid solutions in industries for descaling, acid pickling, petrochemical processes etc.^{1,2} The metal corrosion in the corrosive medium is a complex problem world wide. To alleviate corrosion various proactive techniques such as improvement in materials, anodic/cathodic protection, coatings, modification of materials and corrosion inhibitors are used^{3,4}. Among these techniques, corrosion inhibitors play a predominant role in protecting the metal against corrosion, particularly in acid medium. An organic compound functions as an inhibitor having hetero atoms, aromatic rings, conjugated double (or) triple bond, π -electrons in their structure⁵. In general, synthetic inhibitors are effective to abate corrosion but due to adverse effects of these inhibitors researchers are focussing towards non-toxic, cheap, biodegradable, readily existing green inhibitors⁶. A wide number of scientific research have been carried out to analyze the anti-corrosive property of various plant extracts on corrosion of metals, to discuss a few, *Cymbopogan Citratus*⁷, *Phyllanthus amarus*⁸, *Cascabela Thevetia*⁹, *Grewa Venusta*¹⁰, Arecanut husk¹¹. In our current research, we focussed on the easily available plant *Cissus quadrangularis* (CQ). This plant originates under the type of vitaceae family with more traditional medicinal values. It is also termed as veld grape. CQ belongs to Srilanka and it is broadly spread in South East Asia, Arabic countries and Africa¹². It possesses activities like gastro protective, anti-inflammatory anti-microbial, anti-tumor, etc. The literature evidenced the presence of amyrynes, phenols, tannins etc., in CQ.

EXPERIMENTAL

Preparation of Inhibitor and Metal Specimen

Cissus quadrangularis were collected in the nearby vegetable market, washed thoroughly with water to eradicate impurities, dried. After the completion of drying it was powdered to obtain fine particles. About 1g of the grounded sample was heated in 100 ml of 0.5 M H₂SO₄ (acid extract) / 100 ml of ethanol (ethanol extract) in a round-bottomed flask for 3 hours. The resultant green extracts [acid (CQAE)] and [ethanol (CQEE)] extracts were cooled at room temperature and filtered using Whatman filter paper.

International Journal of Scientific Research and Reviews

Evaluation of Inhibition Effect of *Rosa Damascena* Leaves Extract as an Eco-Friendly Inhibitor for Mitigating Corrosion on Mild Steel in 0.5M Sulphuric Acid Medium

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ABSTRACT

The anti corrosive property of *Rosa damascena* (RD) leaves on mild steel in 0.5M sulphuric acid was analysed by mass loss techniques, impedance and polarisation studies. A maximum of 92.92 % inhibition efficiency was reached by using 12v/v % of RD inhibitor. Thermodynamic parameter specifies spontaneous adsorption of the inhibitor on mild steel surface. The adsorption of *Rosa damascena* inhibitor on mild steel surface was found to follow Langmuir adsorption isotherm. Surface analytical techniques validate the formation of protective layer on the inhibitor.

KEYWORDS: Green inhibitor, weight loss, thermodynamic parameters, electrochemical, surface studies

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