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A Brief Review on Peel Waste as Sustainable Corrosion Inhibitor

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Abstract: ***Naturally occurring corrosion inhibitors can slow down the corrosion rate of metals without posing environmental hazards. Vegetable peels have proved beneficial in this regard. Their usage to effectively reduce corrosion rate is an eco- friendly approach which addresses the problem of waste disposal too. This brief review aims to present corrosion mitigation studies by few vegetable peels in different corrosive media and metals.***
Keywords: peels, corrosion inhibitor, waste, metals, eco-friendly

I. INTRODUCTION

Corrosion of metals is universal and usually reveals itself in the form of structural, aesthetic and financial losses. The annual global economic loss due to corrosion of various metals is assessed to fall in the range of dollars 700 billion and dollars 1 trillion.[1]
The phenomenon of corrosion and its associated problems can be mitigated by addition of inhibitors to the immediate environment of the metals.[2]
Synthetic corrosion inhibitors generally possess conjugated system of bonds heterocyclic rings and functional group containing nitrogen, phosphorus, oxygen and sulphate.[3]
The electron density on these donor atoms is a favourable characteristic to function as adsorption centres.[4]
Their effectiveness, ready availability, easy usage and an extended shelf life makes them an ideal choice for reducing corrosion in pipelines nuclear power plant or offshore operations/ platform.[5]
However, toxicity of synthetic inhibitors like chromates have been well documented. [6,7]
This has given rise to replacing them with natural and green alternatives [8]
Various natural products and plant extracts can function as eco- friendly corrosion inhibitors. A number of reviewers have documented about the same. [9,10] Their inhibition efficacy arises due to the presence of different phyto components containing heteroatoms, aromatic and heterocyclic rings. The use of vegetable and fruit peels to reduce corrosion has also garnered interest over recent years. Owing to the perishable nature of fruits and vegetables their waste disposal has become a major challenge. [11] It is a sustainable approach leading to waste reduction as well as contributing to circular economy principles.[12]
Apart from this fruit waste is usually rich in polysaccharides and different phytochemicals.[13]
This short review aims to present the use of various vegetable and fruit peels for mitigating corrosion of metals in distinct environments.

Table 1: Vegetable peels as corrosion inhibitors of metals in different corrosive media.

Inhibitor	Metal	Corrosive medium	Methodology	Inhibition efficiency
PPE [14]	Carbon steel	Formation water	Ion chromatography, FTIR, SEM, EDX weight loss, OCP measurement	92.27% at 2.5% inhibitor conc
PPE [15]	Low carbon steel	3.5% NaCl	FTIR, weight loss, potentiodynamic polarisation	73.33% at 6ml inhibitor
PPE [16]	Mild steel	HCl, sea and distilled water	Weight loss	More than 70% at 2M HCl
Pisum sativum (PS) [17]	Aluminium alloy	1M NaOH	Weight loss, SEM, AFM, EIS, Tafel plots, linear polarization	94.5% at 1.5 g/l

Pumpkin Peel Extract [18]	Aluminium	1M HCl	Weight loss, EIS, AFM-XPS, EFM	95.42% at 300ppm
Vicia faba peels [19]	Mild steel	3.5% NaCl	GC-MS, Tafel plots, EIS, SEM, Quantum chemical calculations	97.84% at 200ppm hexane extract,88.67% at 200ppm acetone extract.

II. CONCLUSION

The values of inhibition efficiencies of various vegetable peels in diverse corroding media as well as metals has been tabulated above. Fairly good results can be observed from the table. It can be concluded that vegetable peels can serve a dual purpose of hindering the corrosion process as well as that of waste disposal.

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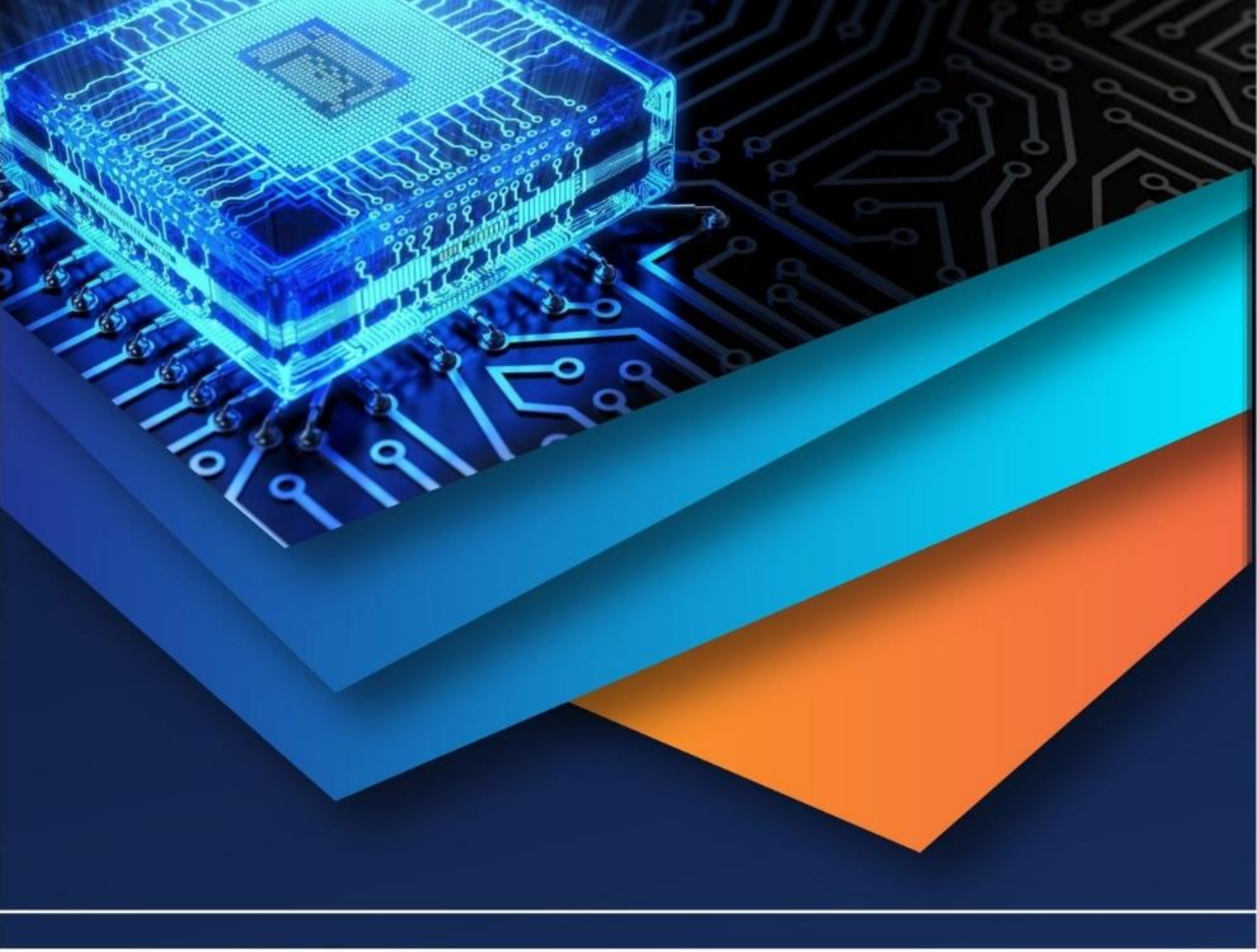

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