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Research Article

Phytochemical Screening and Adsorption Studies of *Brugmansia Suaveolens*

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Abstract

The present study has been designed to investigate the secondary metabolites present in the ethanol extract of *Brugmansia suaveolens* (BS). Furthermore the adsorptive behaviour of *Brugmansia suaveolens* extract was studied by means of XRD for understanding the inhibitive activity of extract for corrosion of mild steel in 1M HCl. The XRD studies confirmed the formation of a protective layer over the surface of the mild steel, which is responsible for the corrosion inhibition effect exhibited by Alkaloids and flavanoids.

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Introduction

Corrosion inhibitors are used to prevent unexpected metal dissolution in the process of acid cleaning of metal [1]. All the studies of corrosion inhibition potential of organic compounds revealed that organic compounds especially those with N, O, S showed effective corrosion inhibition [2]. Nevertheless, most of these compounds are not only expensive but also toxic for humans. Organic corrosion inhibitors, especially green inhibitors, are generally more environmental friendly than inorganic and other organic corrosion inhibitors. As most of the natural products are nontoxic, biodegradable and readily available in plenty, in various parts-seeds, fruits, leaves, flowers etc, have been used as corrosion inhibitors [3]. Due to more number of hetero-atoms (such as nitrogen, oxygen, sulphur, and phosphorus), green inhibitor can adsorb onto metal surface. In addition to that, multiple bonds or aromatic rings can block the active sites onto the metal surface [4]. Earlier, our research group have studied *Clematis gourina* [6], *Cassia roxburghii* [7], *Polycarpaea corymbosa* and *Desmdium triflrum* [8] and *Millingtonia hortensis* and *Cleome chelidonii* [9] as potential corrosion inhibitors for corrosion of mild steel in HCl.

Natural products are the richest source of heterocyclic compounds having higher electron density even at lower concentrations. It has been reported that the biological systems have the corrosion inhibition efficiency due to the functional groups present in aromatic and heterocyclic rings along with electron rich elements like nitrogen, sulphur and oxygen. These substances are found to adsorb on the corroding metal surface and reduce the corrosion rate [10].

Based on the corrosion inhibition properties of *Brugmansia suaveolens* (BS), the present study is aimed at finding out the chemical constituents responsible for its anticorrosive effect. Further, the adsorption mechanism of these compounds on the mild steel surface characterized by XRD. *Brugmansia suaveolens* belongs from *Solanaceae* (Potato family) commonly known as Angel's trumpet, in Tamil local varnacular –Madulam. The plant *Brugmansia suaveolens* (BS) were used for the treatment of anti-infection [11]. These plants are easily biodegradable and readily available from the renewable sources. Economically cost effective and eco-friendly inhibitors for the corrosion of mild carbon steel.

Experimental

Material and Methods

Collection and Identification of Plant Material

The leaves of *Brugmansia suaveolens* were collected from the Kodaikanal Hills, Tamilnadu, India, in early January and they were identified by Rapinat Herbarium, St. Joseph's College, Trichy, Tamilnadu, India.

Preparation of Extract

The leaves (1kg) were dried under shadow for 3-5 days and then extracted using 80% of ethanol (4 x 500ml) by means of cold percolation method. The alcoholic extract was concentrated in a flash evaporator and the residue was stored at 4 ^{o}C until further use.

Preliminary Phytochemical Screening

The photochemical screening and secondary metabolites was done by the standard procedures as propounded by J B Harborne and others [12,14]. The details of the photochemical screening studies are given in Table 1.

Specimen and Inhibitor Preparation

MS specimens containing C = 0.13%, Mn = 0.39%, Cr = 0.25% and Fe = 99.23% were used in the present study. The MS specimens were abraded with a series of emery papers (1/0, 2/0, 3/0 and 4/0 grade) and then the MS specimens were washed thoroughly with double distilled water, degreased with acetone and dried in *vacuo*. The solutions are prepared by the dilution of analytical grade 37% HCl with double distilled water in the presence of inhibitors in the 400 ppm of inhibitor concentration.

Wide angle X–ray Diffraction

In order to confirm the productive film (adsorbed layer) formation by inhibitor molecules (**BC)** on the MS surface, the diffraction pattern of the scrapped sample after 2 h immersion in 1.0 M HCl with 400 ppm concentration of inhibitors was examined using a Rigaku (D/Max ultima III) Cuk&# 945: The X–ray diffract meter was operated at 50 kV and 200 mA. Nickel filtered Cu Kα radiation was used for the measurements with an angular range of $5° < 2\theta < 70°$ at room temperature.

Result and Discussion

The ethanol extract of *Brugmansia suaveolens* (BS) were subjected to photochemical screening with the various qualitative chemical test. The results were summarised in the **Table 1**. The present investigated plant may contain contains hyoscine, apohyoscine, norhyoscine, atropine and noratropine type of alkaloid, a relatively high proportion of tigloyl esters-3α,6β-ditigloyloxytropan-7β-ol, 6β-tigloyloxytropan-3α,7β-diol,3α-tigloyloxytropan-6β,7β-diol (meteloidine) and (-) and (±)-3α-tigloyloxytropan-6β-ol. The roots contain hyoscine, meteloidine, atropine, littorine, 3α-acetoxytropane, 6β-(α-methylbutyryloxy)-3α-tigloyloxytropane, 3α,6β-ditigloyloxytropan-7β-ol, 3α-tigloyloxy tropan-6β-ol, tropine and cuscohygrine are present in the plant.

Norhyoscine is a principal alkaloid of the corollas. A new flavonol glycoside, kaempferol 3-*O*-*α*-L-arabinopyranosyl-7-*O*-*β*-D-glucopyranoside , has been isolated from ethanol extract of leaves of *B. suaveolens* , along with six other known compounds, which include kaempferol 3-*O*-*α*-L-arabinopyranoside, 3-phenyl lactic acid, 3-(3-indolyl) lactic acid, and its methyl ester, physalindicanol A and physalindicanol B [15-16].

Wide Angle X–ray Diffraction Study

The XRD pattern was recorded (**Figure 1**) mainly to determine the presence of protective layer over the MS providing evidence for the corrosion inhibitory effect. XRD patterns were recorded for the MS surface and MS after 2 hours immersion in 1.0 M HCl with 400 ppm concentration of inhibitors and are shown in Fig. 1. XRD pattern for polished MS specimen (pattern a), revealed the characteristic values for Fe (44.8˚ and 64.9˚). The dramatic decrease in the intensity at 44.8˚ and the absence of the peak at 64.9˚ for MS in the presence of inhibitors (BS) clearly showed the formation of a protecting layer on the MS [17]. In addition to that, in our study peaks between 20 to 30 for MS in the presence of inhibitors strongly support for the possibility of a chemisorbed layer formation by organic molecules (C=O and N-H) on the MS surface in 1.0 M HCl solution [18].

Table 1 Phytochemical screening of the plant *Brugmansia suaveolens*

S.No.	Tests	*Results*
1.	Alkaloids	(+)
2.	Amines	(+)
3.	Carbohydrates	(+)
4.	Cardiac Glycosides	(-)
5a	Terpenoids	(+)
5b.	Steroids	(+)
6.	Saponins	(-)
7.	Fixed oils & Fats	(-)
8a.	Tannin	(-)
8b.	Phenolic compounds	(-)
9.	Proteins & Free amino acids	(-)
10.	Flavonoids	(+)

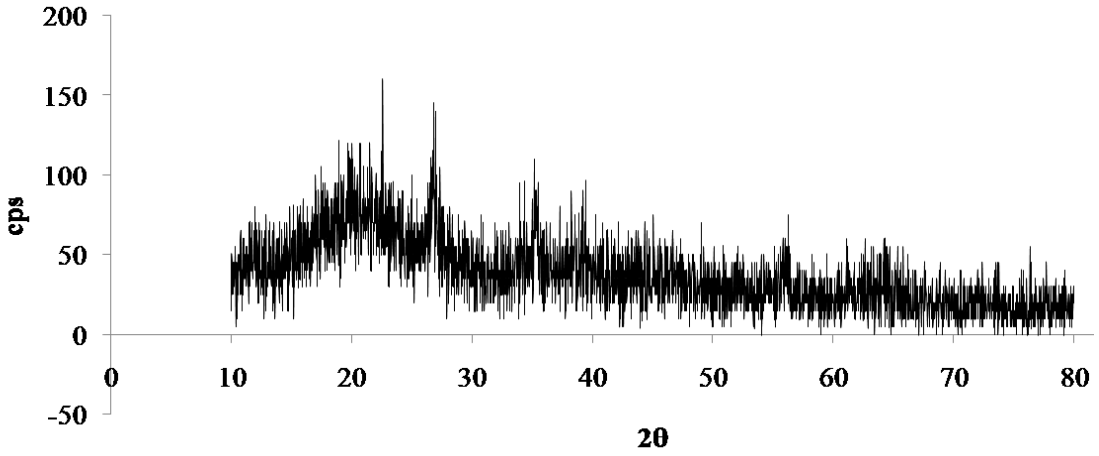

Figure 1 WAXRD pattern of MS surface and MS exposed 1.0 HCl in the presence of BC.

Conclusion

The present study provides rich source of phytochemical constituents present in the ethanolic extract of *Brugmansia suaveolens*. Furthermore XRD proved that the *Brugmansia suaveolens* extract act as a good adsorptive inhibitor on mild steel due to the presence of heterocyclic constituents.

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