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Deterioration Inhibition Of Spherical Shape Of Mild Steel In Acidic Medium By *Philanthus embilica*.

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ABSTRACT

The inhibition of corrosion of mild steel in 1M H2SO4 solution at room temperature by methyl red (2, 4-Dimethylamino-2'-carboxylazobenzene), an organic compound was studied using the weight loss technique. The concentration of the methyl red was varied as 1.0%, 2.0%, 3.0%, 4.0%, 5.0% and 6% weight of each acidic medium and their effects were carefully studied on the corrosion rate of mild steel. The results obtained showed methyl red to be an efficient inhibitor in the acid environment with general decrease in corrosion rate as the concentration of the organic compound increases. The adsorption of the inhibitor on the mild steel obeys the Langmuir adsorption isotherm.

Keywords: Corrosion, Mild Steel, *Philanthus embilica*, H_2SO_4.

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INTRODUCTION

The weight loss technique was studied using *Philanthus embilica* as an inhibitor by room temperature at 1M H_2SO_4 solution in mild steel of spherical shape. The concentration of *Philanthus embilica* was prepared at different concentrations of 1.0%, 2.0%, 3.0%, 4.0%, 5.0% and 6% of the weight of each acidic medium and their effects on the corrosion rate of the mild steel. The results showed that the organic compound increases as the concentration of the corrosion rate in general decreases with the acidic environment. The Langmuir adsorption isotherm of the mild steel obeys on the inhibitor of adsorption.

The health benefits of Indian gooseberry are also known for their high vitamin C content. It helps to increase the immune system, reduce aging, treat throat infections, lower blood sugar levels and develop heart health. Amla acts as a diuretic agent, so it is thought to improve food absorption, balance stomach acids, strengthen the liver, and boost brain and mental function. It strengthens the lungs, enhances fertility, helps the urinary system, better skin quality, andpromotes healthy hair. This fruit boosts vitality, aids vision maintenance, and enhances muscle tone.

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Indian gooseberry or amla (*Emblica officinalis* or *Philanthus embilica*) is a tree of very sour and nutritious fruit that grows in India, the Middle East and some other Southeast Asian countries. It is known as Amla in India and Amalaki in Sanskrit. Because of its powerful antioxidant properties, it is often used in Ayurvedic medicine to enhance the health and skin of the body and the overall immunity of the body.The fruit is light green and will be very sour and fiber to eat. In India, it is eaten with salt and chilli powder or as a pickle or sugar confectionery. It is an important ingredient of Triphala and Sivanprash, both of which are traditional herbal Indian formulas for enhancing health. Amla is also available in various forms such as powder, juice, oils, tablets and spices.Indian gooseberry or amla is rich in vitamin C and vitamin A l It contains high levels of folic acid and minerals such as calcium, potassium, phosphorus, iron, carotene and magnesium l According to the USDA National Nutrition Database, Indian gooseberry is low in calories and only 44 calories per 100 grams of fruit l More than 80% water, protein, minerals, carbohydrates and Fiber.

Gooseberry contains chromium, which has a therapeutic value in people with diabetes. It stimulates an isolated group of insulin-secreting cells, thus lowering blood sugar in diabetic patients. When blood sugar is low, glucose is used by cells to act as a force. Thus, without the risk of blood sugar declines and spikes in diabetics, the metabolism is stronger and you have more energy. Chromium also has the effect of beta-blockers used for heart health by demanding the amount of LDL (bad) choles

Amla powder is used in many hair tonics because it enriches hair growth and hair pigmentation. It strengthens roots, maintains color and enhances magnetism. Applying amla oil to your roots will improve hair growth and color. Amla oil is very popular in India because it has been proven to reduce the risk of hair loss and baldness. This quality is the carotene content of the amla.

Amla prevents health-related hyperlipidemia by demanding the number of free radicals in the body through its antioxidant qualities. Vitamin C and antioxidants help scavenge free radicals; Free radicals are associated with signs of aging such as wrinkles and age spots. Amla powder is used as a face mask to remove age spots.

Working Materials and Sample Preparation

Work Materials and Specimen Preparation

The Metallurgy Department of the Spectrochemical Research Laboratory has obtained the use of the cylindrical steel wire in this study. It was cut to a length of 30cm and properly machined to a diameter of 20mm. It was manually polished using silicon carbide grinding paper to Phase 60 and 120 to ensure smooth surface and minimize corrosion attack on the specimen. It was manually polished using silicon carbide grinding paper to Phase 60 and 120 to ensure smooth surface. After polishing, the rod was cut 3cm long and the edges of these cut pieces were polished. The rods were placed in a desiccator to prevent corrosion testing. Seven specimens with a diameter of 3cm and a diameter of 20 mm were used for testing, marked A, B, C, D, E, F and G. The rods were kept in a desiccator to prevent corrosion prior to experimentation. Seven specimens of length 3cm and diameter 20mm were used for the experiment and were denoted as A, B, C, D, E, F and G.

Inhibitor and Acid

Phyllanthus embilica is used as an inhibitor. Its structural formula is shown in Figure 1 and its molecular formula is $C_{15}H_{15}N_3O_2$. It was prepared in different concentrations as 1%, 2%, 3%, 4%, 5% and 6%. These were used as a blocking compound and diluted with 56 mL of H_2SO_4 to obtain 944 ml of distilled water with a 1M solution of H_2SO_4. It was used as corrosive media for its analogue quality and its filtration for bi-filtered water.

Testing Procedures

The samples were dried in ethanol, air-dried and incubated with 5% concentrated hydrochloric acid (HCl). 30 seconds and an analytical balance using weighed. In the absence of 100 ml of corrosive solution, weigh the samples before and after hanging.

A, B, C, D, E, F and G samples were immersed in seven separate 150 ml open beakers with 100 ml of 1M H_2SO_4. The total concentration of the inhibitor (Phyllanthus embilica) under test was mixed with H_2SO_4 solutions. At concentrations of 0% (control), 1%, 2%, 3%, 4%, 5% and 6%, respectively. Twenty-one days of testing allowed by periodically measuring weight loss every 72 hours. Samples were removed from the beakers, rinsed with a brush, rinsed with distilled water, rinsed with alcohol,to observe the behaviour of corrosion reactions of the tested samples, tests with no inhibitors were performed to compare the tests in restricted environments.) The erosion rate (R) in millimetres per year is estimated [1].

$$\text{Corrosion rate, } R=\frac{87.6W}{DAT} \text{--} (1)$$

Where:
W = Weight loss (W_L) = Initial weight (W_1) – Final weight (W_2) in milligrams.
A = Total surface area of specimen in cm^2.
T = Total time sample was immersed in hours.
D = Density of the specimen in g/cm^3.
R = Corrosion rate in millimetres per year.

The specimens used have cylindrical geometry and each has a total surface area given by:

$$A=2\pi r(l+r) \text{--} (2)$$

Where,
l = length of specimen in cm.
r = radius of specimen in cm.

Curves of corrosion rate (calculated) versus time of immersion were also plotted.

The percentage inhibitor efficiency, P, was calculated from the equation:

$$P=R_1- R_2R_1 \text{ X } 100 \text{--} (3)$$

Where $R_1$and R_2 are the corrosion rates in the absence and the presence respectively, of a predetermined concentration of inhibitor [2-5]. The percentage inhibitor efficiency was calculated for all the inhibitors throughout the exposure period. The degree of surface coverage (ϴ) was calculated from equation:

$$\Theta=R_1-R_2R_1 \text{---} (4)$$

RESULTS AND DISCUSSION

Table- 1.reveals that the mild steel specimen used in this study contains approximately 99% of the other trace elements remaining in the metal extraction process. These levels of trace elements are insignificant to the chemistry of the steel specimens in the corrosive medium.

Table 1: Weight losses in 0-5% concentration of Phyllanthus embilica in 1M H_2SO_4 at every 12-72 Hrs.

Specimen	Concentrationof H_2SO_4 (%C)	Temperature	12 hrs	24 hrs	48 hrs	72 hrs
			$WL10^{-2}$	$WL10^{-2}$	$WL10^{-2}$	$WL10^{-2}$
A	0	30	0.0202	0.0203	0.0202	0.0203
B	1	40	0.0016	0.0039	0.0126	0.0274
C	2	50	0.0115	0.0197	0.0306	0.0495
D	3	60	0.0355	0.0516	0.0748	0.0924
E	4	70	0.0516	0.0744	0.0921	0.1123
F	5	80	0.0721	0.0925	0.1156	0.1382

The weight-loss mild steel was studied at various time intervals from 12 hrs to 72 hrs in the presence and absence of stated concentrations of Phyllanthus embilica in 1M H_2SO_4. The values of weight-loss (W_L), corrosion rate (R), the percentage inhibition efficiency and surface coverage are presented in Table-2. Weight loss was added to the specimen A toF which no inhibitor was added.

Table 2- Inhibition efficiency, Corrosion rate and Surface coverage of Phyllanthus embilica onmild sphericalshape of steel at every 12-72 Hrs.

Specimen	Concentrationof Inhibitor (Phyllanthus embilica) C (%)	Temperature	Corrosion Rate mpy	Inhibitor Efficiency 1%	Surface Coverage 10^2 (Θ)
			WL10^{-2}	**WL**	**WL**
A	0	30	2.000	0	0
B	1	40	8.260	13.33	0.0967
C	2	50	8.230	33.23	0.1334
D	3	60	7.640	20.07	0.2008
E	4	70	6.104	59.87	0.5985
F	5	80	5.107	67.07	0.9967

Specimen G to which the highest concentration of inhibitor was added to the lowest weight loss. The corrosion rate decreased drastically with the application of Phyllanthus embilica to the steel surface with inhibitor molecules. The weight-loss measurements are not linearly proportional to the value of the Phyllanthus embilica concentration, which is most likely due to the formation of a protective film that prevents the diffusion of the steel into an irrigation perspective.

Figures 1-3 show the different inhibitor (Phyllanthus embilica) concentrations at the time of exposure with the weight-loss and corrosion rate of the variation. 4 shows the inhibitor concentration with the percentage inhibition efficiency of the variation [7-8]. This could be attributed to the increased inhibition efficiency of Phyllanthus embilica.

Figure-1 show corrosion of steel by strong sulphuric acid as a function of temperature and concentration. More dilute acid attack steel very rapidly.It is an iso corrosion chart. This is a streamlined method devised by the author for presenting corrosion data, but it can be utilized only when a large amount of data are available to delineate the curves.

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The curves in fig 1.represent corrosion rates of o, 1, 2, 3,4,5,6. These are corrosion or constant corrosion lines. In other words, the outlined areas represent regions where corrosion rates of 0 to 6 mpy would be expected. The corrosion of steel by strong sulphuric acid is complicated because of the peculiar dips in the curves or the rapid increase in corrosion in the neighbourhoods of acids.

The narrowness of this range means that the acids must be carefully analysed in order to obtain reliable corrosion data [9]. The dips or increased attack around 85% are more gradual and less difficult to establish.

Fig 2 indicates that the steel would not be suitable in communications below about 6% at any temperature. Above6% strength, steel can be used. Depending on the temperature involved. Steel is generally above 5 of at concentration up to 6%, applications involving corrosion rates in the range in the range of 5 to 6would involve relatively short life for steel and should be considered carefully.

Steel should be used only if economics demands the use of steel in spide of fairly frequent replacement. Steel comparatively high rates of corrosion around 1-6% acid. High velocity would increase corrosion of steel by concentrated acids because they are inherently oxidizing in nature. Entrained air may have a destructive effect on steel in strong acid service. A long steel line handling 93% sulphuric acid failed prematurely because of grooving of the top inside surface of the pipe. The groove was very sharp and deep and the other surfaces of the pipe showed practically no attack.

Figure 1

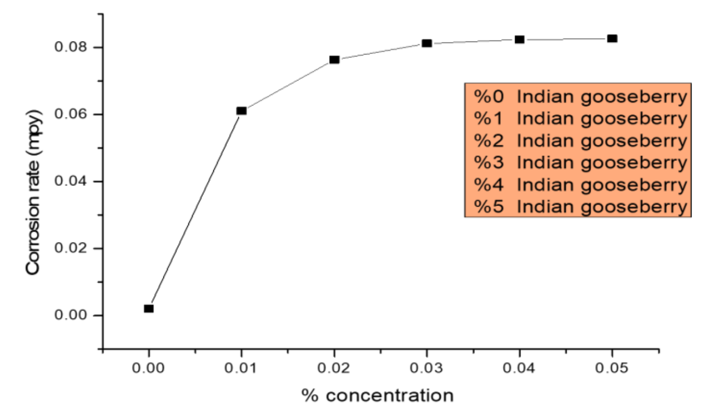


Figure2

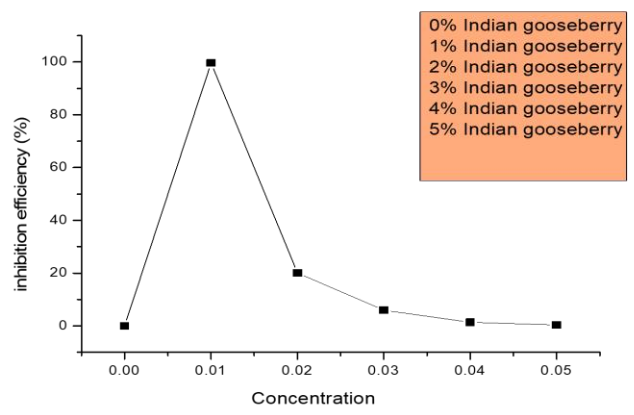
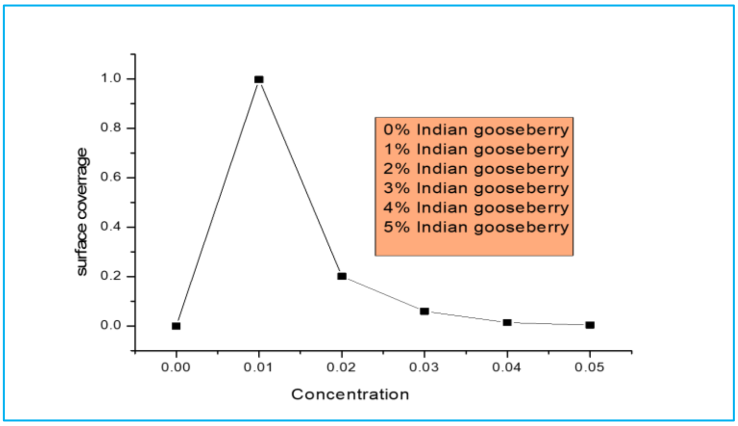


Figure 3



The air was drawn into the system through the packing of the pumps moving the acid. This rapid failure of the line was overcome by veining the air or by preventing the air from entering the pump. Heat treatment of about restores the corrosion resistance.

The highest inhibition efficiency was observed with the addition of 6% concentration of Phyllanthus embilica. This behaviour suggests that the inhibition of the adsorption of molecules onto the molecules of surfaces and Phyllanthus embilica acts as an adsorption inhibitor.

The inhibition action of Phyllanthus embilica is ascribed to the presence of this compound in heteroatoms. Organic compounds that contain functional groups such as -OR and -NR_2 have been reported to inhibit corrosion of metals in alkaline or acidic solutions [10]. The addition of Phyllanthus embilica with similar electrochemical reactions obtained by The Curves. The higher the inhibitor concentration, the higher the inhibitor concentration with the solutions obtained. The Mild Steel Surface provides protection against the formation of a mild steel surface. This film reduces the active surface area of the corrosive medium and delays hydrogen evolution and iron dissolution.

The observed phenomenon is more commonly described as the metal surface at the adsorbed species of a protective layer of the formation of the corrosion inhibition. In the presence of Phyllanthus embilica, corrosion is inhibited by the adsorption of organic molecules onto the metal surface. Phyllanthus embilica is highly enhanced by the presence of iron ions. This is illustrated by the results of the condensation and polymerization reactions leading to the production of iron ions.

The metal / solution interface at the corrosion inhibitors of adsorption is due to the electrostatic or covalent bonding between the adsorbents and the metal surface atoms. The metallic surfaces adsorbed to the inhibiting properties and behaviour of the Phyllanthus embilica molecules, which is the main inhibiting effect for physiochemical reactions. Thus, it is the iron for a good inhibitor.

Furthermore, it is well known that organic compounds, particularly those present in p-bonding, are favored when a strong adsorption process takes place on the metal surface [11]. The properties of the adsorption properties of the metals and alloys have been deduced during the corroding surface of the nature of the inhibitor interaction.

The metal surface can be applied to the adsorption behavior of the inhibitor molecules [12-16]. Several adsorption isotherms can be used to evaluate the inhibitor of adsorption behavior. The Langmuir adsorption isotherm was found to be the best description of the adsorption behavior of Phyllanthusembilica on a mild steel surface, which obeys the following equations [17- 20].

$$\theta = KC1+KC \quad (5)$$

Re-arranging, $C\theta = C+1K$ (6)

Where C is the inhibitor concentration, K is the adsorption equilibrium constant, and surface is the inhibitor of surface coverage. Phyllanthus embilica solutions of different temperature of in Fig. 3. The deviation of the slope from unity is attributed to the molecular interaction between the adsorbed inhibitor species, a factor which was not taken into account The Langmuir equation of derivation. The Langmuir isotherm assumes that: The metal surface contains a fixed number of adsorption sites and one that holds each site.

CONCLUSIONS

In this study, the weight loss technique reveals Phyllanthus embilica to be an effective inhibitor of mild steel in sulphuric acid corrosive medium. The inhibition efficiency increases with increasing inhibition efficiency of Phyllanthus embilica at 6% inhibitor concentration.At this value, the lowest corrosion rate value of 0.0051 mpy was obtained. This is a mixed type inhibitor whose adsorption on mild steel is physiochemical. This is mainly due to film formation, thus blocking the active sites on cathodic and anodic regions. The adsorption isotherm of this inhibitor of the adsorption obeys Langmuir.

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