INTRODUCTION

Mild steel, an alloy of iron is widely used in petrochemical, chemical and metallurgical industries. However, this material has low corrosion resistance in acidic medium that leads to economic losses. Fuel tank, tubbing system, connecting rod etc., are commonly made from mild steel. Therefore, it is important to investigate the corrosion behaviour of mild steel in petroleum fuels. The use of inhibitors is one of the most practical methods for protection against corrosion [10]. It is already proved that organic compounds having heteroatoms can be used as effective corrosion inhibitors for mild steel in acid medium [11]. Several researches have been made using corrosion preventive practices by the oils derived from various plants as an corrosion inhibitors [12]. Vegetable oil esters are receiving increasing attention as a non-toxic, biodegradable, ecofriendly and renewable alternative source diesel fuel. Many studies have shown that the properties of biodiesel are very close to diesel [13,14]. Therefore, biodiesel can be used in diesel engines with little or no modifications. Although there are many works on the preparation and characterization of biodiesel, there is little information on the corrosion behaviour of biodiesel on metallic diesel engine parts [15]. In the present study, the vegetable oil Cleome viscosa Linn (Dog mustard) seed oil used as a biodiesel resource was selected. The corrosion inhibition efficiency of this oil was analysed using mild steel specimens in acid medium with and without the presence of inhibitor at different concentrations (250,500,750 and 1000ppm) and different time intervals (24,48, and 72 hours) at room temperature.

MATERIALS AND METHODS

A rectangular mild steel specimen of size 5 x 1.5 x 1.5 cm was cut from a parent mild steel sheet. The free specimens were pickled with a pickling solution, washed with water, rubbed with cotton cloth and dried then mechanically polished, degreased with trichloroethylene and kept in a desiccators for 2 hours. These plates were used for the weight loss studies. The seeds of Cleome viscosa is collected from the natural habitat and processed. The oils were extracted by mechanical method. The bioinhibitors were added to the acid medium at different concentration and kept at room temperature for different time duration.

In this investigation, the gravimetric weight loss measurement was carried out for mild steel specimens in the presence and absence of inhibitor. The initial weight of the specimens was noted as W1. 250ml of 1N HCl was taken in a beaker, the specimens were dipped in the solution for 24 hours, 48 hours and 72 hours with and without the presence of green inhibitor at the concentrations 250,500,750 and 1000ppm and kept at room temperature. At different intervals, the specimens were taken from the solution and dried and the final weight was noted as W2. The difference between the initial weight and final weight gave the actual weight loss of the specimens (W). The experiments were carried out in triplicates. From the weight loss, the corrosion rate was determined using the formula:

$$\text{Corrosion rate (mmpy)} = \frac{87.6 \times W}{D \times A \times T}$$

Where,

- W is the weight loss in grams
- D is the density in g/cc
- A is the area of exposure in cm²
- T is the exposure time in hours
- mmpy is the millimeter per year

The effectiveness of the inhibitor was assessed in terms of its inhibition efficiency (I.E %) by the following formula:

$$\text{I.E (%) = (weight loss)} \times \frac{(\text{blank solution})}{(\text{weight loss}) (\text{blank solution}) - \text{weight loss with inhibitor}}$$

Where,

- B.S is the weight loss without inhibitor (blank solution)
- I.S is the weight loss with inhibitor

RESULT AND DISCUSSION

Table 1. Variation of corrosion rate (mmpy) at different concentration of Cleome viscosa seed oil bioinhibitor at different time duration

<table>
<thead>
<tr>
<th>Concentration of inhibitor (ppm)</th>
<th>Time duration in hours</th>
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<tbody>
<tr>
<td></td>
<td>24 HRS</td>
</tr>
<tr>
<td></td>
<td>48 HRS</td>
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<tr>
<td></td>
<td>72 HRS</td>
</tr>
<tr>
<td>Control</td>
<td>0.0137</td>
</tr>
<tr>
<td>250ppm</td>
<td>0.0012</td>
</tr>
<tr>
<td>500 ppm</td>
<td>0.0011</td>
</tr>
<tr>
<td>750 ppm</td>
<td>0.0009</td>
</tr>
<tr>
<td>1000 ppm</td>
<td>0.0005</td>
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</tbody>
</table>
The results of the weight loss measurement and scanning electron microscope analysis showed that Cleome viscosa seed oil is a potential bioinhibitor against corrosion of mild steel in acid medium. The inhibition efficiency was increased when higher concentration of Cleome seed oil was added to the acidic medium. SEM micrographs showed in the presence of inhibitor dissolution of corrosion rate was reduced. Hence using these neat oils as biodiesel resources is also safe to the engine from the point of corrosion and as well as safe to the environment due to biodegradable and non-toxic nature to the environment.

REFERENCES: