GSJ: Volume 9, Issue 12, December 2021, Online: ISSN 2320-9186
www.globalscientificjournal.com

INVESTIGATION OF THE INHIBITIVE EFFECT OF LUCKY NUT OIL ON THE CORROSION OF MILD STEEL PLATE

J. Adi [1], E. Peter [2] and S.A. Aye[3]
[1,2,3]Mechanical Engineering Department, Federal University of Agriculture, Makurdi, NIGERIA

ABSTRACT

Investigation of the inhibitive effect of lucky nut oil on the corrosion of mild steel plate was carried out. Lucky nut oil otherwise called yellow oleander oil (Thevetia Peruviana), extract was made from the plant seeds using the crude method, thus drying the seeds and grinding with the aid of a grinding stone and then compressing the grind manually to get the oil. Blends were made with polished mild steel, H_2SO_4, NaOH, water and lucky nut oil for five weeks or 840 hours. The different blends used were water, NaOH and dilute H_2SO_4 solution. The results obtained showed that corrosion rate decreased with increase in inhibitor concentration in water and increased with decrease in inhibitor concentration in water. The corrosion rate in dilute H_2SO_4 decreased a bit with increase in inhibitor concentration and increased immensely with decrease in inhibitor concentration and the corrosion rate in absence of inhibitor was catastrophic. The presence of inhibitor indicated no change on the corrosion rate of polished mild steel plate in NaOH. Thus, it can be concluded that Lucky nut oil as an inhibitor is very effective in water, slightly effective in dilute H_2SO_4, mainly because of primary absorption of its oil (lucky nut oil) on the surface of the mild steel plate and could replace toxic organic chemicals. It poses no change on the corrosion rate of mild steel plate in NaOH as the blend do not corrode even in the absence of the inhibitor in NaOH solution. It concluded that corrosion rate of mild steel plate in water and dilute H_2SO_4 is a function of the concentration of lucky nut oil as an organic inhibitor.

Keywords: Corrosion, Lucky nut, Seeds, Inhibitor, Oil, Mild steel

1.0 INTRODUCTION

Corrosion can be defined as the destructive alteration of the properties of a material when in contact with its environment [1]. Corrosion involves the reaction of a metallic material with its environment and is a natural process in the sense that the metal is attempting to revert to the chemically combined state in which it is almost invariably found in the earth's crust. The process involves chemical reaction between dry-metal surface and the environment [2]. Whilst it is, therefore, a process that may be expected to occur, it should not be regarded as inevitable and its control or prevention is possible through a variety of means. The latter have their origins in electrochemistry, since the reactions involved in causing corrosion are electrochemical in nature, but corrosion control is as much in the hands of the engineering designer as it is the province of the corrosion prevention specialist.

To the engineer, corrosion may be regarded as resulting in a variety of changes in the geometry of structures or components that invariably lead, eventually, to a loss of engineering function e.g. general wastage leading to decrease in section, pitting leading to perforation, cracking leading to fracture. The rusting of ordinary steel is the most common form of corrosion and overall adds up to a high proportion of the total cost attributed to corrosion. Usually, an indication of corrosion in hidden metals and alloys is sudden failure. It is one of the major problems affecting the performance, safety and appearance of materials [3, 4, 5, 6].

All corrosion, however, is not of the general type and localized effects may pose more complex problems, especially in the engineering context. Corrosion is due to a metal inherent desire to return to a more chemically stable state when exposed to the environment [1, 7, 8]. It is important to realize that corrosion characteristics are not inherent properties of alloys, as are yield strength, electrical conductivity and the like, since they relate to a combination of alloy and environment. Consequently, an alloy may be very resistant to corrosion in a particular environment, yet perform poorly in another and even in a given environment factors like temperature, rate of flow and geometrical aspects may be critical. In any event, the significance of corrosion to the engineer is that it leads to loss of engineering function and the following examples have been chosen to illustrate this in a variety of the branches of engineering. They also serve to define some of the commoner forms of aqueous corrosion and their various consequences. The metals tend to interact with their environment thereby forming products of poor mechanical properties. In the water supply industry, corrosion creates severe problems to the water pipes such as potable water pipes which are severely attacked by corrosion or aqueous corrosion [4, 6, 8, 9, 10, 11, 12, 13, 14, 15].

Apart from wet corrosion or aqueous corrosion, buried pipes could be attacked by microbes [4, 6, 13, 15, 16]. As a result, corrosion does not only bring about heavy economic losses, but also causes the following:

1. Loss of transported products such as oil, gas and water.
2. Loss of efficiency in the production process, caused by clogging of pipes with rust.
3. Contamination of products in cans

   As a result of the problems, several methods have been devised to control and prevent corrosion. Use of extracts of natural plant to control corrosion has been proposed and is being investigated by scientists.

   A possible plant of interest is the lucky nut otherwise called yellow oleander plant extract

Lucky nut is an evergreen shrub with a sticky appearance and lovely yellow flowers. The botanical name is Thevetiaperuviana. Other common names include “mexican Oleander and yellow oleander’’ lucky nut is native to South America and thrives in a tropical climate [17, 18].

Lucky nut can grow very tall about 6 to 9m in its native habitat, but is considerably shorter in cultivation, about 1.2 to 3.6m. It can be trained to grow as a tree with a single trunk or allowed to grow in a woody, splitting off in multiple directions. The leaves are 5.5 to 15cm long and narrow to a point at the end. They are a deep glossy green, with a smooth leathery texture.

The flower of lucky nut is about 5cm to 7cm long and grows in clusters at the end of branches. They are usually a rich, bright shape of yellow, though there is a peach colored variety as well. They have gently over lapping petals forming a funnel shape with a deep center containing pollen and nectar.
They are attractive to bees and butterflies and have a sweet fragrance. Lucky nut flowers bloom repeatedly during the warm seasons and are followed by fleshy, seed containing fruits.

The cost and problems associated with corrosion- resistant materials mean that, in many cases, the use of corrosion inhibitors is a practical and economic alternative, which can be designed in a retrofitted treatment. In areas of inhibitor application, there are demands for improved performance of inhibitors to operate under severe conditions. A greater driving- force comes from the environment and more awareness of the adverse effects of certain inhibitive chemicals [2, 10, 13, 14, 18, 19].

The use of natural corrosion inhibitor immersed in an acidic and alkaline media respectively to ascertain the effect of both on the corrosion control of mild steel in the presence of lucky nut as a natural corrosion inhibitor is more economical than the use of heavy chemicals in the industries for the control of corrosion in mild steel. The importance of these cannot be overemphasized for growing industries, especially, in our country Nigeria.

The main objectives of this work are to;

1. Study the possibility of using lucky nut extract as an organic corrosion inhibitor in mild steel in a corrosion environment.
2. To estimate the efficiency of lucky nut as a corrosion inhibitor in an acidic, water and alkaline media respectively.
3. Find a new use for lucky nut plant extract.
4. To investigate and estimate the formation of a protective firm on a metal surface

Today inhibitors, in common, with other chemical products must maintain or improved on existing technical performance. They must be safe to use and environmentally safe. They must also be versatile to cope with new applications and formations in the light of these requirements. Most common chemical inhibitors have proved ineffective and detrimental. Economics of inhibitor used, is an important requirement of corrosion inhibition. This includes inhibitors cost, treatment, monitoring and development. Conversely, less amount will be required to source corrosion inhibitors locally. The local sourcing if successfully done will go a long way in promoting appropriate indigenous technology [3, 8, 14, 17, 18, 20, 21].

Corrosion is a menace that has plagued mild steels. The study will be concerned with how effective lucky nut plant extract can be used as an organic inhibitor for corrosion inhibition of mild steels. Analysis will include samples of polished mild steel been dropped in different mixtures of lucky nut extract with water, grand pure soya oil, tetraoxosulphate (vi) acid and sodium hydroxide in different proportions for five weeks.

2.0 MATERIALS AND METHODS

2.1 Materials

The materials used for this investigation are as listed below

1. A well-polished mild steel (30mm)
2. Distilled water
3. 250mL beaker (13 pieces)
4. Silicon carbide paper
5. Hand lens
6. Tetraoxosulphate (vi) acid
7. Sodium Hydroxide
8. Lucky nut oil was extracted and proportions poured into beakers

Samples A to M are shown below in Figure 1.

Beaker A: Contains 80mL of diluted tetraoxosulphate (vi) acid, three 30mm of polished mild steel and this was used as the control medium

Beaker B: Contains 80mL of sodium hydroxide solution and three 30mm of polished mild steel, it was also used as a control medium

Beaker C: Contains 80mL of distilled water and three 30mm of polished mild steel

Beaker D: Contains 80mL of distilled water, 5mL of lucky nut oil and three 30mm of polished mild steel

Beaker E: Contains 80mL of distilled water, 10mL of lucky nut oil and three 30mm of polished mild steel

Beaker F: Contains 80 mL of diluted tetraoxosulphate (vi) acid, 5mL of lucky nut oil and three 30mm of polished mild steel

Beaker G: Contains 80mL of diluted tetraoxosulphate (vi) acid, 10mL of lucky nut oil extract and three 30mm of polished mild steel

Beaker H: Contains 60mL of distilled water, 20mL of tetraoxosulphate (vi) acid, 5mL of lucky nut oil and three 30mm of polished mild steel

Beaker I: Contains 60mL of distilled water, 20ml of tetraoxosulphate (vi) acid, 10mL of lucky nut oil and three 30mm of polished mild steel

Beaker J: Contains 80mL of sodium hydroxide solution, 5mL of lucky nut oil and three 30mm of polished mild steel

Beaker K: Contains 80mL of sodium hydroxide solution, 10mL of lucky nut oil and three 30mm of polished mild steel

Beaker L: Contains 60mL of distilled water, 20mL of sodium hydroxide solution, 5mL of lucky nut oil and three 30mm of polished mild steel

Beaker M: Contains 60mL of distilled water, 20mL of sodium hydroxide solution, 10mL of lucky nut oil and three 30mm of polished mild steel

Figure 1: Prepared samples in beaker A to M

2.2 Methods

The plant extract (lucky nut oil) was extracted by first picking the dried seeds with its shell on it and further drying it after the outer cover was removed. With the use of a stone the shell was broken off and the seeds were further dried for about two days, then it was grinded using the local grinding stone. The grind was then put in a wide bowl with a little water added to it and after much compression you could see some deposits of oil on the surface, then with the aid of a small form the oil was soaked and pressed into a container. This process continued until there was no oil in the grind anymore at this stage, the grind becomes evenly hardened. The oil extract was then added in concentrations of 5mL and 10mL alternatively into beakers A to M (see

Figure 2) as earlier discussed in section 2.1 (materials) above, for about five weeks in a closed environment and at room temperature. 27.5cm^3 of the concentrated 2M H_2SO_4 acid was diluted in 500cm^3 of distilled water making the concentration of the diluted acid to be 0.11M. 1 N solution of NaOH was made by dissolving 40.0g of NaOH crystals in 1000cm^3 of distilled water.

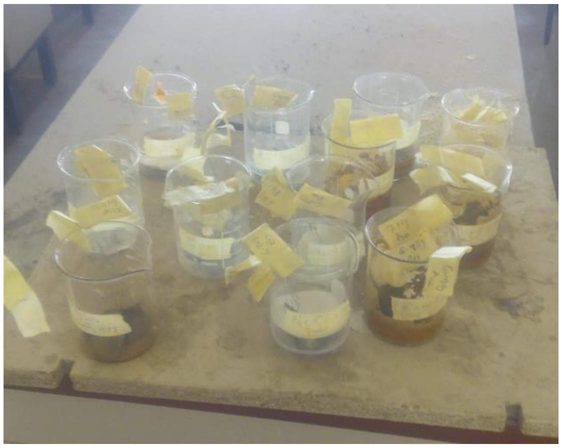

Figure 2: Submerged mild steel samples ready for taking of readings

3.0 RESULTS AND DISCUSSIONS

The results of the corrosion rate of polished mild steel is as presented below:

3.1 Results

Table 6: Week one result

S/N	Medium	Proportion (mL)	Materials	Resident Time (hr)	Observation
1	H_2SO_4	80	Polished mild steel plate	168	1 By visual inspection, corrosion was seen. 2 Viewed with hand lens, corrosion attack was high.
2	NaOH	80	Polished mild steel plate	168	1 By visual inspection, no corrosion was seen. 2 Viewed with hand lens, no corrosion was seen.
3	Water	60	Polished mild steel plate	168	1 By visual inspection, corrosion was seen. 2 Viewed with hand lens, corrosion was much on the cut edges.
4	Water: Lucky nut oil	80:5	Polished mild steel plate	168	1 By visual inspection, corrosion of mild steel was little as the blend has some deposits of brownish color. 2 Viewed with hand lens, the corrosion effect observed at the cut edges was minimal

5	Water: Lucky nut oil	80:10	Polished mild steel plate	168	1 By visual inspection, no corrosion was seen on the mild steel, but color of blend slightly changes to horse blood. 2 Viewed with hand lens, corrosion seen was very insignificant.
6	H_2SO_4 :Lucky nut oil	80:5	Polished mild steel plate	168	1 By visual inspection, the corrosion seen is small as there was some substance formed on the surface of the blend. 2 Viewed with hand lens, corrosion effect were seen at the cut edges
7	H_2SO_4 : Lucky nut oil	80 : 10	Polished mild steel plate	168	1 By visual inspection, there were some observed substance on the surface of the blend with corrosion seen a little. 2 Viewed with hand lens, corrosion effect were observed at the cut edges.
8	Water : H_2SO_4 : Lucky nut oil	60 : 20 : 5	Polished mild steel plate	168	1 By visual inspection, corrosion effect was not seen. 2 Viewed with hand lens corrosion was seen on the cut edges
9	Water : H_2SO_4 : Lucky nut oil	60 : 20 : 10	Polished mild steel plate	168	1 By visual inspection, corrosion was not seen, instead there was some oily deposits on the surface of the blend. 2 Viewed with hand lens, the corrosion seen was slight on the cut edges
10	NaOH : Lucky nut oil	80:5	Polished mild steel plate	168	1 By visual inspection, no corrosion effect was observed, there were deposits of jelly-like whitish substance covering the surface of the blend. 2 Viewed with hand lens, no corrosion effect was observed.
11	NaOH : Lucky nut oil	80 : 10	Polished mild steel plate	168	1 By visual inspection, no corrosion was observed instead there was formation of a jelly-like solid whitish substance on the surface of the blend. 2 Viewed with hand lens, no corrosion was observed.
12	Water : NaOH : Lucky nut oil	60 : 20 : 5	Polished mild steel plate	168	1 By visual inspection, no corrosion was observed as the blend became a little viscous. 2 Viewed with hand lens, no corrosion effect was observed.
13	Water : NaOH Lucky nut oil	60 : 20 : 10	Polished mild steel plate	168	1 By visual inspection, no corrosion effect was seen as the blend became more viscous. 2 Viewed with hand lens, no corrosion effect was seen.

Table 7: Week Two Result

S/N	Medium	Proportion (mL)	Material	Resident Time (hr)	Observation
1	H_2SO_4	80	Polished mild steel plate	336	1 By visual inspection, corrosion was rapid. 2 Viewed with hand lens, corrosion effect was very intense.
2	NaOH	80	Polished mild steel plate	336	1 By visual inspection, no corrosion was seen

					2 Viewed with hand lens, no corrosion effect was observed.
3	Water	80	Polished mild steel plate	336	1 By visual inspection, corrosion was higher than the previous week as the color of blend turns light brown. 2 Viewed with hand lens, corrosion effect was more conspicuous.
4	Water : Lucky nut oil	80 : 5	Polished mild steel plate	336	1 By visual inspection, corrosion effect was very little though it was not seen on the mild steel but some small deposits of brownish coloration was seen on the surface of the blend. 2 Viewed with hand lens, corrosion effect was observed on the cut edges.
5	Water : Luckt nut oil	80 : 10	Polished mild steel plate	336	1 By visual inspection, no corrosion was observed on the mild steel but the color of blend turns horse blood. 2 Viewed with hand lens, no corrosion was seen on the mild steel.
6	H_2SO_4 : Lucky nut oil	80 : 5	Polished mild steel plate	336	1 By visual inspection, corrosion was seen.There were some crystal-like precipitate formed which was greenish- white in color . 2 Viewed with hand lens, corrosion was more pronounce.
7	H_2SO_4 : Lucky nut oil	80 : 10	Polished mild steel plate	336	1 By visual inspection, corrosion seen was a little but the crystals formed here were brownish in color. 2 Viewed with hand lens, corrosion was more pronounced on the cut edges.
8	Water : H_2SO_4 : Lucky nut oil	60 : 20: 5	Polished mild steel plate	336	1 By visual inspection, corrosion effect was not much, but it was more pronounced than the previous week. 2 Viewed with hand lens, corrosion was seen on the cut edges.
9	Water : H_2SO_4 : Lucky nut oil	60 : 20 : 10	Polished mild steel plate	336	1 By visual inspection, the formation of the oily substance increased as corrosion was not seen much. 2 Viewed with hand lens, corrosion was slight.
10	NaOH : Lucky nut oil	80 : 5	Polished mild steel plate	336	1 By visual inspection, there were some jelly-like whitish substance formed on the surface of the blend and this solid substance covered the surface of the blend with no corrosion seen. 2 Viewed with hand lens, no corrosion was seen.
11	NaOH : Lucky nut oil	80 : 10	Polished mild steel plate	336	1 By visual inspection, no corrosion was observed and the whitish substance which covered the blend solidified more. 2 Viewed with hand lens, no corrosion was observed.

12	Water : NaOH : Lucky nut oil	60 : 20 : 5	Polished mild steel plate	336	1 By visual inspection, no corrosion was seen and the blend became more viscous 2 Viewed with hand lens, the corrosion effect was very minimal on the cut edges.
13	Water : NaOH : Lucky nut oil	60 : 20 : 10	Polished mild steel plate	336	1 By visual inspection, corrosion effect was not seen and the blend became more viscous. 2 Viewed with hand lens, no corrosion was observed.

Table 8: Week Three Result

S/N	Medium	Proportion (mL)	Material	Resident Time (hr)	Observation
1	H_2SO_4	80	Polished mild steel plate	504	1 By visual inspection, corrosion was rapid. 2 Viewed with hand lens, corrosion effect was very intense.
2	NaOH	80	Polished mild steel plate	504	1 By visual inspection, no corrosion was seen 2 Viewed with hand lens, no corrosion effect was observed.
3	Water	80	Polished mild steel plate	504	1 By visual inspection, corrosion was higher than the previous week as the color of blend turns light brown. 2 Viewed with hand lens, corrosion effect was more conspicuous.
4	Water : Lucky nut oil	80 : 5	Polished mild steel plate	504	1 By visual inspection, corrosion effect was very little though it was not seen on the mild steel but some small deposits of brownish coloration was seen on the surface of the blend. 2 Viewed with hand lens, corrosion effect was observed on the cut edges.
5	Water : Luckt nut oil	80 : 10	Polished mild steel plate	504	1 By visual inspection, no corrosion was observed on the mild steel but the color of blend turns horse blood. 2 Viewed with hand lens, no corrosion was seen on the mild steel.
6	H_2SO_4 : Lucky nut oil	80 : 5	Polished mild steel plate	504	1 By visual inspection, corrosion was seen. There were some crystal-like precipitate formed which was greenish-white in color. 2 Viewed with hand lens, corrosion was more pronounce.
7	H_2SO_4 : Lucky nut oil	80 : 10	Polished mild steel plate	504	1 By visual inspection, corrosion increased a little but the brown color of the crystals was deepened. 2 Viewed with hand lens, corrosion was more pronounced on the cut edges.
8	Water : H_2SO_4 : Lucky nut oil	60 : 20: 5	Polished mild steel plate	504	1 By visual inspection, corrosion effect was more pronounced than the previous week.

					2 Viewed with hand lens, corrosion was seen on the cut edges more than the week before.
9	Water : H_2SO_4 : Lucky nut oil	60 : 20 : 10	Polished mild steel plate	504	1 By visual inspection, the formation of the oily substance increased as corrosion was not seen much. 2 Viewed with hand lens, corrosion was slight.
10	NaOH : Lucky nut oil	80 : 5	Polished mild steel plate	504	1 By visual inspection, there were some jelly-like whitish substance formed on the surface of the blend and this solid substance covered the surface of the blend with no corrosion seen. 2 Viewed with hand lens, no corrosion was seen.
11	NaOH : Lucky nut oil	80 : 10	Polished mild steel plate	504	1 By visual inspection, no corrosion was observed and the whitish substance which covered the blend solidified more. 2 Viewed with hand lens, no corrosion was observed.
12	Water : NaOH : Lucky nut oil	60 : 20 : 5	Polished mild steel plate	504	1 By visual inspection, no corrosion was seen and the blend became more viscous 2 Viewed with hand lens, the corrosion effect was very minimal on the cut edges.
13	Water : NaOH : Lucky nut oil	60 : 20 : 10	Polished mild steel plate	504	1 By visual inspection, corrosion effect was not seen and the blend became more viscous. 2 Viewed with hand lens, no corrosion was observed.

Table 9: Week Four Result

S/N	Medium	Proportion (mL)	Material	Resident Time (hr)	Observation
1	H_2SO_4	80	Polished mild steel plate	672	1 By visual inspection, corrosion was rapid. 2 Viewed with hand lens, corrosion effect was very intense.
2	NaOH	80	Polished mild steel plate	672	1 By visual inspection, no corrosion was seen 2 Viewed with hand lens, no corrosion effect was observed.
3	Water	80	Polished mild steel plate	672	1 By visual inspection, corrosion was higher than the previous week as the color of blend turns brown. 2 Viewed with hand lens, corrosion effect was more conspicuous.
4	Water : Lucky nut oil	80 : 5	Polished mild steel plate	672	1 By visual inspection, corrosion effect was very little though it was seen on the mild steel but some small deposits of brownish coloration was seen on the surface of the blend. 2 Viewed with hand lens, corrosion effect was observed on the cut edges.

5	Water : Luckt nut oil	80 : 10	Polished mild steel plate	672	1 By visual inspection, a little corrosion was observed on the mild steel and the color of blend remains horse blood. 2 Viewed with hand lens, corrosion was seen on the mild steel and the cut edges turns light brown in color.
6	H_2SO_4 : Lucky nut oil	80 : 5	Polished mild steel plate	672	1 By visual inspection, corrosion was seen. There were some crystal-like precipitate formed which was greenish- white in color. 2 Viewed with hand lens, corrosion was more pronounce.
7	H_2SO_4 : Lucky nut oil	80 : 10	Polished mild steel plate	672	1 By visual inspection, corrosion increased a little but the brown color of the crystals was deepened. 2 Viewed with hand lens, corrosion was more pronounced on the cut edges.
8	Water : H_2SO_4 : Lucky nut oil	60 : 20: 5	Polished mild steel plate	672	1 By visual inspection, corrosion effect was more pronounced than the previous week. 2 Viewed with hand lens, corrosion was seen on the cut edges more than the week before.
9	Water : H_2SO_4 : Lucky nut oil	60 : 20 : 10	Polished mild steel plate	672	1 By visual inspection, the formation of the oily substance increased as corrosion was not seen much. 2 Viewed with hand lens, corrosion was more than the previous week.
10	NaOH : Lucky nut oil	80 : 5	Polished mild steel plate	672	1 By visual inspection, there were some jelly-like whitish substance formed on the surface of the blend and this solid substance covered the surface of the blend with no corrosion seen. 2 Viewed with hand lens, no corrosion was seen.
11	NaOH : Lucky nut oil	80 : 10	Polished mild steel plate	672	1 By visual inspection, no corrosion was observed and the whitish substance which covered the blend solidified more. 2 Viewed with hand lens, no corrosion was observed.
12	Water : NaOH : Lucky nut oil	60 : 20 : 5	Polished mild steel plate	672	1 By visual inspection, no corrosion was seen and the blend became more viscous 2 Viewed with hand lens, the corrosion effect was very minimal on the cut edges.
13	Water : NaOH : Lucky nut oil	60 : 20 : 10	Polished mild steel plate	672	1 By visual inspection, corrosion effect was not seen and the blend became more viscous. 2 Viewed with hand lens, no corrosion was observed.

Table 10: Week Five Result

S/N	Medium	Proportion (mL)	Material	Resident Time (hr)	Observation
1	H_2SO_4	80	Polished mild steel plate	840	1 By visual inspection, corrosion was rapid. 2 Viewed with hand lens, corrosion effect was very intense.
2	NaOH	80	Polished mild steel plate	840	1 By visual inspection, no corrosion was seen 2 Viewed with hand lens, no corrosion effect was observed.
3	Water	80	Polished mild steel plate	840	1 By visual inspection, corrosion was higher than the previous week as the color of blend turns deep brown. 2 Viewed with hand lens, corrosion effect was more conspicuous.
4	Water : Lucky nut oil	80 : 5	Polished mild steel plate	840	1 By visual inspection, corrosion effect was very little though it wasseen on the mild steel but some small deposits of brownish coloration was seen on the surface of the blend. 2 Viewed with hand lens, corrosion effect was observed on the cut edges.
5	Water : Lucky nut oil	80 : 10	Polished mild steel plate	840	1 By visual inspection, corrosion was observed on the mild steel and the color of blend turns dark horse blood. 2 Viewed with hand lens, corrosion was seen on the mild steel and the cut edges had some deposits of brownish coloration.
6	H_2SO_4 : Lucky nut oil	80 : 5	Polished mild steel plate	840	1 By visual inspection, corrosion was seen. There were some crystal-like precipitate formed which was greenish-white in color . 2 Viewed with hand lens, corrosion was more pronounce.
7	H_2SO_4 : Lucky nut oil	80 : 10	Polished mild steel plate	840	1 By visual inspection, corrosion increased a little but the brown color of the crystals was deepened. 2 Viewed with hand lens, corrosion was more pronounced on the cut edges.
8	Water : H_2SO_4 : Lucky nut oil	60 : 20: 5	Polished mild steel plate	840	1 By visual inspection, corrosion effect was more pronounced than the previous week. 2 Viewed with hand lens, corrosion was seen on the cut edges more than the week before.
9	Water : H_2SO_4 : Lucky nut oil	60 : 20 : 10	Polished mild steel plate	840	1 By visual inspection, the formation of the oily substance increased as corrosion was not seen much. 2 Viewed with hand lens, corrosion was more than theprevious week.
10	NaOH : Lucky nut oil	80 : 5	Polished mild steel plate	840	1 By visual inspection, there were some jelly-like whitish substance formed on the surface of the blend and this solid substance covered the surface of the blend with no corrosion seen.

					2 Viewed with hand lens, no corrosion was seen.
11	NaOH : Lucky nut oil	80 : 10	Polished mild steel plate	840	1 By visual inspection, no corrosion was observed and the whitish substance which covered the blend solidified more. 2 Viewed with hand lens, no corrosion was observed.
12	**Water : NaOH : Lucky nut oil**	**60 : 20 : 5**	**Polished mild steel plate**	**840**	**1 By visual inspection, no corrosion was seen and the blend became more viscous** **2 Viewed with hand lens, the corrosion effect was very minimal on the cut edges.**
13	Water : NaOH : Lucky nut oil	60 : 20 : 10	Polished mild steel plate	840	1 By visual inspection, corrosion effect was not seen and the blend became more viscous. 2 Viewed with hand lens, no corrosion was observed.

Table 11: Shows the initial and final readings of the masses of mild steel plate as weighed from the weighing balance.

Medium or Blend		Initial Value (g)	Final Value (g)	Difference in Average (g) (Initial– Final)
1	A_1	6.95	5.49	
H_2SO_4	A_2	6.95	5.45	
	A_3	6.95	5.56	
Average		6.95	5.50	1.45
2 H_2SO_4 + 5mL of Lucky nut oil	A_4	6.95	5.69	
	A_5	6.95	5.54	
				1.37
	A_6	6.95	5.54	
Average		6.95	5.58	
3 H_2SO_4 + 10mL of Lucky nut oil	A_7	6.95	5.64	
	A_8	6.95	5.62	
				1.36
	A_9	6.95	5.52	
Average		6.95	5.59	
4 H_2O + H_2SO_4 + 5mL Lucky nut oil	A_{10}	6.95	6.55	
	A_{11}	6.95	6.53	0.41

	A_{12}	6.95	6.54	
Average		6.95	6.54	
5 $H_2O + H_2SO_4$ + 10mL Lucky nut oil	A_{13}	6.95	6.62	
	A_{14}	6.95	6.53	0.39
	A_{15}	6.95	6.52	
Average		6.95	6.56	
6 H_2O	A_{16}	6.95	5.56	
	A_{17}	6.95	5.57	1.38
	A_{18}	6.95	5.58	
Average		6.95	5.57	
7 H_2O + 5mL Lucky nut oil	A_{19}	6.95	6.92	
	A_{20}	6.95	6.92	0.03
	A_{21}	6.95	6.92	
Average		6.95	6.92	
8 H_2O + 10mL Lucky nut oil	A_{22}	6.95	6.94	
	A_{23}	6.95	6.94	
	A_{24}	6.95	6.94	
Average		6.95	6.94	0.01
9 NaOH	B_1	6.95	6.95	
	B_2	6.95	6.95	
	B_3	6.95	6.95	
Average		6.95	6.95	0.00
10	B_4	6.95	6.95	

NaOH + 5mL of	B_5	6.95	6.95	
Lucky nut oil	B_6	6.95	6.95	
Average		6.95	6.95	0.00
11	B_7	6.95	6.95	
NaOH + 10mL of	B_8	6.95	6.95	
Lucky nut oil	B_9	6.95	6.95	
Average		6.95	6.95	0.00
12	B_{10}	6.95	6.94	
H_2O + NaOH + 5mL	B_{11}	6.95	6.94	
of Lucky nut oil	B_{12}	6.95	6.94	
Average		6.95	6.94	0.01
13 H_2O + NaOH + 5mL of Lucky nut oil	B_{13}	6.95	6.95	
	B_{14}	6.95	6.95	
	B_{15}	6.95	6.95	
Average		6.95	6.95	0.00

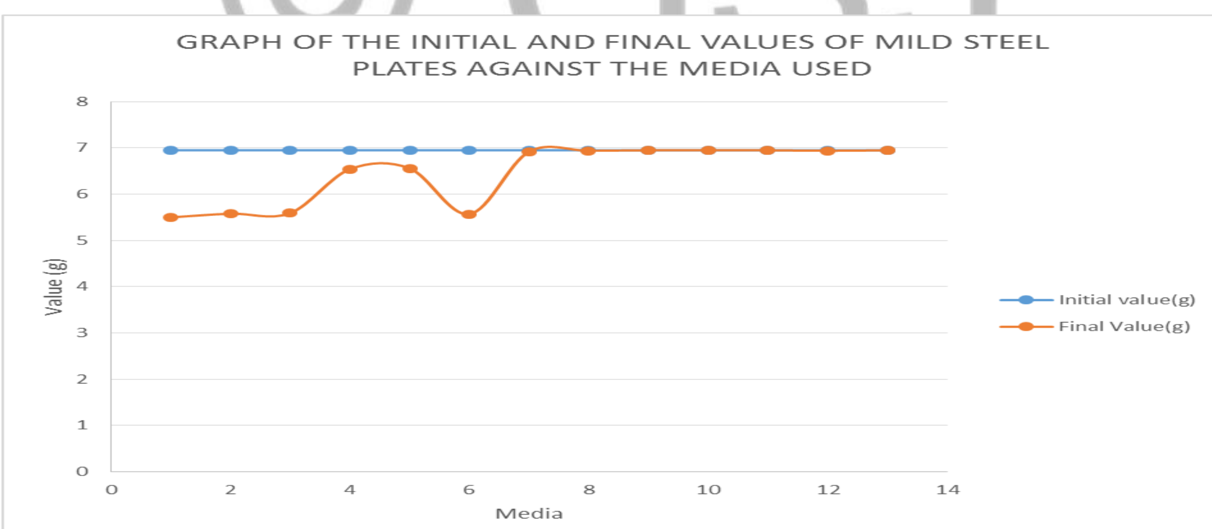

Figure 7: Initial and final values of mild steel plate against the media used

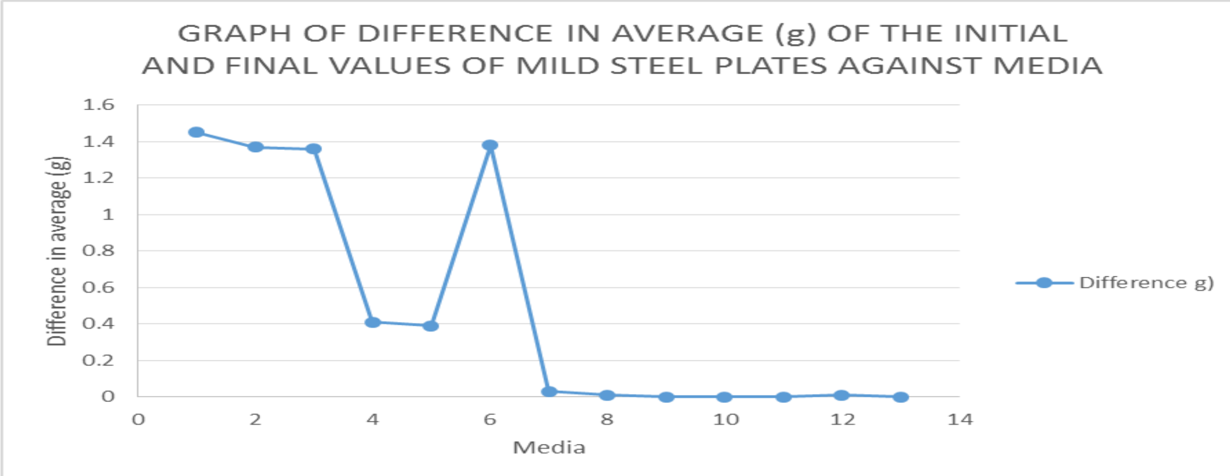

Figure 8: Difference in average of the initial and final values of mild steel plates against the media used

3.2 Discussions

Table 6-11 above shows the result of a corrosion experiment carried out in five weeks, with each table numbered from 1-13.

3.2.1 Week One Result

Table 6 shows the corrosion rate of mild steel, submerged in different proportions of blends for 168 hours. The result gotten as viewed by visual inspection and hand lens shows different corrosion trend of polished mild steel. Where serial numbers 2,5,8,10,11,12 and 13 indicates that no corrosion occurred on the mild steel, although in number 5 the color of blend turns horse blood, serial numbers 3,4,6,7 and 9 indicates that a gradual corrosion occurred on the mild steel, while serial number 1 indicates a high corrosion attack on the mild steel.

3.2.2 Week Two Result

Table 7 shows the corrosion rate of mild steel, submerged in different proportions of blend for 336 hours.The observation as seen from visual inspection and hand lens view shows that no corrosion occurred in serial numbers 2,5,10,11,12 and 13 while a gradual corrosion occurrence was recorded in serial numbers 3,4,6,7,8 and 9 and an intense corrosion occurred in serial number 1.

3.2.3 Week Three Result

Table 8 shows the corrosion rate of mild steel, submerged in different proportions of blends for 504 hours. The observation gotten from visual inspection and hand lens view shows that no corrosion occurred in serial numbers 2,10,11,12 and 13, while a gradual corrosion occurred in serial numbers 4,5,6,7,8 and 9 and an intense corrosion was recorded in serial numbers 1 and 3.

3.2.4 Week Four Result

Table 9 shows the corrosion rate of mild steel, submerged in different proportions of blends for 672 hours. The observation gotten from visual inspection and hand lens view shows that no corrosion occurred in serial numbers 2,10,11 and 13, while a gradual corrosion occurred in serial numbers 4,5,6,7,8,9 and 12 and an intense corrosion occurred in serial numbers 1 and 3.

3.2.5 Week Five Result

Table 10 shows the corrosion rate of mild steel, submerged in different proportions of blends for 840 hours. The observation gotten from visual inspection and hand lens view shows that no corrosion occurred in serial numbers 2,10,11 and 13, while a gradual corrosion occurred in serial numbers 4,5,6,7,8,9 and 12 and an intense corrosion in serial numbers 1 and 3.

3.2.6 Analyses gotten from the Initial and final readings of the masses of the mild steel plate as weighed from the weighing balance

From table 11, the corrosion rate of mild steel in blend 1 as seen from the difference in average column is higher than in blend 6, that in blend 2 is higher than in blend 3, that in blend 4 is higher than in blend 5, that in blend 7 is higher than in blend 8. No corrosion occurred in blend 9,10,11 and 13, but a little corrosion was observed in blend 12. This table reaffirms that as the concentration of inhibitor increased, the corrosion rate decreased.

3.2.7 From the graph in Figure 7 above, the values of the final weights of mild steel plate is a function of the rate of corrosion in the media, thus, the lower values of the final readings of mild steel plate, indicates an increase in corrosion in that media, while an increase in the values of the final readings of the mild steel plate, indicates a decrease in the corrosion, while the values of the final readings of the mild steel plate which corresponds to the initial readings of the mild steel plate indicates that no corrosion occurred in such a media. That is, corrosion was rapid in medium or blend one, it reduced in media 2, 3 and 6, it was minimal in media 4 and 5, it was very minimal in media 7, 8 and 12, while in media 9, 10, 11 and 13, corrosion did not occur.

3.2.8 From the graph in Figure 8 above, the higher values of the difference in average indicates rapid corrosion in such a media, but as the values of the difference in average decreases, it indicates a minimal corrosion in such a media, while, the zero values of the difference in average, indicates that no corrosion occurred in such a media. That is, corrosion was seen more in medium one, it reduced in media 2, 3 and 6, it was minimal in media 4 and 5, it was very minimal in media 7, 8 and 12, while corrosion was not seen in media 9, 10, 11 and 13.

3.3 Effect of Inhibitor Concentration on the Rate of Corrosion of Polished Mild Steel Plate

From the above result, it is evident that the corrosion rate decreases with increase in inhibitor. In water, as seen, the corrosion rate decreased with increase in inhibitor, while in NaOH, the presence of a corrosion inhibitor created no difference in the corrosion rate as there was no corrosion seen, but the blend instead became whitish solid on the surface of the beaker. In the mixture of NaOH:H_2O:Lucky nut oil, the blend became viscous with no corrosion seen in the first 3 weeks but a gradual corrosion observed in the 4th and 5th weeks in the 5mL concentration of the inhibitor, but no corrosion in the 10mL inhibitor concentration. In H_2SO_4, the effect of the inhibitor was felt as the corrosion decreased as the inhibitor increases to a minimal level.

4.0 CONCLUSION AND RECOMMENDATION

4.1 Conclusion

Lucky nut oil otherwise called yellow oleander oil as an inhibitor is very effective in water and in NaOH but it is only slightly effective in H_2SO_4, mainly as a result of the absorption of the oil extract on the surface of the polished mild steel plate and could displace toxic organic chemicals. As in the case of H_2SO_4, the toxicity of the acid as time progressed, eventually surpassed the effectiveness of lucky nut oil extract.

The corrosion rate of the polished mild steel plate in water, NaOH and H_2SO_4 solution is a function of the concentration of the lucky nut oil as an inhibitor.

4.2 Recommendations

Lucky nut oil is recommended for use as an organic corrosion inhibitor, it is easy to extract, inexpensive, environmentally friendly, acceptable and poses no threat to the environment as an organic corrosion inhibitor.

REFERENCES

[1] Fontana, N.G.(1994), Corrosion Engineering 4th Edition Mac Graaw-Hill p. 287.
Harrop D.(1990), Inhibitors Chemical for Corrosion.
[2] Small Man, E.C (1985), Modern Physical Metallurgy, 4th edition, Butterworth, London. P. 510-520.
[3] Aku S.Y., O.B.Oloche, D.S Yawas (2005),Investigation of Non-toxic Plant Extracts as Corrosion Inhibitors Pickling Solution. Journal of Corrosion Science and Technology (3) p. 28.
[4] Cohen, M. (1979), Dissolution of Iron. Corrosion Chemistry, American Chemical society Symposium Series 87p. 143.
[5] Craig A.O (Editor) 1987, ASM Hand Book Vol.13, ASM International, Materials park Ohio.
[6] Edward A.(1999), Inhibition of Corrosion Rate On Mild Steel By Use of Organic Oil Samples. Unpublished B.Eng. project Mech.Eng.DeptA.B.U.Zaria.
[7] Evans, R.V.(1960),The Corrosion and Oxidation of Metals Arnold, Book Publishers London.P. 135.
[8] The Royal Society of Chemistry, Cambridge Hausler, H.(1979), The Methodology of Corrosion Inhibitor Development for CO_2 Systems, Corrosion 88 paper N0.360 NACE, Houston, Texas.
[9] Higgins, R.A.(1972), Materials for Engineering Technicians, Hodder and Stoughton p. 246-263.
[10] Higgins, R.A (1973), Properties of Engineering Materials. Edward Arnold Pub. London P .310.
[11] Idenyi, N.E, S.I. Neife(2005), The Influence of $CaCO_3$ Based Surrounding on the Microbial Corrosion Behavior of Buried Steel Pipelines, Journal of Corrosion Science and Technology vol. 3,p. 105-133.
[12] Landort, D (1993),The Corrosion and Metal Surface Chemistry. Alden press, Oxford. P.129.
[13] Martinez; S. Metikkos-Hukovic(2003)Dept. of Electrochemistry, University of Zagreb Croatia.
[14] An introduction to Corrosion and Protection of Metals, (Chapman and Hall 1985, P. 325).
[15] Aguji, O. (2001). Cost implication of corrosion prevention. Unpublished work on corrosion and pipeline failure, Port Harcourt refinery.
[16] Tomshov, N.O. (1966), Basic Corrosion and Oxidation, John Wiley and Sons, New York,2nd edition.
[17] Wranglem, G. (1972),An Introduction to Corrosion of Metals English Language Book Society.
[18] Chindo I.Y et al, Production of Biodiesel from Yellow Oleander Oil and its Biodegradability, vol.57, No.3, p. 378.
[19] Quraishi, M.A and Ansari, F.A (2003), Corrosion Inhibition of Thermal Applied Electro chemistry 33:233, Netherland..
[20] Yawas, D(2005), Assessment of the Suitability of Some Vegetable Based Oil and Plant Extracts as Corrosion Inhibitor for Oil Field Application, Second Ph.D Seminar, Department of Mechanical Engineering Ahmadu Bello University Zaria, Nigeria.
[21] Corrosion Principle, Corrosion Control in Petroleum Production ATCP publication No. 5 NACE International Houston Texas.