Data on anti-corrosion characteristics of eco-friendly inhibitive extract on the hot corrosion degradation trend of A6063 aluminum alloy in 1.0 M HCl solution

O.S.I. Fayomi a,b,*, J. Fayomi c, E.E. Elemike c

a Department of Mechanical Engineering, Covenant University, P.M.B. 1023 Ota, Nigeria
b Department of Chemical, Metallurgical and Materials Engineering, Tshwane University of Technology, P.M.B. X680 Pretoria, South Africa
c Department of Chemistry, Federal University of Petroleum Resources Effurum, Nigeria

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The study of Lasienthera africanaum as corrosion inhibitor for A6063 grade aluminum alloy in 1.0 M HCl acid solution using weight loss method of corrosion study was investigated at 30 °C and 40 °C to check its degradation trend at high varying temperature application. The results revealed that L. africanum in 1.0 M acidic environment decreased the corrosion rate at various concentrations considered. Inhibitor efficiency (IE) as high as 98.7 and 94.9% both at 30 °C and 40 °C respectively, was observed.

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Specifications Table

Subject area Corrosion science
More specific subject area Material science
Type of data Table, figures

* Corresponding author at: Department of Mechanical Engineering, Covenant University, P.M.B. 1023 Ota, Nigeria.
E-mail addresses: ojosundayfayomi3@gmail.com, fayomi_chris@yahoo.com (O.S.I. Fayomi).

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How data was acquired
The data acquired in this work involved the introduction of already prepared concentrations of the inhibitor into separate beakers maintained at room temperature. A total of seven beakers labelled [1–5] and (X and Y) were used; with 1, 2, 3, 4, 5 containing 100 ml of the acidic extract solution while X and Y were used as the blank (control) for the experiment. The beakers labelled 1–5 contains different volumes of stock solution of the inhibitor with concentrations of 10 mg/L, 20 mg/L, 40 mg/L, 60 mg/L, 80 mg/L which was made up to 100 ml each into different concentration of the acid 1.0 M HCl. Already weighed aluminium alloy coupons were then placed in the test solution. Each coupon was retrieved from the test solutions progressively for 1 h in total of 5 h [1]. After the immersion test, the specimens were carefully dip in water and then properly cleaned to remove loose segments of the film of the corroded samples following by degreasing in ethanol and drying with acetone. The difference in weight of the coupons was again taken as the weight loss.

Data format
Raw, Analysed

Experimental factors
The aluminum alloy coupons were properly weighed before and after immersion into the test solution. The inhibitor was test against temperature of 30 °C and 40 °C at different concentration for the period of 5 h.

Experimental features
The depositions were performed between 60 and 300 min at a temperature of 30 °C and 40 °C. The effect of inhibitor on the properties of aluminum alloy was acquired. The framework of temperature variation condition as it influences the corrosion rate and efficiency was properly observed.

Data source location
Department of Chemistry, Federal University of petroleum Resources, Effurun, Delta State. Department of Chemical, Metallurgical and Materials Engineering, Tshwane University of Technology, Pretoria, South Africa and Mechanical Engineering, Covenant University, Ota Ogun State, Nigeria

Data accessibility
Data are available within this article

Value of the data
- The data obtained could be used to check the degradation trend of the typed aluminum alloy in acidic environment at varying temperature in the present of inhibitor.
- The data could be used to check the effect of increase in temperature on the inhibition efficiency of the inhibitor used (*Lasienthera africanum*)
- The results obtained shows that the inhibition potency of the inhibitor decreases with time in the contaminated environment.
- The given data will show author in the field of corrosion science the effect of 1.0 M HCl concentration on aluminium corrosion, with or with out inhibitor.
- The data obtained could be used to check the correlation of temperature variation on the corrosion of aluminum coupon in acidic medium.

1. Data
The weight losses with depth of depositions were collected and a unique set of experimental frame work data were generated. The immersion process was performed between 60 and 300 min at a varying temperature of 30 °C and 40 °C [2]. The data acquired from the weight loss measurements of
the aluminum coupon is presented in Tables 1–14 below. From the weight loss result, the corrosion rates were calculated and the inhibitor efficiency obtained. The data obtained shows that the rate of corrosion decreases with increase in the concentration of inhibitors, this is also true for the varying temperature though with increase in time the inhibitor efficiency decreases [3,4].

### 2. Experimental design, materials and methods

The materials employed in this work include Aluminum coupons, Thermometer, Analytical weighing balance, heating mantle, Magnetic stirrer, water bath, desiccator.

#### 2.1. Reagents

Hydrochloric acid (HCl), Ethanol, Acetone.

#### 2.2. Plant sample

*Lasienthera africanum* extract.

#### 2.3. Preparation of aluminum coupons for anti-corrosion study

Aluminum sheets of purity 98.8% were used in this study each sheet was 0.14 cm thick and was mechanically cut into rectangular coupons of dimension 3 cm × 4 cm. The total surface area of the coupon used was 12 cm². These coupons were further polished, degreased in ethanol and dried in acetone. The coupons were then stored in a moisture-free desiccator to avoid contamination before using them for corrosion studies [2]. The initial weight of each sample was taken and recorded. All reagents used were of analytical grade. They were used as sourced with no further purification. An aqueous solution of 1.0 M was used as blank solution.

| Time(min) | Initial weight of specimen, $W_i$ (g) | Final weight of specimen, $W_f$ (g) | Weight loss, $\Delta W_{(g)}$ (g) | Inhibition efficiency (%) | Corrosion rate (mm/yr.) |
|-----------|--------------------------------------|------------------------------------|----------------------------------|----------------------------|------------------------|
| 60        | 0.9724                               | 0.9559                             | 0.0165                           | 44.61                      | 84.90                  |
| 120       | 0.9724                               | 0.8343                             | 0.1381                           | 186.69                     | 240.72                 |
| 180       | 0.9724                               | 0.6980                             | 0.2744                           | 247.30                     | 221.30                 |
| 240       | 0.9724                               | 0.6450                             | 0.3274                           | 182.66                     | 216.82                 |
| 300       | 0.9724                               | 0.6346                             | 0.3378                           | 179.36                     | 179.36                 |

### Table 1

Aluminum coupon in 1.0 M HCl at 30 °C without *Lasienthera africanum* extract (control 1).

| Time(min) | Initial weight of specimen, $W_i$ (g) | Final weight of specimen, $W_f$ (g) | Weight loss, $\Delta W_{(g)}$ (g) | Inhibition efficiency (%) | Corrosion rate (mm/yr.) |
|-----------|--------------------------------------|------------------------------------|----------------------------------|----------------------------|------------------------|
| 60        | 0.9558                               | 0.9559                             | 0.0165                           | 44.61                      | 84.90                  |
| 120       | 0.8343                               | 0.8343                             | 0.1381                           | 186.69                     | 240.72                 |
| 180       | 0.6980                               | 0.6980                             | 0.2744                           | 247.30                     | 221.30                 |
| 240       | 0.6450                               | 0.6450                             | 0.3274                           | 182.66                     | 216.82                 |
| 300       | 0.6346                               | 0.6346                             | 0.3378                           | 179.36                     | 179.36                 |

### Table 2

Aluminum coupon in 1.0 M HCl at 30 °C without *Lasienthera africanum* extract (control 2).
Table 3
Aluminum coupon in 1.0 M HCl at 30 °C containing 10 mg/l *Lasienthera africanum* extract.

| Time(min) | Initial weight of specimen, $W_i$ | Final weight of specimen, $W_f$ | Weight loss, $\Delta W_{(g)}$ | Inhibition efficiency (%) | Corrosion rate (mm/yr.) |
|-----------|-----------------------------------|---------------------------------|-----------------------------|--------------------------|-------------------------|
| 60        | 1.0211                            | 1.0151                          | 0.0060                      | 74.9                     | 16.22                   |
| 120       | 1.0211                            | 0.9750                          | 0.0461                      | 70.2                     | 62.32                   |
| 180       | 1.0211                            | 0.8715                          | 0.1496                      | 44.7                     | 134.82                  |
| 240       | 1.0211                            | 0.7257                          | 0.2954                      | 7.6                      | 199.67                  |
| 300       | 1.0211                            | 0.7087                          | 0.3124                      | 6.7                      | 168.93                  |

Table 4
Aluminum coupon in 1.0 M HCl at 30 °C containing 20 mg/l *Lasienthera africanum* extract.

| Time(min) | Initial weight of specimen, $W_i$ | Final weight of specimen, $W_f$ | Weight loss, $\Delta W_{(g)}$ | Inhibition efficiency (%) | Corrosion rate (mm/yr.) |
|-----------|-----------------------------------|---------------------------------|-----------------------------|--------------------------|-------------------------|
| 60        | 1.3696                            | 1.3651                          | 0.0045                      | 81.2                     | 12.17                   |
| 120       | 1.3696                            | 1.3400                          | 0.0296                      | 80.4                     | 40.01                   |
| 180       | 1.3696                            | 1.2654                          | 0.1042                      | 61.5                     | 93.91                   |
| 240       | 1.3696                            | 1.1072                          | 0.2625                      | 17.8                     | 177.43                  |
| 300       | 1.3696                            | 1.0699                          | 0.2997                      | 10.4                     | 162.06                  |

Table 5
Aluminum coupon in 1.0 M HCl at 30 °C containing 40 mg/l *Lasienthera africanum* extract.

| Time(min) | Initial weight of specimen, $W_i$ | Final weight of specimen, $W_f$ | Weight loss, $\Delta W_{(g)}$ | Inhibition efficiency (%) | Corrosion rate (mm/yr.) |
|-----------|-----------------------------------|---------------------------------|-----------------------------|--------------------------|-------------------------|
| 60        | 0.9991                            | 0.9961                          | 0.0030                      | 87.5                     | 8.11                    |
| 120       | 0.9991                            | 0.9782                          | 0.0209                      | 86.4                     | 28.25                   |
| 180       | 0.9991                            | 0.9384                          | 0.0607                      | 77.5                     | 54.70                   |
| 240       | 0.9991                            | 0.7707                          | 0.2284                      | 28.6                     | 154.38                  |
| 300       | 0.9991                            | 0.7076                          | 0.2955                      | 12.9                     | 158.79                  |

Table 6
Aluminum coupon in 1.0 M HCl at 30 °C containing 60 mg/l *Lasienthera africanum* extract.

| Time(Min) | Initial weight of specimen, $W_i$ | Final weight of specimen, $W_f$ | Weight loss, $\Delta W_{(g)}$ | Inhibition efficiency (%) | Corrosion rate (mm/yr.) |
|-----------|-----------------------------------|---------------------------------|-----------------------------|--------------------------|-------------------------|
| 60        | 1.0775                            | 1.0762                          | 0.0013                      | 94.6                     | 3.51                    |
| 120       | 1.0775                            | 1.0680                          | 0.0095                      | 93.9                     | 64.80                   |
| 180       | 1.0775                            | 1.0393                          | 0.0607                      | 85.9                     | 54.70                   |
| 240       | 1.0775                            | 0.8931                          | 0.1844                      | 42.3                     | 124.64                  |
| 300       | 1.0775                            | 0.7959                          | 0.2816                      | 15.9                     | 152.27                  |
Table 7
Aluminum coupon in 1.0 M HCl at 30 °C containing 80 mg/l Lasienthera africanum extract.

| Time (min) | Initial weight of specimen, $W_i$ | Final weight of specimen, $W_f$ | Weight loss, $\Delta W_{(i)}$ | Inhibition efficiency (%) | Corrosion rate (mm/yr.) |
|------------|----------------------------------|---------------------------------|-------------------------------|---------------------------|--------------------------|
| 60         | 0.9851                           | 0.9848                          | 0.0003                        | 98.7                      | 0.811                    |
| 120        | 0.9851                           | 0.9798                          | 0.0053                        | 96.6                      | 7.16                     |
| 180        | 0.9851                           | 0.9723                          | 0.0128                        | 95.3                      | 11.54                    |
| 240        | 0.9851                           | 0.9197                          | 0.0654                        | 79.5                      | 44.21                    |
| 300        | 0.9851                           | 0.8140                          | 0.1711                        | 48.9                      | 92.52                    |

Table 8
Aluminum coupon in 1.0 M HCl at 40 °C without Lasienthera africanum extract (control 1).

| Time (Min) | Initial weight of specimen, $W_i$ | Final weight of specimen, $W_f$ | Weight loss, $\Delta W_{(i)}$ | Inhibition efficiency (%) | Corrosion rate (mm/yr.) |
|------------|----------------------------------|---------------------------------|-------------------------------|---------------------------|--------------------------|
| 60         | 1.0247                           | 0.7822                          | 0.2425                        | –                         | 655.65                   |
| 120        | 1.0247                           | 0.6438                          | 0.3809                        | –                         | 514.92                   |
| 180        | 1.0247                           | 0.6077                          | 0.4170                        | –                         | 375.81                   |
| 240        | 1.0247                           | 0.5828                          | 0.4419                        | –                         | 298.69                   |
| 300        | 1.0247                           | 0.5699                          | 0.4548                        | –                         | 245.93                   |

Table 9
Aluminum coupon in 1.0 M HCl at 40 °C without Lasienthera africanum extract (control 2).

| Time (Min) | Initial weight of specimen, $W_i$ | Final weight of specimen, $W_f$ | Weight loss, $\Delta W_{(i)}$ | Inhibition efficiency (%) | Corrosion rate (mm/yr.) |
|------------|----------------------------------|---------------------------------|-------------------------------|---------------------------|--------------------------|
| 60         | 1.0501                           | 0.8224                          | 0.2277                        | –                         | 615.63                   |
| 120        | 1.0501                           | 0.7141                          | 0.3360                        | –                         | 454.22                   |
| 180        | 1.0501                           | 0.6381                          | 0.4120                        | –                         | 371.31                   |
| 240        | 1.0501                           | 0.6171                          | 0.4330                        | –                         | 292.68                   |
| 300        | 1.0501                           | 0.6070                          | 0.4431                        | –                         | 239.60                   |

Table 10
Aluminum coupon in 1.0 M HCl at 40 °C containing 10 mg/l Lasienthera africanum extract.

| Time (Min) | Initial weight of specimen, $W_i$ | Final weight of specimen, $W_f$ | Weight loss, $\Delta W_{(i)}$ | Inhibition efficiency (%) | Corrosion rate (mm/yr.) |
|------------|----------------------------------|---------------------------------|-------------------------------|---------------------------|--------------------------|
| 60         | 1.0044                           | 0.9279                          | 0.0765                        | 67.5                      | 206.83                   |
| 120        | 1.0044                           | 0.6844                          | 0.3200                        | 10.7                      | 432.59                   |
| 180        | 1.0044                           | 0.6172                          | 0.3872                        | 6.6                       | 348.96                   |
| 240        | 1.0044                           | 0.5932                          | 0.4112                        | 6.0                       | 277.94                   |
| 300        | 1.0044                           | 0.5781                          | 0.4263                        | 5.1                       | 230.52                   |
Table 11
Aluminum coupon in 1.0 M HCl at 40 °C containing 20 mg/l *Lasienthera africanum* extract.

| Time (min) | Initial weight of specimen, $W_1$ | Final weight of specimen, $W_f$ | Weight loss, $\Delta W_{(g)}$ | Inhibition efficiency (%) | Corrosion rate (mm/yr.) |
|------------|-----------------------------------|---------------------------------|------------------------------|---------------------------|-------------------------|
| 60         | 1.0141                            | 0.9691                          | 0.0450                       | 80.9                      | 121.67                  |
| 120        | 1.0141                            | 0.7169                          | 0.2972                       | 17.1                      | 401.77                  |
| 180        | 1.0141                            | 0.6286                          | 0.3855                       | 7.0                       | 347.42                  |
| 240        | 1.0141                            | 0.6049                          | 0.4092                       | 6.5                       | 276.59                  |
| 300        | 1.0141                            | 0.5893                          | 0.4248                       | 5.4                       | 229.71                  |

Table 12
Aluminum coupon in 1.0 M HCl at 40 °C containing 40 mg/l *Lasienthera africanum* extract.

| Time (Min) | Initial weight of specimen, $W_1$ | Final weight of specimen, $W_f$ | Weight loss, $\Delta W_{(g)}$ | Inhibition efficiency (%) | Corrosion rate (mm/yr.) |
|------------|-----------------------------------|---------------------------------|------------------------------|---------------------------|-------------------------|
| 60         | 0.9964                            | 0.9787                          | 0.0177                       | 92.5                      | 47.86                   |
| 120        | 0.9964                            | 0.7250                          | 0.2714                       | 24.3                      | 366.89                  |
| 180        | 0.9964                            | 0.6154                          | 0.3810                       | 8.1                       | 343.37                  |
| 240        | 0.9964                            | 0.5933                          | 0.4031                       | 7.8                       | 272.47                  |
| 300        | 0.9964                            | 0.5744                          | 0.4220                       | 6.0                       | 228.19                  |

Table 13
Aluminum coupon in 1.0 M HCl at 40 °C containing 60 mg/l *Lasienthera africanum* extract.

| Time (Min) | Initial weight of specimen, $W_1$ | Final weight of specimen, $W_f$ | Weight loss, $\Delta W_{(g)}$ | Inhibition efficiency (%) | Corrosion rate (mm/yr.) |
|------------|-----------------------------------|---------------------------------|------------------------------|---------------------------|-------------------------|
| 60         | 0.9898                            | 0.9728                          | 0.0170                       | 92.8                      | 45.96                   |
| 120        | 0.9898                            | 0.7251                          | 0.2647                       | 26.2                      | 357.84                  |
| 180        | 0.9898                            | 0.6109                          | 0.3789                       | 8.6                       | 341.48                  |
| 240        | 0.9898                            | 0.5887                          | 0.4011                       | 8.3                       | 271.11                  |
| 300        | 0.9898                            | 0.5752                          | 0.4146                       | 7.7                       | 224.19                  |

Table 14
Aluminum coupon in 1.0 M HCl at 40 °C containing 80 mg/l *Lasienthera africanum* extract.

| Time (min) | Initial weight of specimen, $W_1$ | Final weight of specimen, $W_f$ | Weight loss, $\Delta W_{(g)}$ | Inhibition efficiency (%) | Corrosion rate (mm/yr.) |
|------------|-----------------------------------|---------------------------------|------------------------------|---------------------------|-------------------------|
| 60         | 1.0009                            | 0.9889                          | 0.0120                       | 94.9                      | 32.44                   |
| 120        | 1.0009                            | 0.7408                          | 0.2601                       | 27.4                      | 351.62                  |
| 180        | 1.0009                            | 0.6215                          | 0.3794                       | 18.5                      | 341.93                  |
| 240        | 1.0009                            | 0.6214                          | 0.3876                       | 13.2                      | 261.99                  |
| 300        | 1.0009                            | 0.6099                          | 0.3910                       | 12.9                      | 211.43                  |
2.4. Preparation of plant extract for corrosion inhibition studies

*L. africanum* leaf sample was bought from Ota market in Ogun state Nigeria and was properly washed. The sample was further dried and ground into fine powder. The acidic leaf extract was prepared by adding 5.0 g of the plant sample in 100 ml 1.0 M HCl [6]. The resulting solution was boiled for 5 h and allowed to stand before filtering. It was observed that 0.2528 g of organic soluble matter dissolved in the acidic medium. This becomes the stock solution and from these concentrations of 10 mg/L, 20 mg/L, 40 mg/L, 60 mg/L, 80 mg/L were made [7].

2.5. Weight loss measurement

This work involved the introduction of already prepared concentrations of the inhibitor into separate beakers maintained at room temperature. A total of seven beakers label (1–5 and X and Y)
were used; with 1, 2, 3, 4, 5 containing 100 ml of the acidic extract solution while X and Y were used as the blank (control) for the experiment. The beakers label 1–5 contains different volumes of stock solution of the inhibitor with concentrations of 10 mg/L, 20 mg/L, 40 mg/L, 60 mg/L, 80 mg/L which was made up to 100 ml each into different concentration of 1.0 M HCl [8].

Previously weighed aluminum coupons were then placed in the test solution. Each coupon was retrieved from the test solutions progressively for 1 h in total of 5 h [1]. After the immersion test, the specimens were carefully dip in water and then properly cleaned to remove loose segments of the film of the corroded samples following by degreasing in ethanol and drying with acetone. The
difference in weight of the coupons was again taken as the weight loss. From the initial weight of the aluminum coupons, the weight loss, the corrosion rate (CR) and inhibition efficiency were determined [9] (Figs. 1–4).

3. Conclusion

1. The corrosion rates drastically decreased with increase in concentration of the extracts in comparison to the blank. The 80 mg/L extract have the lowest corrosion rate, which depict that the inhibitive action of the extract is concentration dependent.

2. *L. africanum* have been demonstrated to be an effective corrosion inhibitor for 1.0 M HCl environments at 30 and 40 °C

The corrosion resistance and inhibitor efficiency of aluminium increased with addition of *Lasienthera africanum* as inhibitor. Inhibition efficiency as high as 98.7% and 94.9% in 1.0 M was observed in the varying temperatures.

3. The rate of corrosion of the aluminium in HCl environmental conditions is a function of the concentration of *L. africanum* extract.

**Transparency document. Supporting information**

Transparency document associated with this article can be found in the online version at https://doi.org/10.1016/j.dib.2018.04.007.

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