TECHNICAL REPORT

# ALKALOIDS AS CORROSION INHIBITORS FOR ZINC IN ACID SOLUTION

B. L. Jain & J. N. Gaur
*Department of Chemistry, University of Rajasthan, Jaipur-302 004.*
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The effectiveness of papavarine, nicotine, quinine salicylate and quinine sulphate as corrosion inhibitors o zinc in hydrochloric and sulphuric acids has been studied. Quinine salicylate, nicotine & quinine sulphate show higher inhibition efficiency in sulphuric acid whereas papavarine gives higher values in hydrochloric acid.

It has been reported earlier that nitrogen, oxygen and sulphur-containing compounds are effective inhibitors for the corrosion of metals in acid medium [1,2]. Alkaloids have been reported as inhibitors for metals in acid medium [3–5].

The present investigation deals with study of some alkaloids as inhibitors towards zinc in 0.1N hydrochloric and sulphuric acid solutions using galvanostatic polarisation method.

## EXPERIMENTAL

Zinc sample of pure grade having rectangular shape was used for corrosion rate measurements. Samples embedded in araldite so as to expose an area of 2 sq cms were used for polarisation studies. Samples were degreased in acetone, washed in distilled water and air dried. All the solutions are prepared in distilled water except quinine sulphate and quinine salicylate which were prepared in alcohol. Solutions were stirred during experiments.

## POLARISATION

The polarisation experiments were carried out by using rectangular specimens. Platinised platinum sheet was employed as an auxiliary electrode. For galvanostatic polarisation a stable dc power source with higher variable resistance in the series with the cell was used to control the cell current at different values. Potential of the working cell electrode was measured by means of a potentiometer–null detector assembly. All potentials are reported against S.C.E. After attaining steady state potential the polarisation was carried out, cathodic first and then anodic. Experiments were carried out at 27 $\pm$ 1° C.

The inhibitive efficiency was calculated employing the formula.

$$\text{Inhibition efficiency} = \frac{I - I'}{I} \times 100$$

where I and I' are the corrosion currents without and with the inhibitors respectively.

### Result & Discussions

To investigate whether the inhibition is of the cathodic, anodic or mixed type, Tafel diagrams were obtained with and without inhibitor. Tables I & II give the comparative performance of the quinine sulphate, quinine salicylate, papavarine & nicotine in hydrochloric & sulphuric acids.

In 0.1M hydrochloric acid papavarine shows better inhibition at the lower concentration range, increasing up to 94%. The inhibition efficiency of papavarine in sulphuric acid is less than in hydrochloric acid. The corrosion potential values are higher in hydrochloric acid than in sulphuric acid.

**Table I Kinetic Parameters for Corrosion of Zinc in Hydrochloric acid (0.1N)**

| Inhibitor | Inhibitor conc g/l $\times (10^3)$ | $I_{corr}$ (mA) | $E_{corr}$ (mV vs sce) | % inhibition |
|---|---|---|---|---|
| Hydrochloric acid 0.1N | — | 12 | 1016 | — |
| Papavarine | 40 | 1.2 | 981 | 89 |
| | 10 | 1.1 | 984 | 90 |
| | 20 | 0.7 | 986 | 94 |
| Nicotine | 4 | 3.9 | 1006 | 67 |
| | 6 | 3.1 | 1007 | 73 |
| | 8 | 3.0 | 997 | 75 |
| Quinine Salicylate | 2 | 4.2 | 984 | 64 |
| | 4 | 3.0 | 981 | 75 |
| | 10 | 2.1 | 979 | 82 |
| Quinine Sulphate | 2 | 7.2 | 960 | 40 |
| | 4 | 6.2 | 955 | 48 |
| | 6 | 5.7 | 970 | 52 |

**Table II Kinetic Parametres for Corrosion of Zinc in 0.1N Sulphuric acid T = 27 ± 1° C**

| Inhibitor | Inhibitor conc g/l ($\times 10^3$) | $I_{corr}$ (mA) | $E_{corr}$ (mV vs sce) | %Inhibition |
|---|---|---|---|---|
| Sulphuric acid 0.1N | — | 14 | 1014 | — |
| Papavarine | 4 | 2.6 | 959 | 81 |
| | 20 | 1.6 | 930 | 88 |
| Nicotine | 2 | 3.6 | 990 | 73 |
| | 4 | 2.9 | 980 | 79 |
| | 8 | 1.6 | 982 | 88 |
| Quinine Salicylate | 4 | 2.7 | 962 | 80 |
| | 8 | 2 1 | 946 | 84 |
| Quinine Sulphate | 2 | 6.7 | 900 | 52 |
| | 4 | 5.9 | 895 | 57 |
| | 6 | 4·5 | 980 | 67 |

In the case of nicotine the inhibition efficiency increases with concentration. The corrosion potential values are higher in hydrochloric acid.

Quinine salicylate provides good protection. The concentration of the compound is the function of inhibition efficiency. Quinine sulphate shows less inhibition in both the acids. Quinine sulphate is less effective than quinine salicylate. On increasing the concentration the inhibition increases but not rapidly. Quinine salicylate and quinine sulphate both show better inhibition in sulphuric acid than in hydrochloric acid.

In hydrochloric acid papavarine is the most effective inhibitor, and quinine sulphate is least effective.

In sulphuric acid also, the quinine sulphate shows the lowest protection whereas all other compounds show nearly the same efficiency.

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