



ALTRET Industries Private Limited

Inhibition of the Corrosion of Mild Steel in Hydrochloric Acid By “PERMOLE 8011”

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Introduction

The corrosion inhibition of steel (Mild Steel) in HCl solution is carried out by newly developed **PERMOLE 8011**-corrosion inhibitor with excellent result. Corrosion of metals is a major industrial problem that has attracted a lot of investigators in recent years. Corrosion inhibitors are of great practical importance, being extensively employed in minimizing metallic waste in engineering materials. Several N – and S – containing organic compounds have been used as inhibitors. The corrosion inhibition is a surface process, which involves the adsorption of the organic compounds on metal surface.

Keywords: Corrosion inhibitor; Amine base surfactant; mild steel.

Inhibitors of acid solution: The low-molecular-weight organic inhibitors in acid solution function by being adsorbed on the metal surface. The precise nature of this adsorption process and of the adsorption sites is important in acid inhibition system.

In a general sense adsorption is inferred from the relationship between inhibitor efficiency [expressed as the relative reduction in corrosion rate] and inhibitor concentration. This relationship frequently has the form of an adsorption isotherm, which would be expected if inhibitor efficiency is a function of the fraction of surface covered by the inhibitor.

A second very widely reported phenomenon is the variation of inhibitor efficiency, for any given molar concentration of a particular type of compound, with chain length or stereo-chemical structure. For example, the inhibitive efficiency of amines has been found to increase with chain length, with cross-sectional area of the molecule, with the inclination of the molecule to the metal surface and other stereo-chemical properties. This has been assumed to indicate inhibition by adsorption, greater efficiency corresponding to greater surface coverage or closeness of packing and also, possibly, to difference in ease of adsorption related to steric hindrance factors.

With existing available corrosion inhibitors of acid particularly hydrochloric acid the experiments are carried out to identify the **efficiency** of corrosion inhibition at static

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condition with particular dosage. The **comparisons of results obtained are given in** table.

Weight loss determination:

Mild steel coupons of 80 x 10 x 1.60 mm were used for weight loss measurements. The total geometric surface area of coupons exposed is 1874. 76 mm². The coupons were suspended through a hole 4.20 mm in radius. Corrosion test experiment was carried out in given condition as per Table1:

Result and Discussion:

Test Condition:

Data of Corrosion Coupons: -

1. Length – 80 mm
2. Breadth -10 mm
3. Height - 1.60 mm
4. Hole Radius- 4.20

mm Metal: -Mild Steel

Density of Metal (Mild Steel): -

7.86 Temp. 40^o C

Condition- Static

Test Duration-24 hours

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Table 1: Inhibition efficiency of Permole 8011 obtain from weight loss measurement in presence of HCl

| Particular | Initial weight (Before) | Final weight (After) | Weight Loss in mg | gm/cm ² / 24 hours | mpy | Inhibitor Efficiency |
|---------------------------------|-------------------------|----------------------|-------------------|-------------------------------|----------|----------------------|
| 3% HCl | 8748 | 7486.8 | 1261.20 | 0.00002803 | 574.3575 | NIL |
| 3% HCl+ 2% of TT* Of HCl | 8728.6 | 8691.6 | 37.000 | 0.00000082 | 12.6933 | 97.7900 |
| 3% HCl + 2% Coraban S of HCl | 9413.3 | 9383.8 | 29.500 | 0.00000066 | 10.3439 | 98.1990 |
| 3% HCl + 1% Maxclean 801 of HCl | 9405.4 | 9353.4 | 52.000 | 0.00000116 | 13.7549 | 97.6051 |
| 3% HCl + 1% Permole 8011 of HCl | 8768.8 | 8755.6 | 13.200 | 0.00000029 | 4.6354 | 99.1929 |

* TT- Tolytriozole

Conclusion: -

The corrosion of mild steel in HCl solution without inhibitor increases with increase in acid concentration. The inhibitors used in this investigation (Toly triozole, aldehyde base competitor corrosion inhibitor (Coraban S), Maxclean 801 and special amine base surfactant Permole 8011) inhibit the acid corrosion of mild steel to various degrees. The order of inhibition efficiency (%) is Permole 8011 > Coraban > Max clean 801 > TT. On the basis of activation energy, Amine base surfactant and its precursor obey the mechanism of physical adsorption.

Acknowledgements: -

The above result is fact as per the experiment carried out at Altret Laboratory. During the field application result may vary depending upon plant specification and system design.

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