РУСЕНСКИ УНИВЕРСИТЕТ "АНГЕЛ КЪНЧЕВ"

ФИЛИАЛ – РАЗГРАД

CORROSION INHIBITION OF LOW-CARBON STEEL IN A 0.1 M H_2SO_4 MEDIUM

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INTRODUCTION

The study of the theoretical foundations and characteristics of corrosion processes on steels is of great practical importance. Suffice it to note that the vast majority of all engineering solutions are based on the use of details made of steel. In this sense, the successful corrosion protection of the embedded steel products is of great importance. Numerous studies have shown that a number of organic chemical compounds introduced in insignificant amounts in aggressive corrosive environments reduce significantly the rate of the corrosion process, thus substantially reducing its harmful effects.

Preliminary results for the inhibitory effect of *6-(10H-phenothiazin-10-yl)-1H,3H-benzo[de]isochromene-1,3-dione* on the corrosion of low carbon steel in sulfuric acid medium are reported in the present study.

EXPERIMENTAL

The investigated samples were cut of sheet steel 3, type *EN-S235J2*.

The experiments were performed in a corrosive medium, consisting of 0.1M sulfuric acid solution at constant temperature (25°C).

The effect of the concentration of the inhibitor *6-(10H-phenothiazin-10-yl)-1H,3H-benzo[de]isochromene-1,3-dione* on the corrosion rate, the degree of protection and the coefficient of inhibition was studied. The structural formula of the tested organic compound is given in Figure 1. The inhibitor was dissolved in ethanol and introduced into the corrosive medium in the form of an ethanol solution.

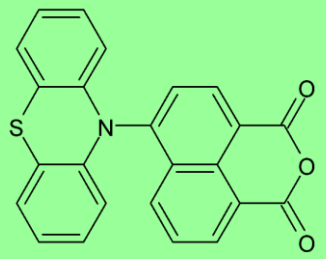

Fig. 1. Structural formula of the studied organic inhibitor *6-(10H-phenothiazin-10-yl)-1H,3H-benzo[de]isochromene-1,3-dione*

All experiments were performed in laboratory conditions. In order to study the inhibitory effect a conventional gravimetric method (Chiang, K., Mintz, T., 2008) was used.

RESULTS AND DISCUSSION

The studies performed enabled to successively determine the corrosion rate (k), the efficiency of the inhibitor (Z) and the coefficient of inhibitory action (Y).

- **Corrosion rate** (k) can be calculated using the expression:

$$k = \frac{(m_0 - m)}{St}\left[gm^{-2}h^{-1}\right],$$

where m_0 and m is the mass $[g]$ of the steel before and after the experiment, respectively; $S\left[m^2\right]$ is the surface of the sample and $t[h]$ is the exposition time of the samples (54 h) in the corrosive medium (0,1 M H_2SO_4).

In order to evaluate the efficiency of the investigated inhibitor, two magnitudes were calculated:

- **Degree of protection** (Z): $Z = \frac{(k_0 - k)}{k_0} \times 100[\%]$,

where k_0 is the corrosion rate of the tested steel in the corrosive medium in the absence of inhibitor, and k is the respective rate after the addition of the organic inhibitory substance.

- **Inhibition action coefficient** (Y): $Y = \frac{k_0}{k}$.

The results obtained from the laboratory tests are presented in Table 1.

Table 1. Corrosion rate (k), degree of protection (Z) and inhibition action coefficient (Y) values for different concentrations of the organic additive

$C\left[moldm^{-3}\right]$	0.0000	5×10^{-7}	1×10^{-6}	5×10^{-6}	1×10^{-5}	5×10^{-5}
$k\left[gm^{-2}h^{-1}\right]$	1.7523	1.7032	1.6558	1.6079	1.5593	0.8815
$Z[\%]$	-	2.80	5.51	8.24	11.01	49.69
Y	-	1.03	1.06	1.09	1.12	1.99

For a more informative presentation of the obtained results, Figure 2 graphically presents the dependencies of the corrosion rate (k) and the degree of protection (Z) on the concentration of the organic substance.

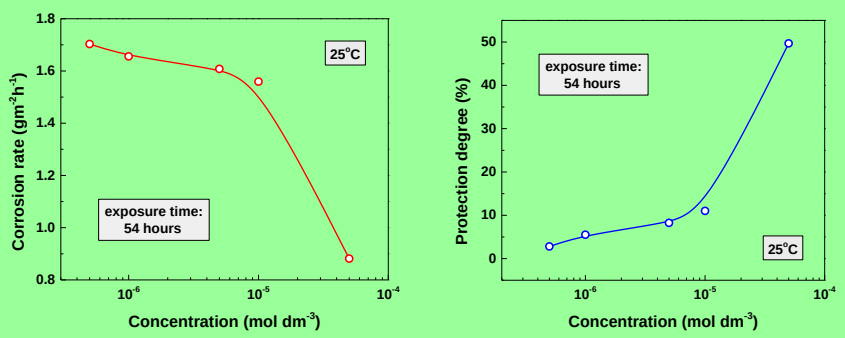

Fig. 2. Dependence of the corrosion rate (a) and degree of protection (b) on the concentration of organic inhibitor

CONCLUSION

1. The studied organic substance *6-(10H-phenothiazin-10-yl)-1H,3H-benzo[de]isochromene-1,3-dione* exhibits good inhibitory properties against the corrosion of low carbon steel in sulfuric acid medium.
2. By means of a gravimetric method, data were obtained on the corrosion rate, the efficiency of the inhibitor and the coefficient of inhibitory action by varying its concentration.
3. The obtained results confirm the fact that aromatic compounds containing N, O and complex bonds in their molecule are good inhibitors of steel in mineral acid media.
4. In preliminary studies, a suitable solvent for the tested organic compound was sought, in order to an approach for its introduction with higher concentrations in aggressive acidic media.

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