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Original Research Paper

Chemistry

CORROSION INHIBITION EFFECT OF GLYCINE (amino acid) on Alloy Metal in Alkaline medium

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ABSTRACT The-inhibition effect of glycine towards the corrosion on bronze in alkaline medium was investigated using weight loss measurement technique. The effect of inhibitor concentration against inhibitor action, was investigated. it was found that glycine act as a good inhibitor for the corrosion of bronze in NaOH medium. Maximum inhibition efficiency is shown at highest concentration of inhibitor (glycine) at the lowest strength of base.

KEYWORDS : Glycine, corrosion, Bronze, Alloy Metal and Inhibition efficiency

Introduction

Corrosion is the deterioration of metal by chemical attack or reaction with its environment. It is a constant and continuous problem, often difficult to eliminate completely. Prevention would be more practical and achievable than complete elimination.

Copper and copper-based alloys are commonly used in heat exchangers, constructions, electronics, coinage and art works etc. Despite the good corrosion resistance of copper and its alloys, corrosion inhibitors have to be used in order to reduce the damage of metal dissolution in aggressive alkaline media. Inhibitors are substance which when added in small quantity to a corrosive environment, lower the corrosion rate. They reduces the corrosion by either acting as a barrier, by forming an adsorbed layer or retarding the cathodic and anodic process.

Typical corrosion inhibitors for copper and its alloys are heterocyclic compounds containing nitrogen, oxygen or sulphur atoms. The effectiveness of these organic molecules is based on their ability to form a protective film by several mechanism. (i.e. adsorption, polymerization) Nevertheless, an important disadvantage of hetrocyclic compounds is their toxicity and the lack of biodegrada bility. In line with the environment protection regulations and ecological policies for the use of chemicals , the latest trend in corrosion research is focused on producing and testing new environmentally- friendly inhibitors as alternatives for the toxic substances. Recently, several works aimed to investigate the use of amino acids as corrosion inhibitor of iron, steel, aluminium, vanadium, lead copper and its alloys in various aggressive media. Amino acids are innoxious, biodegradable, soluble in aqueous media, relatively cheap and easy to produce at high purity. These properties would justify the use of amino acids as corrosion inhibitor.

Furthermore , in recent papers we have reported the beneficial effect exerted by several amino acids, i.e.cysteine, glutamic acid, glutamine, glycine, asparagine, methionine on bronze corrosion in alkaline media. We have found that protection effectiveness of the amino acids on bronze corrosion strongly depends on the size and electronic effect of the substituents in molecule. However, the efficiency of amino acids as corrosion inhibitors does not only depend on their chemical structure but also on the solution pH, because it may influence the corrosion mechanism, the state of amino acids molecules(pronated, deprotonated, zwitter ion) and the state of metallic surface.

In this context, continuing our earlier work about the use of amino acids as environment-friendly inhibitors, the aim of the present paper is to evaluate the anticorrosive properties of glycine, glutamic acid, glutamine and asparagine on bronze corrosion in a strong alkaline solution.

Preparation method of glycine :

In a round -bottom flask is placed (120moles) of aqueous ammonia (sp. Gr. 0.90) and to it is gradually added, with stirring, 189g (2moles) of monochloroacetic acid. The solution is stirred until the chloroacetic acid is dissolved and it then set aside for about four-eight hours at room temperature .The solution, which is colourless or faintly yellow, is concentrated on' a water bath under reduced pressure to a volume of about 200cc.

The concentrated solution of glycine and ammonium chloride is transferred to a beaker, the flask is rinsed with a little water, and this is added to the main portion. The volume of the solution is finally brought to 250cc with water and the glycine is precipitated by the gradual addition of 1500cc of methyl alcohol.

The solution is well stirred during the addition of the methyl alcohol and is cooled in an ice box for four to six hours to allow complete crystallization. The solution is filtered, and the glycine crystals are washed by suspending them in 500cc of 95 percent methyl alcohol. They are again collected on the filter and washed with a little methyl alcohol and then with ether. After air drying the yield is 10g of glycine.

Experimental:

Commercial bronze specimens of dimension 2.5cm x 2.0 cm x 0.05cm containing a small hole of about 2mm. diameter near the upper edge were taken. Specimens were cut from the centre of a bronze sheet and were thoroughly cleaned, buffed, rubbed with emery paper to obtain mirror like spotless surface. The specimens were finally degreased by using acetone. All chemicals used for the systhesis of amino acid were to analytical reagent grade and solution of NaOH were prepared in double distilled water.

Each specimen was suspended by a V- shaped glass hook made by fine capillary glass tube and immersed in a glass beaker containing SOml of test solution at room temperature. After the exposure of sufficient time the test specimen was taken out, cleaned under running water and finally dried with filter paper then desicator after drying specimens weighted.

The percentage corrosion inhibition efficiency was calculated as-

$$IE/\eta \ \frac{(\Delta M_u - \Delta M_i)}{\Delta M_u} = x100$$

Where, ΔM u = Mass Loss of Metal in inhibited solution.

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The degree of surface coverage (θ) of metal was calculated as;

$$\theta = \frac{(\Delta M_u - \Delta M_i)}{\Delta M_u}$$

The corosion rate in mmpy (milli mils penetration per year) can be obtained by following equation.

Corrosion Rate (mmpy) = 87.6 ΔM/ATd

Where, ΔM = Mass loss in mg.

A = Exposed area of metal surface in cm^2.
T = Time of exoposure in hours
d = metal density in gm cm^{-3}.
H2N - CH2 - COOH
Glycine

Result and Discussion:

The inhibition of corrosion is a complex phenomenon and the efficiency of inhibitor depends on various of factors. The most evaluated factors on the inhibition efficiency of amino acids compound in fig(I).

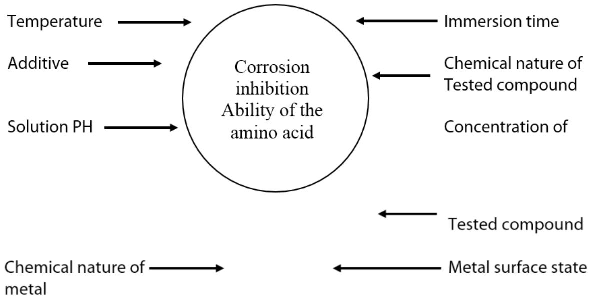
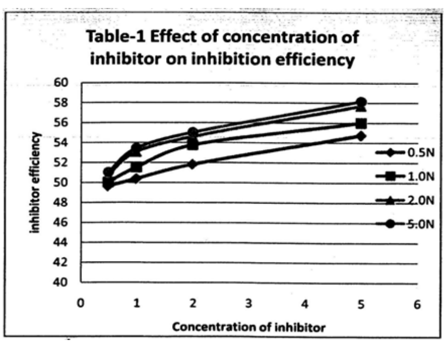


Fig (1)

In this paper we discuss effect of three factors namely immersion time, solution PH, inhibitors concentration. Immersion time can play a decisive role in the prevention of corrosion ability. Amino acids have shown an decreasing in its inhibition performance by rising exposure time or immersion time. Increasing solution PH, increases inhibition efficiency maximum IE shown at the 5N NaOH Solution. The other hand rising inhibitor concentration increase the inhibition efficiency so corrosion is decreases. For found the maximum corrosion inhibitor concentration is minimum.



Conclusion:

The efficiencies of synthesized amino acid glycine as corrosion inhibition for bronze in alkaline media have been studies. Results obtained from weight loss technique indicate that glycine act as more efficient inhibitor than glutamic acid, asparagine, glutamine in experimental conditions.

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