Study the Dissolution Reduction of Brass in Tap Water

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Abstract

A trial to use a natural, safe and available inhibitor in reducing corrosion rate of brass in tap water was held, this inhibitor is bees honey. The conditions of experiment look like to that in cooling systems at least in a stage of it. The corrosion estimation was evaluated by using weight loss method with and without inhibitor (honey). All experiments were done at 23°C and good inhibition efficiencies were obtained at the specified concentration of inhibitor. For the best results we can foundisat (3g) from inhibitor to reduce the corrosion made the efficiency be (70%), that means this inhibitor is good for brass.

الخلاصة

تم اجراء محاولة لاستخدام مثبط طبيعي التكوين, امين ومتوفر لتقليل تاكل البراص في مياه الشبكات هذا المثبط هو عسل النحل. ظروف التجربة كانت اقرب مايمكن الى الظروف الموجودة في انظمة التبريد والتي تستخدم مياه الشبكات على الاقل في مرحلة من مراحل عملية التبريد. طريقة الفقدان بالوزن هي الطريقة التي اتبعت لاحتساب معدل التاكل مع او بدون المثبط (العسل). اجريت جميع التجارب بدرجة حرارية هي 23 م وقد تم الحصول على نسب جيدة من التثبيط عند التركيز المعين للمثبط.

وان افضل نتائج حصلت عليها عند اضافة (3g) من المثبط وادى الى نقصان التآكل وجعل الكفاءة تصل الى (70%) وهذا يعني ان العسل مثبط جديد مع البراص

Introduction

Cooling water tubes are used extensively in industry (Sastri, *et al.*,2007). Corrosion of cooling water tubes or pipes is a common phenomenon. In cooling system, mild steel is the primary metal of construction used, this usually being so for low-chloride waters. Mild steel is often avoided and non-ferrous alloys such as the cupronickel and aluminum brasses are employed (Shreir, 1994).

Due to corrosion problems, several grades of inhibitors were used; such as, chromates, nitrites, polyphosphates, etc. in the cooling system but since these chemicals are detrimental to health and the environment, the recent orientation is to use safe or green inhibitors. Many studies allotted for this field can be found elsewhere (YIN , 2004; Bouklah, & Hammouti, , 2006; Hussein, *et al.*, 2010).

In this paper a trial to use honey of bees as an inhibitor in cooling system was done in a medium of tap water as a cooling fluid and brass as a metal composing the tubes.

Experimental

The weight loss method was used as a means to evaluate the corrosion rate. Tap water was used as a corrodent and a flat brass specimens as a metal to be tested which have the composition Cu 67.2, Pb 0.029, Fe 0.002, Zn 32.769. The temperature was 23 °C (room temperature) and the inhibitor was honey sold from the Iraqi market under the tradition name of **Sunbulah**, produced by Food and Fine Pastties Manufacturing factories (Saudi Arabia).The cell of these experiments is shown in figure 1 below. Before weighing the specimen, the following cleaning cycle was used to prepare it:

1- using of sand paper to remove dirt.
2- washing in tap water.
3- washing in acetone.
4- drying.
5- dipping in 3%HCl solution.
6- drying.

After the above steps weighing the specimen to get first weight measurement. After that exposing the specimen to the corroding solution with and without inhibitor for a specified time then, the specimen is detached and cleaned gently by a suitable tissue to remove corrosion products and the second mesurement is obtained by weighing it. The difference between w1 and w2 represents the weight loss and the inhibitor efficiency can be calculated according to

Efficiency=(W1-W2)/W1*100% ……..1

The volume of corroding solution was 100 ml.

Figure1: the corrosion cell

Results and Discussion

Table 1 represents the abstracted data from experiments. From these results, the inhibition efficiency values were calculated and tabulated in table 2

Table 1: Weight loss Vs. period of exposure of brass to tap water with and without honey

Time, hr	ΔW(g) at inhibitor concentration of			
	0 g	2 g	3 g	3 g
1	0.0021	0.0013	0.0008	0.0006
2.5	0.0020	0.0014	0.0002	0.0006
18	0.0019	0.001	0.0008	0.0006

Table 2: Inhibition values under various concentrations of honey

Time, hr	Inhibition efficiency, % at concentration of		
	1g	2g	3g
1 2.5 18	57.14 30 47.36	61.9 90 57.89	71.4 70 68.42

From the above tables figure 2 and 3 were obtained, in these figures at 1 g of honey the efficiency is decreased then increased by time progressing, for 2g the reverse is to be said while for 3g , roughly saying a stable efficiency, is seen. The interpretation lies: in small concentration of inhibitor, the coverage of inhibitor has small values (it is clear from table 2), therefore moderate values of inhibition is obtained and there will be a bare area at which corrodent is penetrating till reaching surfaces, as the inhibitor quantity increased, the film of inhibitor is extensive widely, hence, minimizing the bare areas. Also by increasing time exposure for the same inhibitor concentration, a random action of inhibitor is seen, i.e., increasing of efficiency then decreasing or vice versa, this could be interpreted due to adsorption and desorption mechanism of the inhibitor molecules.

It is further noticed that in absence of inhibitor, as the time increased the weight loss is decreased, the reason for this might be attributed to tha formation of corrosion product which stifle the surface of specimen, hence reduce corrosion rate or weight loss.

From the above data, one could ask; why does honey have such inhibitive action? In order to answer such question, the identity of honey must be known and by returning back to its formulations[3], it is seen that it contains carbohydrates, proteins, amino acids, vitamins, minerals, some elements like sulphur and others. Since many inhibitors action is attributed to presence of N, S and others (Shreir, 1994; YIN , 2004) accordingly these elements and the available function groups are responsible for the formation of bonding or attracting forces with the surface forming a structure like film and finally inhibition.

As a summary and from table 2 honey is a good inhibitor used for anticorrosion of brass in tap water.

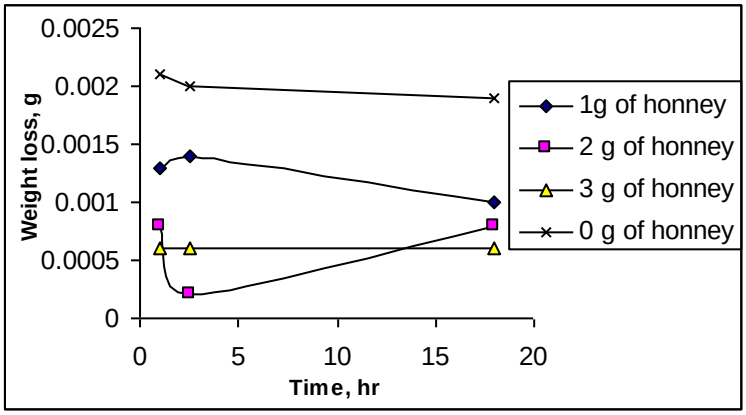

Figure 2: effect of time on weight loss

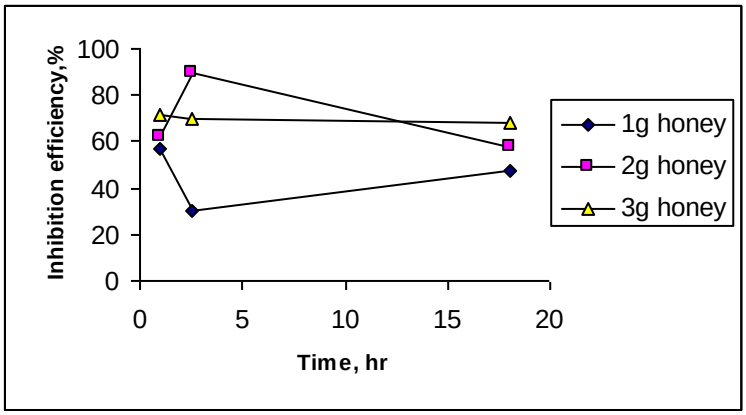

Figure 3: effect of time on inhibition efficiency

Conclusions

Corrosion of brass in tap water can be effectively reduced by using a natural material, safe and available honey. Good values of efficiency of inhibition were obtained by weight loss method. Due to wide variety of compounds and elements composing honey, it is expected that this material can be used in corrosion reduction or prevention by composing bonds or adsorption on the surface of metal. In this study honey proved itself as a good inhibitor.

References

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