



Study Of Anti-Corrosive Properties Of Co^{++} , Ni^{++} And Cu^{++} Metal Chelates Of Hydrazones

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Abstract- Corrosion poses a significant challenge in the use of metals, leading to high maintenance and protection costs. Despite being a constant and persistent issue, it can be mitigated by retarding or preventing the corroding processes. This study focuses on the corrosion inhibition activity of hydrazone metal ion chelates. The results indicate that these chelates demonstrate corrosion inhibition properties, offering potential solutions for addressing the detrimental effects of corrosion on materials.

1. Introduction.:-

Corrosion is the deterioration of metal by the chemical reaction when metal comes in contact with the atmosphere or moisture there is an oxidation reduction processes¹. Corrosion of metals is a constant and continuous problems often difficult to eliminate². The use of inhibitor is one of the most practical methods for protection against corrosion³⁻⁶. Corrosion inhibitor are chemical compound which is used in small quantities can retard the degradation of metals in hostile tenvironmen⁷. Literature serve shows that many synthetic compound are acts as inhibitors mainly depend on some physic-chemical properties of molecule related to its functional group to the possible steric effect and electronic density of the atoms, adsorption is also supposed to depends on the possible interaction of pi orbital of the inner orbital with d orbital of the surface atom , which induce greater adsorption of the inhibitor molecule on the surface of C- steel, leading to the formation of corrosion protection film^{8,9} . The organic molecule adsorb on the metal surface through heteroatom, such as nitrogen, oxygen, and sulphure blocking the the active site and generating a physical barrier to deduced the transport of corrodible species to metal surface¹⁰⁻¹⁴. Schiff vase compound and their metal complex acts as anti- corrosion agent¹⁵⁻¹⁶. Some Schiff base compound have recently been reported as effective corrosion inhibitors for mild steels^{17,18} . In present work used metal ion complexes are already reported method of synthesis and characterization of metal complexes are published in research journal. Only effect of corrosion inhibition property mention here.

2. Chemistry of corrosion.

Corrosion reaction is electrochemical in nature. They involve the transfer of charged ions across the surface between a metal and the electrolyte solution in which it is immersed. There are two types of electrode reactions occurring at the metal surface i) Anodic ii) Cathodic.

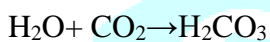
Consider the corrosion consisting of formation of rust on iron. Oxygen gas and water must be present along with iron to rust. Some part of metal surface serves as anode where oxidation takes place.



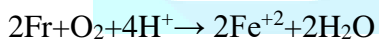
The electrons given up by iron reach another region of the same metal surface, where oxygen of air is reduced to water by H^{+} ions as



The reduction reaction occurs in an acidic medium. The origin of H^{+} ions is carbonic acid formed by atmospheric carbon dioxide and moisture or water



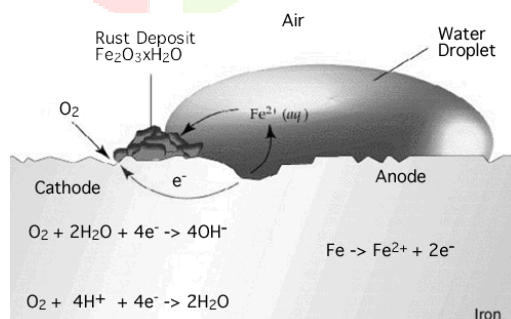
The net corrosion reaction is obtained by adding two reactions.



The oxidized Fe^{+2} ions are further oxidized by oxygen in presence of water into the rust in the form of hydrate ferric oxide.



3. Mechanism of rusting.



It is well known in surface chemistry that surface reactions are strongly affected by the presence of foreign molecules. Corrosion process, being a surface reaction, can be controlled by a compound known as inhibitors which adsorb on the reacting metal surface. The term adsorption refers to molecules attached directly to the surface, normally only one molecular layer thick and not penetrating into the bulk of the metal itself. The technique of adding inhibitor to the environment of metal is a well-known method of controlling corrosion. The inhibiting compound contributes to the formation of a thin layer on the surface which stifles the corrosion process.

Inhibition is one of the most important application in the corrosion process. Inhibitor protect the metal by adsorbing onto the surface and retard metal corrosion in aggressive environment. Selecting the appropriate inhibitor for specific environment and metal is of great importance, since an inhibitor that protect one particular metal may accelerate the corrosion of another. A survey of literature reveals that the applicability of organic compound as corrosion inhibitors for steel has been recognized for long time. A large number of organic compounds, particularly those containing nitrogen, oxygen or sulphure in a conjugated system are known to be applied as inhibitors to control corrosion of iron and steel. The inhibition process has been shown to occur via inhibitor adsorption isothermal and the efficiency of the inhibitor strongly depend on the structure and chemical characteristic of the adsorbed inhibitor layer formed under particular experimental condition. It has been reported that the adsorption of an organic compound onto the surface of metal is dependent on the following properties of the inhibitor molecule such as steric factors, functional group, electron density at the donor atoms and π orbital character of donating electrons and on the nature of substrate metals and the type of interaction between organic molecules and the metallic surface. In other word the efficiency of an organic compound as corrosion inhibitor depends not only on the characteristics of the environment in which it acts the nature of the metal at the interface, but also on the structure of the inhibitor itself, which includes the number of adsorption active centers in the molecule, their charge density in the molecular size, the mode of adsorption, the formation of metallic complexes and projected area of the inhibitor on the metallic surface.

In the present work we studied the effect of heterocyclic compound and its metal complexes on corrosion.

4. Experimental

For the study of anti-oxidative effect of ligand and its metal complexes, steel wire is used for the experiment. Wire is purchased from local market. First of all wire is cleaned by regmal paper (sand paper) then it is washed with distilled water and cleaned by filter paper. Then it is dried in oven. Then near about length of 3.5 cm pieces are made by cutter. Its weight are taken on digital one pan balance. In second step 0.5 N solution of H_2SO_4 is prepared and standardized by NaOH. Then 5 beaker beakers of 100 ml taken, they are cleaned with distilled water and dried. Labeled them by number 1 to 5. In each beaker contain 10 ml of 0.5 N H_2SO_4 acid. In addition to this beaker number 2 contain legend (HMPBEBTH). In beaker number 3, 4, 5 contain metal complexes Co, Ni, Cu of ligand (HMPBEBTH) respectively. In each beaker added metal pieces which is previously weighed and kept it for 48 hours. After 48 hours metal pieces are taken out and cleaned with water and followed filter paper and its weight are taken. Weight of metal wire pieces before experiment, after experiment, loss in weight, % loss is calculated by usual method. % inhibition efficiency is calculated by using following formula

$$I. E. = \frac{W_u - W_i}{W_u} \times 100$$

Where

I. E. = Inhibition Efficiency.

W_i = Loss in weight in inhibitor solution.

W_u = weight loss in control solution.

5. Result and discussion

Table no. 1

	Compound	Initial wt.	Final wt.	Loss in wt.	% Loss in wt.	I.E.
1	control	1.523	1.306	0.217	14.258	--
2	HMPBEBTH	1.621	1.428	0.193	11.906	16.437
3	[Co(HMPBEBTH) ₂] Cl ₂ . H ₂ O	1.537	1.469	0.068	4.454	68.950
4	[Ni(HMPBEBTH) H ₂ O] Cl ₂	1.516	1.453	0.063	4.155	72.466
5	[Cu(HMPBEBTH) Cl] Cl.H ₂ O	1.362	1.283	0.079	5.800	58.342

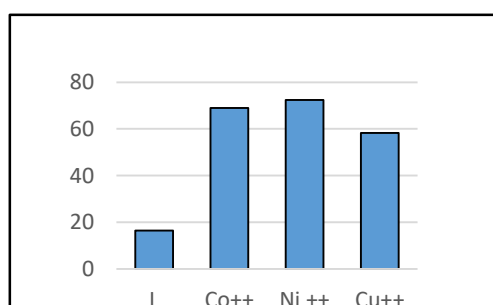
Table no.2

Sr. No.	Compound	I.E.
1	HMPBEBTH	16.437
2	[Co(HMPBEBTH) ₂] Cl ₂ . H ₂ O	68.950
3	[Ni(HMPBEBTH) H ₂ O] Cl ₂	72.466
4	[Cu(HMPBEBTH) Cl] Cl.H ₂ O	58.342

From the observation table it indicates that ligand as well as metal complexes have corrosion inhibitive properties. Ligand HMPBMBTH is least inhibitive property.

Among the metal complex of the Ni⁺⁺ most corrosion inhibitor and the complex Cu⁺⁺ least inhibitive property. Complex of the Co⁺⁺ is medium corrosion inhibitor.

Anti-corrosive properties can be graphically represented as follows.



References:-

- 1) M. Faiz; A. Zahari, K. A Wang, and H.Hussin. RSC Advances, Vol. 10 p p 6547-6562 (2020).
- 2) N.B.I. Akens Hamilton-Amachree. Chemistry International, Vol. 6, p p 117-128 (2019)
- 3) Quraishi M Shukla, S.K. Matter Chem. Phys. P p 685 (2009)
- 4) Abdel Hameed R.S. Advances in applied science research 2 (3) pp 483-499 (2011)
- 5) Abd. El Hameed, R.S. Alshafey, HI, soliman, S.A. Metwaly M.S. Al-Azhar Bull. Sci. 19, 283 (2008).
- 6) Shehula H.A. et al Material Science 8 (7) pp 302 (2012). 7) J.D. Talati. D.K. Gandhi, Indian J. Technol. 30 (1982) 312.
- 8) Benitiss, F. Lagrenee, M., Trainsel, M. J Corros, 56, pp 733-742 (2000)
- 9) Benitiss, F., Traisel, M. , Lagrenee. M. J. Apple, Electrochem, 31, pp 41-48 (2001)
- 10) Wang, H.L. Lie. R.B. Xin, J., Corros. Sci., 46, 2455-2466 (2001)
- 11) Solmaz. R., Kardas, G., Yazici, B. Erbil. M. Prot. Met., 41, pp. 581-585 (2005)
- 12) Emegul, K.C., Kurtaran, R. Atakal, O., Corros .Sci, 4., p p 2803-2817 (2003)
- 13) Liu, F.G., Du. M., Zhang, J, Qui. M. Corros Sci, 51 pp. 102-109 (2009)
- 14) Khaled, K.F, Amin, M.A. Corros Sci., 51, p p 1964-1975 (2009).
- 15) I. Ahamad, R. Prasad and M.A. Qurashi. Corrosion Science, 52, p p 933-942. (2010).
- 16) M. Antonijevic and M petrovic, International Journal of Electrochemical Science 3 (1) p p 1-28 (2008).
- 17). Desai M.V., Desai, M.B. Shah C. B. Desai S.M. Corrs. Sci., 26, pp 827 (1986).
- 18) H. shokry, M Yuasa. I . Sekine, R.M. Issa, H.Y. El-Baradie and O.K. Comma. Corro. Sci. 40(12) pp 2173 (1998). 19). Suraj B. Ade, Balasaheb u. Jadhav. Subhash M. Lonkar, Nana V. Shitole. IETIR 7(3) (2020)
- 20) Wurrod Ali Jaafar and Ruwaidash. S. Saeed. Syn. Rev. Pharma. 11 (10) pp 134-143(2020)