SUMMARY

1- A literature survey on the previous studies on electrochemical behavior of copper in aqueous solutions is given, in the first part of the thesis, with particular emphasis on its behavior in neutral solutions.

2- Galvanostatic "cathodic and anodic" polarization curves was constructed for copper, at different immersion times in natural water free additives and natural water containing organic additives, it was found that:

a) For copper electrode immersed in water free additive, the values of $I_{corr.}$ deceases and consequently the percent I.E. increase with increasing the immersion time in natural water. And this would indicate that during the immersion period of the copper electrode a protective film is assumed to form onto the surface. As a result the rate of both the oxygen reduction on the cathodic sites and the metal dissolution on the anodic sites are decreased and this gives a suggestion that during the immersion period of the copper electrode, the dissolved oxygen is assumed to chemisorbe onto the copper surface and its reduction together with possible formation of surface cuprous oxide (Cu_2O) film on the metal surface which makes a negative shift in potential giving an indication to cathodic protection.

b) For copper electrode immersed in natural water containing organic additives, as the Cu_2O surface film is formed, the inhibitor molecules are adsorbed on both the oxide-free and the oxide-covered sites forming a stable and barrier film, and this leading to a shift in percent I.E. to a higher values than the blank, and this is due to the formation of a barrier complex layer which consists of directly adsorbed inhibitor molecules on the metal surface sites in equilibrium with the cuprous inhibition complex underliad with surface cuprous oxide film.

c) For copper electrode kept exposed to air for different periods of time then immersed in test solution containing the organic additive, it was obtained that increasing the pre-exposure time of copper in air lead to decrease the $I_{corr.}$ until a minimum is reached at about 12 hours.

The decrease in $I_{corr.}$ and consequently the increase in percent I.E. as well as the increase of Bc relative to the blank, reflect that the inhibitor molecules are chemsorbed on and react with cuprous oxide forming a stable and protective barrier film.

3- Cyclic voltamograms were constructed for copper, in sodium hydroxide solution. The complete cycle, the effect of reversal potential, immersion time and the pre-exposure periodes. Perior to cathodic reduction were studied. It was found that:

a) The cyclic voltammogram of copper in sodium hydroxide solution is characterized by four anodic steps before oxygen evolution and three cathodic ones. The successive oxidation steps correspond to the formation of Cu_2O, $Cu(OH)_2$, $HCuO_2^-$ and Cu_2O_3. The three cathodic steps correspond to successive reduction of the formed oxides to metallic copper.

b) Cathodic reduction of the surface layer spontaneously formed on the copper electrode in the absence organic additives, two cathodic peaks (K and L) are obtained which lie within nearly the same potential region of the two cathodic peaks (I and M), and this give strong evidence for the formation of $Cu(OH)_2$ and its reduction together with Cu_2O.

c) Cathodic reduction of the surface layer spontaneously formed on the copper electrode in the presence of organic additives,Two potential regions of the cathodic peak K which obtained for the reduction of the surface layer formed spontaneously in absence of organic additives. Moreover, no cathodic peak corresponding to peak L is observed, which may be attributed to the presence of a stable surface layer not available for reduction.

4- Studying of the IR-spectrum of the protective film formed on the copper surface in different organic solutions. By comparing the IR spectrum of the free organic compounds with those of their complexes, we found a set of new bands, and a shift in basic viberational bands from that of the free ligand which confirm the formation of complex.

5- Scanning electron miocroscopy (SEM). the film formed on each copper specimen was studied using scanning electron microscope (SEM), which show a great difference for each micrograph, giving an indication to the formation of surface films on each copper specimen.