

2.1.5. Organic additives	49
2.2. Results.....	51
2.2.1 The electrochemical and corrosion behavior of copper electrode immersed for different periods of time in natural water.	51
2.2.1.1. corrosion (steady state) potential ($E_{\text{corr.}}$).....	51
2.2.1.2. Polarization behavior in natural water	51
2.2.1.3. .Effect of organic compounds.....	52
2.2.1.4. Behaviour of the pre-treatment copper electrode in air prior to immersion in water-free additive.....	54
2.2.2. Behaviour of copper electrodes exposed to air for various periods of time as a pre-treatment prior to immersion in natural water containing additives.....	55
2.2.3. Effect of immersion time in the test solution	56
2.3. Discussion	58
2.3.1. Behavior in the natural water.....	58
2.3.2. Effect of immersion time in natural water-free additive.	59
2.3.3. Behavior in presence of some organic compounds.....	61
2.3.4. Effect of cuprous oxide film.....	63

Chapter III

Introduction	88
3.1. Experimental	91
3.2. Results	92
3.2.1. The reduction behavior of the surface layer formed on copper electrode.....	92
3.2.2. The reduction behavior of the anodized copper electrode in	

1.0 M NaOH solution	92
3.2.2.1. The reduction behavior of the surface layer spontaneously formed on the copper electrode.....	94
3.3. Discussion	97
3.3.1. Anodic oxidation of copper electrode in 0.1 M NaOH solution	97
3.3.2. Cathodic reduction of the anodically formed surface film on the copper electrode in 0.1 M NaOH.....	99
3.3.3. Cathodic reduction of the surface layer spontaneously formed on the copper electrode	100
IV. Scanning electron microscopy (SEM)	108
V. The infrared spectrum identification of the formed precipitates	116
1. Studying of the IR spectrum of the protective film formed on the copper surface in different organic solutions.....	117
1.1. IR spectrum of 4-amino antipyrin and its Cu-complexes.....	117
1.2. IR spectrum of 3-methyl pyrazolone and its Cu-complexes.....	118
1.3. IR spectrum of 3-amino 1,2,4-triazole and its Cu-complexes....	119
References.....	
Summary	
Arabic sammary.....	