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Characterization and Electrochemical Preparation of Thin Films of Binary Heavy Metals (Cu-Pb,Cu-Cd,Cu-Zn) from Simulated Chloride Wastewaters

Abbas Hamid Sulaymon[1], *Sawsan A. M. Mohammed*[2], *Ali Hussein Abbar*[3,*]

[1] Environmental Engineering Department, University of Baghdad, Iraq
[2] Chemical Engineering Department, University of Baghdad, Iraq
[3] Chemical Engineering Department, Al-Qadissya University, Iraq
[*]E-mail: aliabbar68@yahoo.com

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Cu-Pb, Cu-Cd, and Cu-Zn thin films were electrodeposited from a simulated chloride wastewater solution using stainless steel rotating disc electrode. The linear sweep voltammograms of the single metallic ions show that electrodeposition of these ions was under mass transfer control due to the well-defined plateau observed under different rotations. The voltammograms of binary systems elucidate the possibility of selective separation of copper from these binary systems. Currents transients measurements, anodic linear sweep voltammetry (ALSV) and atomic force microscopy (AFM) were used to characterize the electrocryatalization process and morphology of these thin films. ALSV profiles show a differentiation for the dissolution process of individual metals and binary systems. Two peaks of dissolution Cu-Pb film was observed while three and four peaks observed for Cu-Cd and Cu-Zn films respectively indicating different phases have been existed. The model of Scharifker and Hills was used to analyze the current transients and it revealed that Cu-Pb and Cu-Cd electrocrystalization processes are governed by three –dimensional progressive nucleation controlled by diffusion, while Cu-Zn electrocrystallization process starts as a progressive nucleation then switch to instantaneous nucleation process for $t/t_m>3$.AFM images reveal that Cu-Pb film is more roughness than Cu-Cd and Cu-Zn films.

Keywords: Heavy metals, Electrodeposition, Anodic dissolution, Electrocrystalization, Cu-Pb / Cu-Cd / Cu-Zn thin films.

1. INTRODUCTION

Heavy metals are elements having atomic weights between 63.5 and 200.6, and a specific gravity greater than 5.0 [1].They are toxic pollutants and are usually released into the surface and