

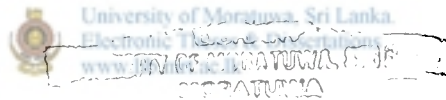
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EFFECTS OF OPERATING CONDITIONS ON ELECTRODIALYTIC CONCENTRATION OF SILVER FROM PHOTO-PROCESSING EFFLUENTS

By

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THIS THESIS WAS SUBMITTED TO THE DEPARTMENT OF CIVIL
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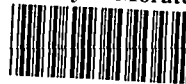
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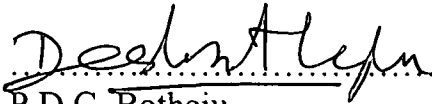
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ABSTRACT

Electrodialysis is now recognized as a cleaner technology for reclaiming waste chemical solutions including industrial effluents contaminated with heavy metals. Compared with the conventional separation methods (chemical precipitation, filtration, evaporation, electrolysis, etc.), electrodialysis offers remarkable advantages such as less area requirement, ability to incorporate into the production process itself, avoidance of the generation of hazardous chemical sludge and many more. In this study, Electrodialytic recovery of Silver (Ag) from photo-processing effluents was investigated with the aim of understanding the possible effects of various operating conditions on the process.

In this study a laboratory fabricated four-membrane, five-compartment, Electrodialysis cell was used with the cationic and anionic selective ion exchange membranes Asahi Kasei K501SB and A501SB, respectively, which are originally used for seawater desalination. The removal efficiency of Ag^+ at different current densities was studied, using synthetically prepared metal ion solutions and actual industrial effluents containing Silver (photo processing effluents). Time dependent sampling was done and analyzed with a flame atomic absorption spectrophotometer (GBC 932).

According to the experimental results, very significant removal efficiencies were observed in the range of current densities studied. At low current densities of 2 and 4 mA/cm^2 , removal percentages observed were 36 and 53.5, respectively. However at high current densities of 8 and 10 mA/cm^2 , removal percentages increased up to 85 and 96 respectively (for an initial feed concentration of 1000 mg/L). However at those high current densities, ion exchange membranes were found to be damaged due to high heat dissipation. It was also noticed that at low concentrations of feed solution (i.e. 300 and 100 mg/L), the removal efficiencies were reduced remarkably. Considering these results Electrodialysis with the aid of desalination ion exchange membranes could be recognized as an efficient and locally made sustainable technology for treating silver containing effluents having a sufficiently high contamination level, while reclaiming the metal silver for reuse. However the necessity of a final smoothing treatment stage such as metal replacement, ion exchange or adsorption is stressed to obtain higher quality water.

Few experimental trials on Electrowinning were also conducted at a single electrical potential (5V), in order to compare the power consumption of the two processes. Results revealed that

the power consumption for electro dialysis is comparatively lower than electrowinning (i.e. by only considering the power consumption of the reactor, without accessories).

Necessity of the construction of pilot scale reactors is recognized for a full economical review of the two process schemes. On the other hand experiments must be carried out on the synthesis of ion exchange membranes having good permselectivity towards multivalent cations, so that the Electro dialysis process could be applicable on treating other industrial effluents contaminated with multivalent metal cations.



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CONTENTS

List of Tables	i
List of Figures	ii
Abbreviations	iv
CHAPTER 1: INTRODUCTION	1
1.1. Electrodialysis	2
1.2. Electrowinning	4
1.3. Treatment of Silver containing effluents	5
1.3.1 Silver	5
1.3.2 Fate of Silver in the Environment	5
1.3.3 Silver Toxicity	6
1.3.4 Standards on Silver Exposure	7
1.4. Photographic Effluents	7
1.5. Methods for Silver Recovery from Photo-effluents	8
1.6. Necessity of Electrodialytic Silver Recovery	9
1.7. Objectives of the Research Study	9
1.8. Scope of the Study	10
CHAPTER 2: LITERATURE REVIEW	11
2.1. Electrodialysis Reactor	12
2.2. Some of the Important Definitions in Electrodialysis	15
2.2.1 Current Density	15
2.2.2 Transport Number	15
2.2.3 Current Efficiency	16
2.2.4 Concentration Polarization and Limiting Current Density	16
2.3. Modified Electrodialysis Processes	17
2.3.1 Ion Exchange Assisted Electrodialysis	17
2.3.2 Complexation Electrodialysis	20
2.3.3 Bipolar Membrane Electrodialysis	21
2.3.4 Electrodialysis Reversal (EDR)	22
2.4. ED Process Economy	22
2.5. Electrodialysis Membranes	23
2.5.1 Membrane Manufacturing	23
2.5.2 Membrane Modifications	24
2.5.3 Membrane Fouling and Fouling Control	26
2.6. Metal Removal Applications of Electrodialysis	27
2.7. Electrowinning	32
2.7.1 Common Applications of Electrowinning	36
2.8. Conclusions Arrived from the Literature Review	41

CHAPTER 3: MATERIALS AND METHODS	43
3.1. Electrodialysis	44
3.2. Electrowinning	47
CHAPTER 4: RESULTS AND DISCUSSION	49
4.1 Electrodialysis Experiments on Artificial Silver Solutions	50
4.1.1 Experiments with 1000 mg/L Initial Concentration	50
4.1.2 Experiments at 0.4 mA/cm ² Current Density	58
4.1.3 Experiments at 0.6 mA/cm ² Current Density	61
4.2 Electrodialysis Experiments on Actual Photo-processing Effluents	63
4.2.1 Experiments at 0.6 mA/cm ² Current Density	63
4.3 Electrowinning Experiments	67
4.4 Comparison of Power Consumption for a Unit Metal Removal	72
CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS	76
5.1 Conclusions	77
5.2 Recommendations	77
Publications	79
Bibliography	80



LIST OF TABLES

Table	Page
Table 4.1: Percentage Ag^+ Removal at Different Current Densities	57
Table 4.2: Removal Percentages of Electrodialytic Treatment of Actual Wastes	65
Table 4.3: Results of Electrowinning Experiments on Artificial Ag Solutions	69
Table 4.4: Results of Electrowinning Experiments on Actual Silver Containing Effluents	70
Table 4.5: Power Consumptions of Electrodialysis and Electrowinning Experiments	73



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11

LIST OF FIGURES

Figure	Page
Figure 2.1: Schematic Presentation of a Five Compartment ED Reactor	12
Figure 2.2: Production of Acids and Bases Using Bipolar Membrane ED	21
Figure 3.1: Schematic Presentation of the ED Process	45
Figure 3.2: ED Reactor at the Exp. Set up	45
Figure 3.3: Parallel Flow Arrangement	46
Figure 3.4: Duel Head Peristaltic Pump	46
Figure 3.5: pH Controller	46
Figure 3.6: Spacer Arrangement	46
Figure 3.7: Electrowinning Exp. Set up	47
Figure 3.8: Electrode Arrangement	47
Figure 3.9: Measurement of Conductivity	47
Figure 3.10: Atomic Absorption Spectrophotometry	47
Figure 4.1: Ag Concentration of Feed	51
Figure 4.2: Ag Concentration of Cationic Concentrate	52
Figure 4.3: Variation of Potential Difference	53
Figure 4.4: Variation of Feed Temperature	54
Figure 4.5: Variation of Feed pH	55
Figure 4.6: Variation of Electrode Rinse pH	55
Figure 4.7: Ag Concentration of Anionic Concentrate	56
Figure 4.8: Ag Concentration of the Electrode Rinse	57

Figure 4.9: Results of 4 mA/cm ² - Artificial Metal Solutions	59
Figure 4.10: Results of 6 mA/cm ² - Artificial Metal Solutions	62
Figure 4.11: Results of 6 mA/cm ² - Industrial Waste Solutions	64
Figure 4.12: Results of Electrowinning of Artificial Solutions at 5V	68
Figure 4.13: Results of Electrowinning of Industrial waste Solutions at 5V	71
Figure 4.14: Membrane Damage due to Non-uniform Current Distribution	74
Figure 4.15: Ag Accumulation on the Membrane Surface	74
Figure 4.16: Recovered Silver in Electrowinning Experiments	74
Figure 4.17: Non-uniformity of Silver Plating	74



ABBREVIATIONS

AAS	-	Atomic Absorption Spectrophotometer
AEM	-	Anion Exchange Membrane
BPM	-	Bipolar Membranes
c.d	-	Current Density
CEM	-	Cation Exchange Membrane
DC	-	Direct Current
ED	-	Electrodialysis
EDI	-	Electrodeionization
EDR	-	Electrodialysis Reversal
EDTA	-	Ethylenediaminetetraacetic acid
EN	-	Electroless Nickel
HSA	-	High Surface Area
HMT	-	High Mass Transfer
HDPE	-	High Density Polyethylene
IEC	-	Ion Exchange Capacity
OSHA	-	US Occupational Safety and Health Administration
SS	-	Stainless Steel
USEPA-		United States Environmental Protection Agency



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