

CONTENTS**1. INTRODUCTION**

1.1.	Pollution	1
1.1.1.	Type of pollution	1
1.1.1.1.	Air pollution	1
1.1.1.2.	Soil pollution	2
1.1.1.3.	Radioactive pollution	3
1.1.1.4.	Water pollution	4
1.1.1.4.1.	Excreta and organic industrial waste	6
1.1.1.4.2.	Infection agents	6
1.1.1.4.3.	Plant nutrients	7
1.1.1.4.4.	Organic pesticides	7
1.1.1.4.5.	Waste mineral and chemicals	8
1.1.1.4.6.	Oil	8
1.1.1.4.7.	Radioactive liquid waste	8
1.2.	Toxicity and Chemistry of Some Heavy Metals	9
1.2.1.	Toxicity of heavy metals	9
1.2.2.	Chemistry of some heavy metals	9
1.2.2.1.	Copper	9
1.2.2.2.	Zinc	13
1.2.2.3.	Cadmium	13
1.2.2.4.	Nickel	13
1.3.	Different Tools Used for the Management of Waste	
	Water	14
1.3.1.	Chemical precipitation	14
1.3.2.	Evaporation	15
1.3.3.	Ion exchange	15
1.3.3.1.	Type of ion exchange materials	16
1.3.3.1.1.	Natural ion exchange materials	16
1.3.3.1.1.1.	Zeolite	16
1.3.3.1.1.2.	Nile rose plant (water Hyacinth)	17
1.3.3.1.1.3.	Animal bone (Animal Tricalcium Phosphate)	17
1.3.3.1.2.	Synthetic ion exchanger materials	18
1.3.3.1.2.1.	Inorganic ion exchanger	18
1.3.3.1.2.1.1.	Properties of synthetic inorganic ion exchanger	19
1.3.3.1.2.2.	Organic resins	20
1.3.3.1.2.2.1.	Properties of organic resin	20
1.4.	Treatment of Waste Water Using Inorganic and Organic	
	Materials	24
1.4.1.	Treatment of waste water using inorganic ion exchanges	24
1.4.2.	Treatment of waste water using organic resins	30

		Page
1.4.2.1.	Acrylic acid polymers {P(AA)}	30
1.4.2.2.	Acrylamide polymers {P(AM)}	31
1.4.2.3.	Acrylamide polymeric resins and its polymeric impregnated	32
1.4.3.	Mechanism of the template polymerization technique	33
1.4.4.	Factors affecting on the sorption process	34
1.4.4.1.	Swelling	34
1.4.4.2.	Degree of swelling	35
1.4.4.3.	Capacity	35
1.4.4.4.	Temperature	36
1.4.4.5.	Particle size and porosity	37
1.4.4.6.	Effect of pH	37
1.4.4.7.	Selectivity	37
1.5.	Literature Survey	39

2. EXPERIMENTAL

2.1.	Chemical and Materials	45
2.2.	Equipments	45
2.2.1.	Water thermostat shaker	45
2.2.2.	Infrared spectrophotometer (IR)	45
2.2.3.	X-Ray diffraction patterns (XRD)	45
2.2.4.	X-Ray fluorescence spectrometer (XRF)	47
2.2.5.	Atomic absorption spectrophotometer (AAS)	47
2.2.6.	Inductive coupled plasma (ICP)	47
2.2.7.	pH-meter	47
2.3.	Preparation and Characterization of Materials Used ...	47
2.3.1.	Synthesis of poly(acrylamide-acrylic acid) {P(AM-AA)} resin	47
2.3.2.	Synthesis of poly(acrylamide- acrylic acid) impregnated silicon titanate P(AM-AA)-SiTi	48
2.3.3.	Characterization of the prepared samples	48
2.3.3.1.	Chemical stability	49
2.3.3.2.	Determination of swelling degree	49
2.4.	Sorption Investigation	49
2.4.1.	Equilibrium time	49
2.4.2.	Effect of sodium hydroxide treatment	50
2.4.3.	Apparent capacity measurement	50
2.4.4.	Effect of pH of the medium.....	51
2.4.5.	Sorption isotherm	52
2.4.6.	Effect of sodium salt on the sorption behavior of some heavy metals	53
2.4.7.	Column technique	53

3. RESULTS AND DISCUSSIONS

3.1.	Preparation of Poly(Acrylamide-Acrylic Acid)-Silicon Titanate {P(AM-AA)-SiTi}	55
3.2.	Characterization of Poly(Acrylamide-Acrylic Acid)-Silicon Titanate {P(AM-AA)-SiTi}	57
3.2.1.	Infrared spectroscopy (IR)	57
3.2.2.	X-Ray diffraction patterns(XRD)	58
3.2.3.	X-ray fluorescence spectroscopy (XRF)	59
3.2.4.	Chemical stability	59
3.2.5.	Effect of pH on the dissociation of the resin	60
3.3.	Effect of NaOH Treatment	60
3.4.	Batch Investigations.....	61
3.4.1.	Effect of contact time on sorption behavior of P(AM-AA)-SiTi	61
3.4.2.	Effect of batch factor(V/m)	61
3.4.3.	Effect of pH of the Medium	62
3.4.4.	Sorption isotherm	63
3.4.5.	Effect of reaction temperature	65
3.4.6.	Effect of some anionic species on the sorption behavior of Cu^{2+} , Cd^{2+} , Ni^{2+} and Zn^{2+} ions on P(AM-AA)-SiTi	65
3.4.7.	Effect of some complexing agent on the sorption behaviour of P(AM-AA)-SiTi	66
3.4.8.	Apparent capacity measurements	67
3.5.	Column Studies	68
3.5.1	Removal of Cu^{2+} , Cd^{2+} , Ni^{2+} and Zn^{2+} ions from simulated waste water on P(AM-AA)-SiTi columns	69
3.5.2.	Applications on treatment and removal of some toxic heavy metals from waste water using P(AM-AA)-SiTi columns	70
	SUMMARY	107
	REFERENCES	112
	ARABIC SUMMARY	