

# CONTENTS

CHAPTER NO	TITLE	PG.NO.
<b>CHAPTER 1</b>	<b>INTRODUCTION</b>	<b>1-31</b>
1.1	Introduction	1
1.2	Ion exchange	1
1.3	A retrospective on developments in ion exchange	3
1.4	Classification of ion exchangers	5
1.5	TMA salts (tetravalent metal acids salts) as cation exchangers	12
1.6	Hybrid ion exchangers	18
1.7	New developments in ion exchange materials	19
1.8	Aim and scope of the present work	21
	References	25
<b>CHAPTER 2</b>	<b>HYBRID MATERIALS - M(IV)PHOSPHONATES AS CATION EXCHANGERS</b>	<b>32-139</b>
2.1	Novel hybrid materials- metal phosphonates	32
2.2	Literature survey in the current area of study	36
2.3	Aim and scope of the present work	39
2.4	Sol-gel process	41
2.5	Experimental	43
2.6	Material characterization	46
2.7	Thermodynamics, kinetics and adsorption studies	58
2.8	Experimental	69
2.9	Results and discussion-Part I	71
2.10	Results and discussion-Part II	87
2.11	Concepts in ion exchange and metal separations	103
2.12	Experimental	111
2.13	Results and discussion	113
2.14	Conclusions	130
	References	131

**CHAPTER 3    HYBRID MATERIALS - M(IV)POLYAMINES AS    140-178**  
**AMPHOTERIC EXCHANGERS**

3.1	Introduction	140
3.2	Aim and scope of the present work	141
3.3	Experimental	142
3.4	Material characterization	144
3.5	Anion exchange properties of ZrD/ZrT	145
3.6	Cation exchange properties of ZrD/ ZrT	145
3.7	Amphoteric behavior of the material	147
3.8	Case study	147
3.9	Regeneration and reusability of ion exchanger	148
3.10	Instrumental methods of characterization	148
3.11	Results and discussion-Part-I	149
3.12	Results and discussion-Part-II	162
3.13	Conclusions	175
	References	176

**CHAPTER 4    FABRICATION AND UTILITY OF CHELATING    179-228**  
**MEMBRANE**

4.1	Introduction	179
4.2	Membrane synthesis	180
4.3	Aim and scope of the present work	183
4.4	Objectives of the present work	184
4.5	Experimental	185
4.6	Characterization of ion exchange membranes	187
4.7	Adsorption studies	196
4.8	Results and discussion Part-I	199
4.9	Results and discussion Part-II	211
4.10	Conclusions	218
	References	219

**SUMMARY**

**PUBLICATIONS**

**APPENDIX**