Use of Phosphorus-Containing Polymers for the Removal of Metal Ions from Wastewater

By: Lupa, I. (Lupa, Laviniia)[1]; Popa, A (Popa, Adriana)[2]; Ilia, G (Ilia, Gheorghe)[2]

PHOSPHORUS-BASED POLYMERS: FROM SYNTHESIS TO APPLICATIONS

Edited by: Monge, S; David, G

Book Series: RSC Polymer Chemistry Series

Volume: 11 Pages: 225-251

Published: 2014

Document Type: Article; Book Chapter

Keywords

KeyWords Plus: CHITOSAN-POLYPHOSPHATE BEADS; LIGAND SYNERGISTIC INTERACTION; IMMOBILIZED PHOSPHATE LIGANDS; ENVIRONMENTAL SAMPLES; AQUEOUS SOLUTIONS; EXCHANGE-RESINS; ACID GROUPS; METHYLENEPHOSPHONIC ACID; MACROPOROUS POLYMERS; SELECTIVE ADSORPTION

Author Information

Reprint Address: Popa, A (reprint author)
+ Romanian Acad, Inst Chem Timisoara, B Dului Mihai Viteaz 24, Timisoara 300223, Romania.

Addresses:
+ [1] Politehn Univ Timisoara, Fac Ind Chem & Environm Engr, Timisoara 300223, Romania

Email Addresses: apopa_ro@yahoo.com

Publisher

ROYAL SOC CHEMISTRY, THOMAS GRAHAM HOUSE, SCIENCE PARK, CAMBRIDGE CB4 4WF, CAMBS, ENGLAND

Categories / Classification

Research Areas: Polymer Science

Web of Science Categories: Polymer Science

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CHAPTER 11

Use of Phosphorus-Containing Polymers for the Removal of Metal Ions from Wastewater

Lavinia Lupa, Adriana Popa and Gheorghe Ilia

The removal of heavy metals from various industrial waste effluents before discharging the effluent is a global environmental concern. In this chapter the advantages of the use of natural and synthetic chelating resins in the removal of various metal ions from aqueous solutions are presented. The chelating resins were obtained by the chemical modification of their surface with different phosphorus pendant groups. One may notice that the modification of the polymeric matrix through phosphorylation of its surface with different phosphorus pendant groups leads to an increase in the adsorption efficiency of the polymer in the removal of metal ions from various aqueous solutions. It was observed that the selectivity for various metal ions and the maximum adsorption capacity of the functionalized polymer depended on the type of the functionalized groups grafted on the polymeric matrix, the properties of the ion-exchange/coordination resin, and the phosphorylation conditions. In conclusion, the use of a functionalized polymer with various types of phosphorus pendant groups showed good feasibility in the removal of metal ions from different aqueous solutions.
Use of Ionic Liquids in Solid-Liquid Separation Processes

Lavinia Lupa, Petru Negrea and Adriana Popa

Additional information is available at the end of the chapter

http://dx.doi.org/10.5772/65890

Abstract

This chapter reports the possible use of ionic liquids (ILs) in solid-liquid separation processes by their immobilization in suitable solid supports. This method presents some benefits such as economical one—due to the fact that a smaller quantity of ILs is used and the loss of ILs in the aqueous phase is avoided; and second the efficiency benefit—because the advantages of the ILs are combined with the properties of the solid support, and this enhances the removal process of metal ions from aqueous solutions and could be successfully used in the removal processes of metal ions from aqueous solutions containing trace amounts. The type of solid supports used for the immobilization of different ILs, and the methods used for the immobilization were discussed. Also the adsorption efficiency of these ionic liquid immobilized solid supports in the removal process of different metal ions (Cr, Hg, Pt, Au, Pd, Cs, Sr, Tl, etc.) from aqueous solutions were presented. The inorganic materials present a higher efficiency to be used as solid supports for the immobilization of the ILs. It was observed that the physical method of impregnation, especially ultrasonication, has a positive effect on the adsorption capacities of the materials obtained.

Keywords: ionic liquids, heavy metals, impregnation, encapsulation, adsorption

1. Introduction

The huge quantities of waste, discharged from various industries and from human activities, and their negative effect on human health and the environment, have led to some stringent regulations. These have driven researchers to find and develop some new efficient methods for the removal and recovery of organic and mineral contaminants from discharged wastes.

Many separation techniques have been proposed especially for the treatment of wastewaters containing heavy metals, such as precipitation [1, 2] ion-exchange [3, 4] liquid-liquid
Use of Ionic Liquids in Solid-Liquid Separation Processes

By: Lupu, L (Lupu, Liviu) [1]; Negrea, P (Negrea, P. d.) [1]; Popa, A (Popa, Adriana) [1]

PROGRESS AND DEVELOPMENTS IN IONIC LIQUIDS
Edited by: Hendry, S
Published: 2017
Document Type: Article; Book Chapter

Abstract

This chapter reports the possible use of ionic liquids (ILs) in solid-liquid separation processes by their immobilization in suitable solid supports. This method presents some benefits such as economical one due to the fact that a smaller quantity of ILs is used and the loss of ILs in the aqueous phase is avoided; and second the efficiency benefit because the advantages of the ILs are combined with the properties of the solid support, and this enhances the removal process of metal ions from aqueous solutions and could be successfully used in the removal processes of metal ions from aqueous solutions containing trace amounts. The type of solid supports used for the immobilization of different ILs, and the methods used for the immobilization were discussed. Also the adsorption efficiency of these ionic liquid immobilized solid supports in the removal process of different metal ions (Cr, Hg, Pt, Au, Pd, Cs, Sr, TI, etc.) from aqueous solutions were presented. The inorganic materials present a higher efficiency to be used as solid supports for the immobilization of the ILs. It was observed that the physical method of impregnation, especially ultrasonic cleaning, has a positive effect on the adsorption capacities of the materials obtained.

Keywords

Author Keywords: ionic liquids; heavy metals; impregnation; encapsulation; adsorption

KeyWords Plus: CYPHOS IL 101; TETRADECYLETHYLPHOSPHONIUM CHLORIDE; PHASE EXTRACTION; CYPHOS IL 101; BIOPOLYMER CAPSULES; AQUEOUS-SOLUTIONS; METAL-IONS; FUNCTIONALIZED SILICA; WATER SAMPLES; HCL SOLUTIONS; REMOVAL

Author Information

Reprint Address: Lupu, L (reprint author)
   Politehn Univ Timisoara, Fac Ind Chem & Environm Engn, Timisoara, Romania.
Addresses:
   [1] Politehn Univ Timisoara, Fac Ind Chem & Environment Engn, Timisoara, Romania
E-mail Addresses: lavinia.lupu@upt.ro

Publisher

INTECH EUROPE, JANEZA TRDINE 9, RJEKA, 51000, CROATIA

Categories / Classification

Research Areas: Chemistry; Electrochemistry; Materials Science
Web of Science Categories: Chemistry, Physical; Electrochemistry; Materials Science, Multidisciplinary

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