Removal of pollutants e.g. heavy toxic metal ions and sulfide ions from waste and drinking water using immobilized polysiloxane ligand systems.

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Abstract

One of the most encountering problems in the Gaza Strip is the dramatic increasing level of heavy metal pollutants and high concentrations of sulfur components in waste, used and drinking water. The incorporation of chelating groups onto polysiloxane matrices is finding its way into increasing number of applications in areas such as extraction, recovery and separation of metal ions from aqueous solutions and organic solvents. Further applications of these systems are their use in chromatography and catalysis. Polysiloxane matrices are one of the most rapidly expanding areas of materials research and development. Many new functionalized polysiloxane ligand systems have been reported and one of the widely current used methods for the preparation of the polysiloxane ligand systems is the sol gel process. This process involves hydrolysis and polycondensation reactions and leads to three-dimensional crosslinking matrix. The technological importance of the sol-gel process arises from its simplicity.

It has been extensively working on the chemical modification method of the polysiloxane precursors since the last few years, and has published a Rev iew article in 2007 (J. Organomet. Chem. 692 (2007) 2861-2886). Many techniques have been used to characterize their chemical structures including high-resolution solid-state nuclear magnetic resonance (NMR) techniques, FT-IR and X-ray photoelectron spectroscopy (XPS). These immobilized ligands exhibit high potential for extraction of metal ions from aqueous solution that need to be further exploited.

The main objective of this project is to optimize the performances of amine immobilized polysiloxane ligand systems (monoamine, diamine, triamine phenylenediamine) and their acetate derivatives for extraction and removal of heavy toxic metal ions from waste, used and drinking water. Some metal chelate complexes may also be used for removal mercaptant components from used and driniking water.

For the synthesis:

Polycondensation reactions between tetraethoxysilane (TEOS, precursor for silica) and organotrimethoxysilane are very efficient pathways to get polysiloxane-immobilized ligand systems with a large variety of organofunctional ligand groups. The general idea is to react TEOS with an appropriate silane coupling agent (RO)3Si(CH2)3-X (X= NH2, I, Cl..). X can then be substituted by other ligand groups to produce more complex functional ligands such iminodiacetate, and even macrocyclic ligands.