Gamma radiation induced Pectin- ((3-acrylamidopropyl) trimethylammonium chloride - Co-acrylic acid) hydrogel for very selectively Silver (Ag) metal adsorption.

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Introduction

Heavy metal dispose to the environment is making detrimental effect on our ecosystem. The presence of heavy metal in higher concentration causes several negative health effect of human and other organisms. Majority of recent research on heavy metals includes lead, mercury, chromium, copper etc[1]. However, silver can also be considered as toxic due to few health effect when disposed in large concentration e.g. algiria, a disease related to skin pigmentation, liver and kidney degeneration and respiratory disorder. This metal is widely used in different industries including mirrors, photographic films, batteries, electronic devices food and pharmaceuticals. Due to pollution control and high economic demand it is necessary to recover silver metal[2]. Water insoluble polymer network hydrogel can be used to recover different metals selectively. In our present work, in presence of acrylic acid, (3-acrylamidopropyl) trimethylammonium chloride (APTA) monomer will be grafted on the backbone of pectin by applying gamma irradiation. The synthesized hydrogel will be characterized by FTIR, DSC, SEM and equilibrium swelling as function of pH. Then the hydrogel will be used in multielement adsorption and single metal silver adsorption.

Experimental

Gelatinized pectin solution was prepared by dissolving pectin in water at 50 ℃ temperature and stirring at 500 rpm. APTA monomer and acrylic acid were added to make blend and irradiated at different radiation doses from ^{60}Co ɣ-ray source. After irradiation, obtained hydrogels were extracted in water at 60 ℃ temperature for 24 hours. The resultant Gels were used for adsorption of heavy metal ions from multielement solution and silver ion from silver solution. Metal ions concentration were measured by ICP-MS.

Result and Discussion

Entrapment of (3-acrylamidopropyl) trimethylammonium chloride (APTA) and acrylic acid was confirmed by FTIR analysis. It was found that the equilibrium swelling is decreasing with increasing radiation dose from 5 kGy to 25 kGy. Thermal stability was studied by differential scanning calorimetry (DSC). Since hydrogels of 5kGy radiation dose is mechanically weak and cannot be reused for adsorption, hydrogel of 10 kGy radiation dose was used for multielement adsorption and then silver ion adsorption. Figure 1 shows the multielement adsorption for different initial concentration ranging from 600 ppb to 5000 ppb where silver metal adsorption is selectively highest among 27 metals. Adsorption isotherms and kinetic models were also applied for the data obtained from multielement adsorption and single silver metal adsorption. Scanning electron microscopy (SEM) clearly shows the loading of metal in the void space of hydrogel.

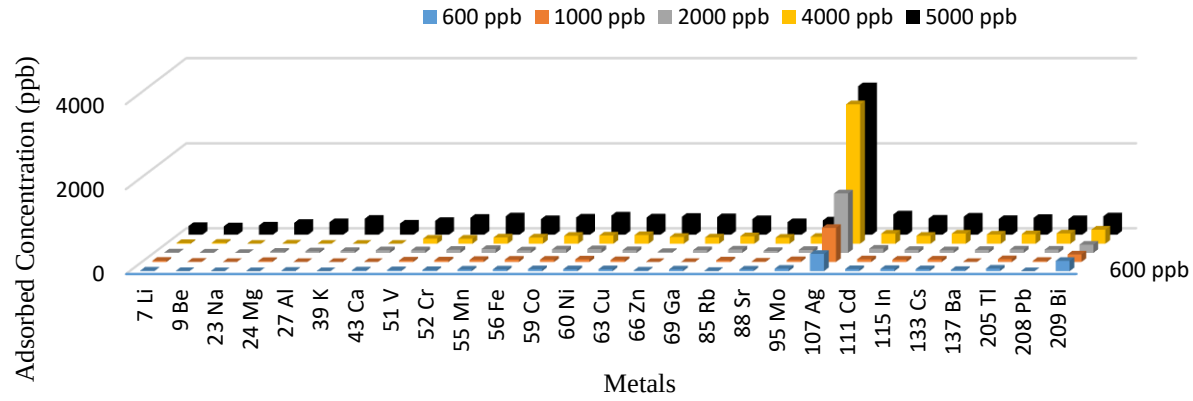

Fig. 1: multielement adsorption by Pectin-(APTA-Co-AAc) hydrogel

Reference

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