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Synthesis and Characterization of Copolymer Derived from 2-Amino 6-Nitrobenzothiazole, Biuret and Formaldehyde and Their study as Ion Exchange Resin for Toxic Cationic Elements

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Abstract: *The condensation of 2-amino 6-nitrobenzothiazole and biuret with formaldehyde at molar ratios of 1:1:2 of the reacting monomers within the sight HCl as a catalyst yielded a copolymer as an ion exchange resin. Electronic spectra, FTIR spectra, and 1H NMR spectra were used to analyze the resin. The batch equilibrium method was used to investigate the ion-exchange characteristics of this resin for Cu 2+, Ni2+, Zn2+, Co2+, and Pb2+ ions throughout a pH range of 2.0 to 6.0 and in fluids of varying ionic strengths. In the following order, the resin polymer demonstrated a better chooisness for removing these ions $Pb^{2+} > Cu^{2+} > Ni^{2+}$. The quantity of metal ion in use up by resin rises as the pH of the medium rises, according to analysis ratio of distribution as a function of pH. Scanning electron microscopy was used to analyze the surface morphology of the copolymer resin, which revealed the intermediate state among crystalline and amorphous nature. This research could be used to treat industrial waste water.*

Keywords: Copolymer; Resin; Polycondensation; Ion-exchanger; Heavy elements; Metal ion uptake; Distribution ratio.

I. INTRODUCTION

Poisonous and substantial metals found in industrial effluents are among the most dangerous contaminants, and adsorption, which is a major environmental problem, has a significant impact on their connection with water streams [1-2]. Since of their hazardous character and tendency to be maintained in living systems, the separation of heavy and poisonous metal ions from industrial effluents is of foremost attention. This emphasizes the use of specific functional polymeric sorbents to recover these hazardous ions from water [3-4].

Literature reviews have shown that copolymers made primarily of 4-hydroxybenzophenones and their derivatives are useful in many areas, along with unwanted water treatments, metal repairs, protective coatings and biological interests. It is known to be ion exchangers are used on a large scale to dispose of radioactive waste from nuclear power plants. [5]. Chelate ion interchange actions of poly (2-hydroxy, for acryloxybenzophenone) resins in the direction of divalent metal ions was investigated as time and pH characteristics using the batch equilibrium method [6]. The associated styrene / meric acid chelate matrix has been reported to be highly capable of removing metal ions along with Cr^{3+}, Fe^{3+}, Ni^{2+}, $Cu^{2+}$and Pb^{2+} [7]. An acidic polymer consisting of poly (methacrylic acid) and poly (acrylic acid) has an affinity for eliminating metal particles such as Co^{2+}, Ag^{2+}, Ni^{2+}, Cu^{2+}, and Cr^{3+} at a special pH and polymer metal ion ratio [8]. Melamine, salicylic acid including formaldehyde terpolymers has been shown to improve the selection of Cu2 +, Fe3 +, and Ni2 + ions, followed by improved selection of Cd2 +, Co2 +, Pb2 +, and Zn2 + ions [9]. Metal ion uptake increases as the molar ratio of terpolymers blended using substitute benzoic acid increases [11]. Using a batch equilibrium approach and several manufactured terpolymer resins, our research group has reported chelating ion-exchangers to remove dangerous producing metal ions from aqueous solution. The findings revealed that the synthetic glue has a high capability for removing certain metal ions [12-13]. Copolymers of 8-hydroxyquinoline, formaldehyde and catechol