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*Research Paper*

# Chelation Ion Exchange Studies of Copolymer Resin from o-Toluidine, Biuret and Formaldehyde

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**Abstract**

The TBF copolymer resin was synthesized by the condensation of o-Toluidine and biuret with formaldehyde in the presence of 2M HCl as a catalyst at 120 ± 2 $^0$C for 5 h with molar proportion of reactants. The TBF copolymer proved to be a selective chelating ion-exchange polymer for certain metals. Chelating ion-exchange properties of this polymer were studied for $Cu^{2+}$, $Ni^{2+}$, $Co^{2+}$, $Zn^{2+}$, and $Pb^{2+}$ ions. A batch equilibrium method has been employed in the study of the selectivity of metal-ion uptake involving the measurements of the distribution of a given metal ion between the copolymer sample and a solution containing the metal ion. The study was carried out over a wide pH range and in media of various ionic strengths. The polymer showed higher selectivity for $Cu^{2+}$, $Ni^{2+}$ than for $Co^{2+}$, $Zn^{2+}$, and $Pb^{2+}$ions. Study of distribution ratio as a function of pH indicates that the amount of metal ion taken by TBF copolymer resin increases with the increasing pH of the media.

**Keywords:** Synthesis, Condensation, Ion-exchange property, Distribution ratio.

**Introduction**

A resin is said to be ampholytic ion-exchanger resin if it contains both cation and anion as exchangeable ion. Some ion-exchanger resins have chelating properties making them highly selective towards certain metal ions. Studies of chelation ion-exchange properties of copolymer resin derived from 1,5-diaminonaphthalene, 2,4-dihydroxy- propiophenone and formaldehyde (Das NC et, al, 2022). Gharbi et al. (Gharbi, S. 2014) have synthesized the chelating ion exchange resin by the condensation of 8-hydroxyquinoline with pyrogallol using formaldehyde as a cross linking agent at 120oC in DMF in the presence of HCl acid as catalyst. The cation exchange capacity was measured and the effect of pH and metal ion concentration on the ability of the ion-exchange were studied. The ratio of cation exchange reaction and the distribution coefficient in tartaric acid medium at different pH were also studied using the method of batch equilibrium. Rahangdale studied separation of toxic metals ions from waste water using pyrogallol-biuret-formaldehyde copolymer resin (Sanjiokumar S. Rahangdale et al 2020). A batch equilibrium method was employed in the study of the selectivity of metal ion uptake. The study was carried out over a wide pH range and in media of various ionic strengths. The polymer showed higher selectivity for Fe3+, Cu2+ ions than for Ni2+, Co2+, Zn2+, Cd2+, and Pb2+ ions. Study of distribution ratio as a function of pH indicates that the amount of metal ion taken by resin is increases with the increase of PH of the medium. The metal uptake properties of chelating azo polymeric resin were studied (Keerthiga et al. 2015). Synthesis and chelate ion exchange properties of copolymer resin: 8-hydroxyquinoline-5 sulphonic acid-catechol-formaldehyde (Mandavgade SK et.al. 2022). The chelating properties of synthesized resin such as total ion-exchange capacity, effect of pH, concentration and time for different metal ions Ni(II), Cu(II), Zn(II), Cd(II) and Pb(II) were also studied by employing batch equilibrium method. A new chelating copolymer resin (oAABF) was synthesized through copolymerization of o-amino acetophenone, biuret and formaldehyde in acidic medium (HCl) by condensation reaction. Selectivity and binding capacity of copolymer resin studied by batch equilibrium method towards Ni2+, Co2+,Cd2+, Zn2+ and Cr3+ in different pH and treatment time (Rashid and Coworker,2017). A novel hexylthioglycolate ion-exchange resin from poly (ethyl acrylate - acrylonitrile - divinyl benzene) beads were prepared and adsorption capacities of this resin for Co(II), Ni(II), Cu(II), Zn(II), Cd(II), Hr(II), and Pb(II) at different pH was studied.( Dwivedi and coworker, 2014).

**Synthesis of o-Toluidine–Biuret–Formaldehyde (o-TBF) Copolymer Resin.**

The four different types of o-TBF copolymer resins have been successfully synthesized and abbreviated as given in Table 1.

**Synthesis of o-TBF-I copolymer resin**

The new copolymer resin o-TBF-I was synthesized by condensing o-Toluidine (1.07 g, 0.1 mol) and biuret (1.03 g, 0.1 mol) and formaldehyde (7.50 ml, 0.2 mol) in molar ratio of 1:1:2 in the presence of 2M (200 ml) HCl as a catalyst at 122°C ± 2°C for 5 hrs in the round bottom flask attached with water condenser and was heated in an oil bath with occasional shaking to ensure thorough mixing. The temperature of oil bath was controlled by dimmer state (Sanjiokumar et al, 2019, 2020, 2021). The resinous cream product obtained was removed