
SYNTHESIS AND CHARACTERIZATION OF RENEWABLE TANNIN- PHENOL-FORMALDEHYDE CATION EXCHANGE RESIN FROM

***Terminalia arjuna* (KUMBUK)**

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ABSTRACT

The aim of this work is a synthesis of a cation exchange resin using natural affinity of tannins towards metal ions. Tannins were extracted from *Terminalia arjuna* (Kumbuk) using soxhlet extraction method. Total polyphenolic content was calculated using folin-ciocalteau reagent. The natural form of tannins cannot be used as an ion exchanger due to its high water solubility. The problem was overcome by polymerizing tannins with formaldehyde molecules. The low ion exchange capacity of a typical tannin-formaldehyde resin was overcome by introducing phenol. A series of tannin-phenol-formaldehyde resins were synthesized using different tannin to phenol ratio. Ion exchange capacity was measured using monovalent cation, Na⁺ and it was further increased by sulfonation. To check the applicability as an ion exchange resin, highest ion exchange capacity resin was used to check solubility and swelling properties in water samples with different pH values. Fourier transform infrared spectroscopic (FTIR) and differential scanning calorimeter (DSC) analysis were carried out to characterize the resin series. FTIR results were used to gauge changes of tannins in polymerization, new bond formation with sulfonation and its changes with different phenol/tannin ratio. DSC analysis results were used to characterize the thermal stability of the resin. Ion exchange capacity was higher in sulfonated resins and the highest value was recorded in 1:1 ratio tannin/phenol resin as 1.552 meq/g. Solubility test and DSC analysis have confirmed the stability of highest ion exchange capacity resin in all pH values and temperature up to 280 °C.

Keywords: Tannin of Terminalia Arjuna, Cation Exchange Resin, Sulfonation, Ion Exchange Capacity, Synthesis