Semi interpenetrating networks of chitosan /acrylic acid / thiourea for sequestering cadmium from aqueous solution

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Abstract

The issue of remediation of heavy metal ions from environmental matrices is one of the biggest challenges owing to their persistence, bioaccumulation and resistance to biodegradation. Crosslinked networks have gained attention in the recent past due to their mechanical strength, sorptive properties and offer the possibility of reusability. The present paper deals with the synthesis of novel chitosan based crosslinked networks and explore its potential for removal of Cd^{2+} ions from aqueous solution. Microwave radiation induced free radical polymerization is carried out using chitosan (CS) and acrylic acid (AA) monomers in presence of initiator ($K_2S_2O_8$) and crosslinked with thiourea (CH_4N_2S). FTIR spectroscopy, XRD, SEM and thermal analysis techniques (TGA/DTG/DTA) are employed to characterize the synthesized network metrics. The physico-chemical analysis confirmed the formation of crosslinked network. The effect of polymerization variables such as amount of solvent, concentration of initiator, monomer and crosslinker, reaction time are maximized as a function of percentage grafting (Pg). The liquid uptake potential of the synthesized crosslinked network is evaluated in terms of percentage swelling (Ps). The crosslinked network exhibited maximum percentage grafting (3845%) and percentage swelling (311.25%) under maximized conditions. The results obtained for removal of cadmium (II) are analyzed using adsorption isotherm models and better fit is obtained with freundlich isotherm model. Crosslinked network is found to be an efficient device for facile sequestering of Cd^{2+} ions from an aqueous solution.

Image

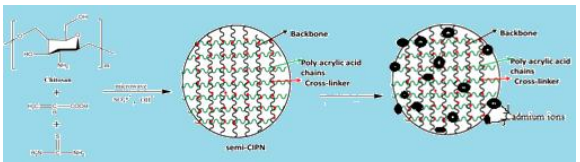


Fig 1: Synthesis of crosslinked network and adsoprption of cadmium ions

Recent Publications

1. Crini G., Badot P.M., 2008. Application of chitosan a natural aminopolysaccharide for dye removal from aqueous solutions by adsorption processes using batch studies: a review of recent literature. Prog Polym Sci 33, 399-447.
2. Ngwabebhoh F.A., Gazi M., Oladipo A.A., 2016. Adsorptive removal of multi-azo dye from aqueous phase using a semi-IPN superabsorbent chitosan-starch hydrogel Chemical Engineering Research and Design, 112, 274-288.
3. Chiou M.S, Ho P.Y., Li H.Y., 2004. Adsorption of anionic dyes in acid solutions using chemically cross-linked chitosan beads Dyes Pigments, 60, 69-84.
4. Chiou M.S., Kuo W.S., Li H.Y., 2003. Removal of reactive dye from wastewater by adsorption using ECH cross-linked chitosan beads as medium. Journal of Environmental Science and Health Part A, 38, 2621-2631.
5. Cadaval T.R., Dotto G.L., Pinto L.A., 2015. Equilibrium isotherms thermodynamics and kinetic studies for the adsorption of food azo dyes onto chitosan films. Chem Eng Commun 202, 1316-1323.
6. Bhullar, N., Kumari, K., Sud, D., 2017. Studies on chitosan-based superhydrophilic adsorbent for phasing out Rhodamine 6G dye and Cd^{2+} ions from aqueous solutions. Desalination and Water Treatment, 95, 355-364.



Biography (150 word limit)

Kamlesh Kumari is professor of Chemical Engineering and presently working in the area of biopolymers and development of new biobased materials for various applications, particularly in environmental remediation. She has expertise in design, synthesis and characterization of polymeric biomaterials. Another area of her interest is development of carrier (beads/ films/ tablets) for modulated delivery of drugs and fertilizers. She is teaching to undergraduate and post graduate students of Chemical Engineering. She has more than 30 publications in international journal of repute and presented her research in number of national and international conferences. She also had written many book chapters. She has guided two Ph.D. students and many postgraduate student projects.

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