Desalination and Water Treatment
www.deswater.com

34 (2011) 354–360
October

1944-3994/1944-3986
doi: 10/5004/dwt.2011.2800

Synthesis of novel PVA crosslink mixed matrix scaffolds and adsorption of copper ions from waste water

Tzu-Yang Hsien[a,*], Yu-Ling Liu[b], Chin-Hsuan Huang[c], Po-Heng Lin[c], Da-Ming Wang[c]

[a]*General Education Center, China University of Technology, Taipei, Taiwan, R.O.C. 116*
Tel. +886 (2) 29313416; Fax: +886 (2) 29300915; email: tyhsien@cute.edu.tw
[b]*Teacher Education Center, Ming Chuan University, Taipei, Taiwan, R.O.C.*
[c]*Department of Chemical Engineering, National Taiwan University, Taipei, Taiwan, R.O.C.*

Received 3 September 2010; Accepted 3 January 2011

ABSTRACT

Mixed matrix scaffolds were composed through uniform distributed of ion exchange resins (H^+ form Amberjet, ID 780 μm) into the stereo-structural chitosan matrix prepared by dissolving chitosan powder with a middle molecular weight into acetic solutions. Along the synthesis processes of mixed matrix scaffolds, 4 wt% of chitosan solutions containing of resin particles were homogeneous crosslinked with aqueous polyvinyl alcohol (PVA) solutions to produce PVA crosslink mixed matrix scaffolds. Specifically, ion exchange resin particles suspending in a viscous PVA crosslink chitosan solution were poured into cylindrical aluminum containers to prepare PVA crosslink chitosan mixed matrix scaffolds through the freeze-gelation process. PVA crosslink mixed matrix scaffolds were then utilized for removal of copper ions from waste water. The uniform distribution of ion exchange resins embedded in the stereo structure of chitosan matrices can clearly be observed on the images of the scanning electron micrograph (SEM). The adsorption processes were operated by adsorbing copper ions of waste water onto the amine functional groups ($–NH_2$) exposed on the external and porous stereo-structural surfaces of chitosan matrices as well as the sulfonate functional groups at the outer surface of ion exchange resins respectively. Adsorption experiment were carried out at 25°C and pH 6.0 over the concentration ranging from 200 to 3000 mg Cu^{2+}/l. The maximum adsorption capacity for PVA crosslink mixed matrix scaffolds were 93.5 mg Cu^{2+}/g-adsorbents at the initial copper ion concentration of 2500 mg Cu^{2+}/l. The adsorption isotherm curve could be simulated by Langmuir adsorption model. The desorption ratio of copper ions of PVA crosslink chitosan mixed matrix scaffolds was 97.9% at a low initial copper ion concentration of 200 mg Cu^{2+}/l. As the initial copper ion concentrations increased, desorption ratio decreased.

Keywords: Chitosan; Mixed matrix scaffold; Adsorbent

*Corresponding author.

Presented at the AMS6/IMSTEC10, The 6th conference of the Aseanian Membrane Society in conjunction with the 7th International Membrane Science and Technology Conference, Sydney Australia, November 22–26, 2010