O 15. DESIGN AND EVALUATION OF ORGANO-MONTMORILLONITE NANOCLAY LOADED PVB/PAN NANOFIBROUS MEMBRANE WITH A SANDWICH STRUCTURE FOR HEAVY METAL REMOVAL

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ABSTRACT: Water pollution in aquatic system has become a major challenge today. Because, hazardous chemicals especially heavy metals which are mainly produced by industries can cause many problems. High concentrations of heavy metals have a terrible effect on both living microorganisms and environment. Heavy metals such as nickel, copper, cobalt, zinc and chromium are detected in water coming from tanning, electroplating, mining operations, petrochemical industries and textile products. Pollution by chromium (Cr) is a widespread in aquatic systems. This heavy metal ion occurs in two oxidation states; Cr^{6+} such as chromate and bichromate (CrO_4^{2-}, $HCrO_4^-$) and trivalent chromium (Cr^{3+}). Cr^{6+} is more carcinogenic and toxic to human health than Cr^{3+} . So these toxic metals should be removed from wastewaters using some methods. Adsorption is the most common method for removal of heavy metals by using proper and effective adsorbent. In recent years, usage of nanofibrous materials has recently been increased due to their some characteristics such as fine diameters (ranging from submicron to several nanometers), large surface area, high porosity, high gas permeability, and small interfibrous pore size. Nanofibers can be generated by an electro-spinning technique which provides the capacity to lace together types of nanofillers, nanoparticles or other additives to be incorporated into an electrospun nanofiber matrix. This application method allows to create new nanofiber composites having various properties to be used in different fields. In this respect, the main goal of the study is to design organo-montmorillonite nanoclay (Cloisite 20A) loaded PVB (*Polyvinyl butyral) and PAN (*polyacrylonitrile) nanofiber membrane with sandwich structure for hexavalent chromium (Cr^{6+}) removal. Briefly, this fabrication was carried out by sandwiching the nanoclay incorporated PVB nanofiber mat between two layers of PAN electro-spun mats. To achieve a good binding performance of metal ions, membrane was functionalized with ethylenediamine and ethylene glycol in the presence of catalyst. This treatment method allows to create a high amine loading that is necessary for chromium binding onto membrane surface. After that, adsorption of hexavalent chromium (Cr^{6+}) ions were evaluated in a batch arrangement. Experiments were performed as a function of contact time, solution pH, and initial Cr^{6+} ion concentration. The maximum adsorption capacity of membrane was obtained at pH=2 and it tends to diminish with increasing pH from 1.0 to 5.0. The applicability of the adsorption isotherms was tested and it can be reported that the adsorption capacity was very satisfying. As a result, this work demonstrated that the novel electrospun membrane has potential for membrane applications in wastewater treatment systems.

Keywords: Polyacrylonitrile*, polyvinyl butyral, hexavalent chromium, nanofiber, electro-spun*