

DEVELOPMENT OF CELLULOSE ACETATE MEMBRANES CONTAINING NANOPARTICLES FOR WATER APPLICATIONS

Joana Silva*, Ana S. Abreu, M. Oliveira and A. V. Machado

Institute of Polymers and Composites (IPC) and Institute of Nanostructures, Nanomodelling and Nanofabrication (I3N), University of Minho, Campus de Azurém, 4800-058 Guimarães, Portugal

*corresponding author: joana.luisa.silva@gmail.com

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Abstract

The growth of human population and inherent activities, the improper industrialization practices, the direct addition of materials TO the waterway, and the excessive use of fertilizers containing phosphates to increase the production of crops are the main sources for the high input of phosphates in water bodies. These effects have been causing eutrophication, and bacterial contamination of the water. In fact, the bacteria present in the water can cause harmful disease, sickness or other problems to the human being. Moreover, the excess of phosphates in the aquatic system induces excessive growth of plants, which consume oxygen of the water body, thereby creating the state of hypoxia, which causes a reduction in specific fish and other animals. Therefore, the removal of phosphates from eutrophic waters and bacteria are crucial to avoid health problems, especially near urban areas[1].

The most common way to purify water is through membrane separation processes, in fact, cellulose acetate (CA) membranes have been used for reverse osmosis membranes [2] for converting impaired water into fresh-water. However, several components can be incorporated into cellulose structure to allow the development of membranes for different applications[3].

The present work aims to develop a hybrid membrane based on CA with embedded silver and/or aluminium nanoparticles, for the remediation of contaminated aquatic environments with microorganism, which can also be used for removal of water contaminated with phosphate ion. Therefore, CA membranes were obtained by solution casting, where silver and/or aluminium nanoparticles were chemical reduced *in-situ*. Silver nanoparticles (Ag-NPs) were synthesized using silver nitrate and sodium borohydride as reducing agent. Otherwise, aluminium nanoparticles (Al-NPs) were obtained using aluminium isopropoxide as the starting precursor in the presence of acid.

The detection of Al-NPs in the membranes was carried out by FTIR spectra analysis, which showed that Al-O bonds were formed between the aluminium precursor and the CA. The study of phosphorus adsorption kinetics in membranes with embedded Al-NPs were proven to be efficient for the removal of phosphorus. This membrane showed considerable ability to remove phosphate ions from aqueous solutions at low aluminium nanoparticle content into the CA/Ag-NPs matrices. *In-situ* the developed membranes showed good antimicrobial behaviour preventing the growth of microorganisms. The results indicate that the synthesized CA/Ag-NPs/Al-NPs membranes could have potential to be used in the remediation of water resources.

References

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