Electrospun, pH-responsive microfibrous membranes as adsorbents for bacteria removal from contaminated aqueous solutions

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Water is one of the most essential elements in human life. Through many decades, humanity is facing a major problem of water contamination with subsequent high risks in human health and quality of life. During the last years there is an increased interest on the protection and purification of urban wastewater contaminated by pathogens [1]. Several techniques currently used to treat wastewater rely on direct chemical processes, (i.e. Chlorination and Advanced Oxidation Processes (AOPs)), which however, lead to the generation of harmful byproducts. Membrane filtration technologies are often employed for the decontamination and purification of water supplies including Microfiltration (MF), Ultrafiltration (UF), Nanofiltration (NF) and Reverse Osmosis (RO). Such technologies have been proved to be energy-efficient and in addition they do not require the use of chemicals [2].

Herein, novel materials in the form of microfibrous membranes have been generated by means of the electrospinning technique and further evaluated as adsorbents for selected bacteria microorganisms. Electrospinning is a low-cost method that is used for the production of fibrous materials with fiber diameters ranging between a few nanometers up to a few micrometers [3]. Consequently, such materials are characterized by high surface-to-volume ratios rendering them appropriate in various applications including water remediation through filtration [4]. Random copolymers consisting of the hydrophobic methyl methacrylate (MMA) and the hydrophilic/pH-responsive 2-diethylamino ethyl methacrylate (DEAEMA) (pKa ~ 7.3) synthesized by conventional free radical polymerization have been electrospun under specific electrospinning conditions to yield cylindrical, beaded-free microfibrous polymer membranes. The morphology and the thermal stability of the membranes were determined by scanning electron microscopy (SEM) and thermal gravimetric analysis (TGA), respectively. The aforementioned materials were assessed against the gram-negative bacteria of *Pseudomonas aeruginosa* and *Advenella species* in order to determine their performance as wastewater filtration systems. The bacteria removal by the microfibrous membranes was studied by measuring the optical density (OD) of the microorganisms by UV-Vis spectrophotometry.

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References

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