Antibacterial properties of a non-woven filter based on textile waste for copper and silver removal.

Meriem Saadouni [1,2], Youness Bouhaj [2], Ayoub Nadi [2], El bouari Abdeslam[2], Omar Cherkaoui [2] and Mohamed Tahiri [1*]

[1] Organic Synthesis Extraction and Valorisation Laboratory, Ain Chok's Sciences Faculty, (OSEV), Hassan II University of Casablanca, Morocco
[2]Higher School of Textile and Clothing Industries, REMTEX Laboratory, Casablanca, Morocco
Email : mohtahiri@yahoo.fr

Abstract: Polyacrylonitrile fibers (PANF) are commonly used polymer materials for treating wastewater generated across various industrial processes. These fibers are economically viable, possess excellent mechanical properties, and offer a large surface area. The primary objective is to eliminate specific heavy metal ions from water solutions by forming metal chelates, notably with Ag^{+} and Cu^{2+} ions. To accomplish this, a non-woven filter was developed with specific characteristics: an air permeability of 1100 cfm, a thickness of 0.04 cm, and a mass per unit area of 550 g/m^2, relying on surface functionalization to facilitate the formation of metal chelates, thereby enabling the adsorption and desorption of metal ions on its surface.

Functionalized PANF wastes were generated through the reaction of PANF with hydroxylamine hydrochloride, yielding an efficient adsorbent capable of targeting various organic dyes (anionic, cationic, and reactive) as well as diverse heavy metals. Previous research validated the adsorbent's efficacy in removing hexavalent chromium from water solutions, alongside an exploration of its mechanical and thermal properties to understand the adsorption mechanism. The antibacterial properties of the developed fibers were assessed using Escherichia coli bacteria, employing the zone of inhibition method on agar medium. While the metal-free reference material demonstrated no impact on E. coli, S. aureus, and Pseudo threat, fibers forming chelates with Ag^{+} and Cu^{2+} exhibited potent bactericidal effects, even at low concentrations.

Keywords: Antibacterial activity, technical textile waste, industrial wastewater, non-woven filter, filtration.

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