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PhD Thesis Defense

Entitled

DEVELOPMENT OF HIGHLY EFFICIENT HYBRID-FUNCTIONALIZED MEMBRANES FOR SUSTAINABLE WATER HARVESTING

By

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Date & Venue

11.00 AM

Thursday, 13 June 2024

F3 - 043

Abstract

Water scarcity has emerged as a critical global challenge. This problem catches the world interest by events such as the severe drought in Europe during the summer of 2022. While desalination plants offer a solution, their high energy consumption necessitates the exploration of alternative, sustainable water resources. Addressing the urgent need for alternative water resources in the face of increasing water scarcity. A viable option was presented by fog harvesting. Which is a method to collect water from atmospheric fog. This method was initially developed to meet the demands of varieties of sectors such as agricultural purposes, household used and reduce the load on the desalination plants by using the advancements in material science have expanded its potential to meet broader water demands. This research explores enhancement in fog collection efficiency using nanocomposite materials, specifically polyvinylchloride/titanium oxide (PVC/TiO_2) and polystyrene/titanium oxide (PS/TiO_2). Additionally, the study examines the potential of polyethylene 2,5-furanoate (PEF), a biobased polymer derived from plant sources, as a sustainable alternative to polyethylene terephthalate (PET) for water harvesting applications. An aluminum mesh was employed as the base structure for the fog collectors. After that it was coated with our polymer composite constructed through dipping and electrospinning methods. The coated polymer composites mesh demonstrated significant improvements in water harvesting rates. The findings suggest that innovative material combinations can lead to low-cost, sustainable, and renewable sources of water.

Keywords*:* Water scarcity, fog harvesting, sustainable water resources, nanocomposites, polyvinyl chloride, polystyrene, polyethylene 2,5-furanoate (PEF), polyethylene terephthalate (PET), titanium oxide (TiO_2), aluminum mesh, dipping method, electrospinning