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COMPARATIVE STUDY ON HYDROPHOBIC TEXTILE TREATMENT HERARCHICAL STRUCTURES VERSUS COPPER SULFIDE NANOSTRUCTURES

Cynthia Almeda Torres[1*], Hernando Arreola Bencomo[1], Hortensia Reyes-Blas[1], Imelda Olivas-Armendariz[1], Héctor Camacho-Montes[1], Juan Francisco Hernandez-Paz[1], Claudia A. Rodriguez-Gonzalez[1]

[1]Universidad Autónoma de Ciudad Juárez, Avenida del Charro 459 Norte, C.P. 32310, Ciudad Juárez, Chihuahua, México.

*Corresponding author e-mail (al229165@alumnos.uacj.mx)

This study investigates the use of hierarchical structures and copper sulfide nanostructures to impart hydrophobic properties to textiles, with applications in various fields including water treatment and biomedicine. Despite the potential benefits, the differences in hydrophobicity between textiles treated with hierarchical structures versus nanoscale structures have not been fully investigated. To begin addressing this gap, hierarchical structures and nanostructures were synthesized using a standardized procedure: an iron electrode immersed in a solution of pentahydrated copper sulfate yielded copper powder, subsequently subjected to a solid-vapor reaction to produce copper sulfide. Nanostructures of identical composition were obtained by subjecting a portion of the copper sulfide to mechanical milling. Characterization via X-ray diffraction (XRD) identified the presence of the covellite phase of copper sulfide in both cases. Cotton textiles were then treated using the dip coating method with a solution comprising PDMS and isopropyl alcohol. Scanning electron microscopy was employed to assess the morphology and distribution of structures and nanostructures on the textiles. A significantly improved distribution was observed in textiles treated with nanostructures compared to those treated with hierarchical structures. Furthermore, contact angle tests confirmed a 16% increase in hydrophobicity for textiles treated with copper sulfide nanostructures compared to those treated solely with copper sulfide at 0 seconds, although this effect diminished by 10% after 300 seconds.

Key Words: Hydrophobicity, hierarchical structures, copper sulfide nanostructures.