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Fabrication of Multifunctional GO-CNT@PCL Core-Shell Nanocomposites with Spider Leg Bioinspired Hierarchical Architectures Using Wet Electrospinning-Assisted Self-Assembly

Il file deve essere nominato

- Numero prima preferenza tematica (vedi circolare):
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Abstract

This work highlights the importance of developing efficient fabrication and modification strategies for the simultaneous removal and recovery of chemical contaminants from water, in compliance with circular economy and zero-waste guidelines. The optimization of absorbent materials requires a multidisciplinary approach, including knowledge of processing technology and surface engineering. Adequate levels of porosity, surface area, and roughness, along with tailored wettability, are crucial to allow efficient removal, while mechanical robustness is necessary to withstand severe external stresses without causing secondary pollution. Nanomaterials such as metal organic frameworks, nanoclays, carbon nanotubes, and graphene or graphene oxide have shown excellent sorption performances. However, their difficulty in handling and removing from water requires them to be incorporated or anchored into various substrates with well-defined morphology. Porous core-shell nanocomposites, having a flexible polymeric skeleton coated with GO-CNTs as active compounds, offer the possibility to conjugate the easy processability and good mechanical properties of polymers with the adsorption performance ensured by the surface characteristics of external sheath. Unfortunately, the current protocols involve multi-step procedures, whose laboriousness increases as the morphological and functional complexity of hierarchical structures increases. This study presents a novel approach to fabricating nanohybrid structures, consisting of a 3D fibrous network of polycaprolactone (PCL) wrapped by graphene oxide (GO) sheets with carbon nanotube (CNT) brushes anchored onto the GO sheets. The method involves electrospinning PCL solutions onto a suspension of GO and CNTs in ethanol, resulting in self-assembly through electrostatic wrapping of GO sheets around PCL fibers and π-π stacking between GO and CNTs. The resulting monoliths are lightweight with 99% porosity and exhibit a 1575% stiffness improvement. The nanopatterned surface allows for efficient removal of methylene blue

and/or methyl orange from stagnant water with approximately 100% efficiency. Overall, this approach offers a fast and efficient way to design multifunctional nanohybrid structures with enhanced mechanical properties and improved removal of chemical contaminants from water.

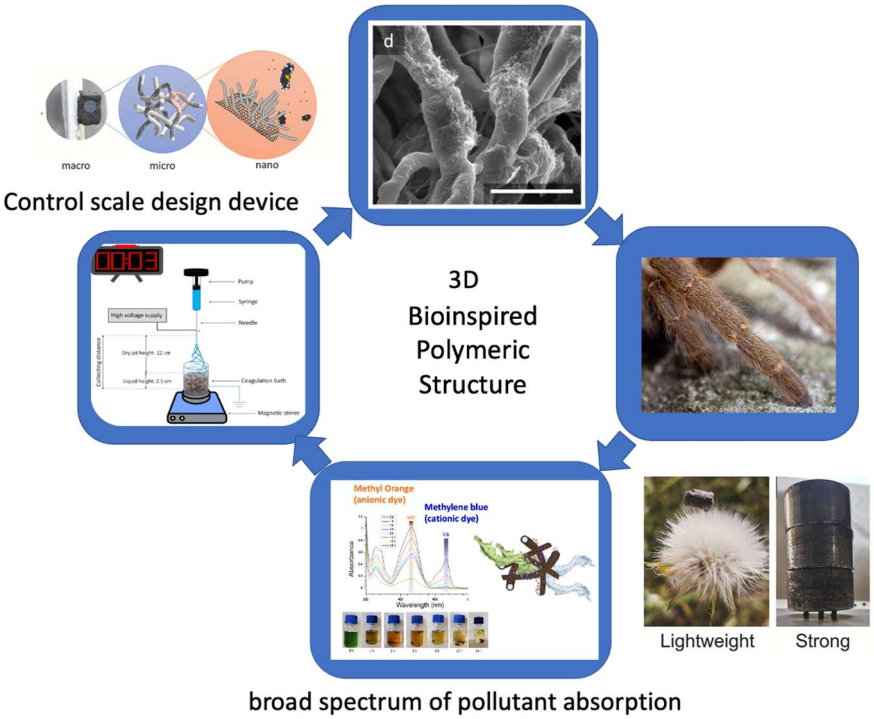

Figura 1.Schematic representation of design Multifunctional GO-CNT@PCL Core-Shell Nanocomposites with Spider Leg Bioinspired Hierarchical Architectures(from high adsorption capacity to Strenght)..