Modification of cotton fibers with magnetic core-shell mesoporous silica nanoparticles

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Abstract

Fabric materials have a wide diversity in the nature in which can be highlighted the cotton as one of the most abundant consisted in 96% of cellulose [1]. The functionalization of cotton avoids facile degradation and damage by the environment, moisture, microorganisms, etc., [2] and allows to obtain a highly desired material with extensile applications such as medical, construction, textile, among others [3]. Electrostatic assembly better known as layer-by-layer (LbL) technique is an alternative option of cotton modification that consists in depositing controllable nanolayers by the adsorption of oppositely charged polyelectrolytes on the surface for further immobilization of charged nanoparticles [4], besides, LbL technique is very attractive for cotton modification due to its simplicity and its easy incorporation in just one coating at ambient conditions. LbL has an environmental characteristic that the most common solvent employed is water and the concentration needed is relatively low [5]. Nanostructured materials have been aimed of many investigations in the textile field because of their attracting characteristics such as high surface area and unique physicochemical properties compared to bulk materials [6]. Recently, core-shell nanoparticles have been focused due to their synergistic affects using a combination of a core and a shell made by different precursors, and which unique and useful functionalities are obtained depending on this interaction affording to expand the fields of applications according to the shape, size and smart characteristics given by these core-shell nanostructures [7]. In the present study, we have pretreated and modified cotton fibers using PDDA and PSS polymers in order to functionalize the surface with charged polyelectrolytes for further nanoparticles attaching by electrostatic interaction. Magnetite and Magnetic core-shell mesoporous suspension were prepared for coating the cotton fibers to compare and characterize the resulting material as a novel, innovative and promising product for different fields of application.

Image

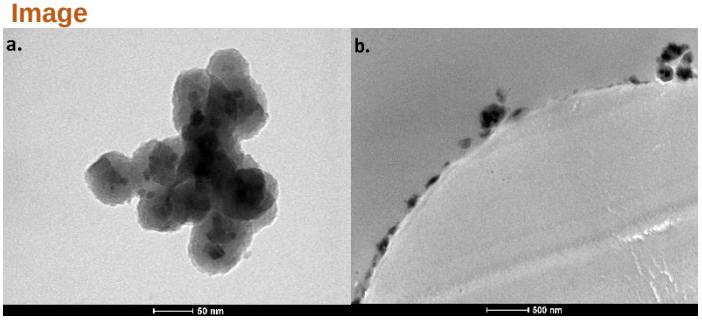


Figure. Transmission electron microscopy (TEM) images of (**a**) magnetic core-shell mesoporous silica nanoparticles and (**b**) cotton fiber modified with these nanoparticles.

Recent Publications

[1] L. Hao, R. Wang, K. Fang, Y. Cai, *Ind. Crops Prod.* **2017**, 95, 348.

[2] Q. Xu, L. Xie, H. Diao, F. Li, Y. Zhang, F. Yu, X. Liu, *Carbohydr. Polym.* **2017**, 117, 187.

[3] V. C. Ferreira, A. J. Goddard, O. C. Monteiro, *J. Photochem. Photobiol., A* **2018**, In Press, Accepted Manuscript.

[4] Y. Chen, F. Ge, S. Guang, Z. Cai, *J. Alloys Compd.* **2017**, 726, 484.

[5] F. Fang, D. Xiao, X. Zhang, Y. Meng, C. Cheng, C. Bao, X. Ding, H. Cao, X. Tian, *Surf. Coat. Technol.* **2015**, 276, 726.

[6] M. Shaban, S. Abdallah, A. A. Khalek, *Beni-Suef University J. Basic Appl. Sci.* **2016**, 5, 277.

[7] W. Wang, S. Liu, C. Li, Y. Wang, C. Yan, *Talanta* **2018**, 182, 306.



Biography

David Patiño Ruiz is a Doctoral Candidate in Engineering with Emphasis in Science and Technology of Materials at the University of Cartagena and Chemical Engineer from the same Institution. The researches directed by him has been focused on the synthesis, characterization and application of nanomaterials for different fields in which includes water and soil treatments, drug load and delivery, among others. He has made oral presentation in different conferences with nanotechnology approaches, and has made research exchanges repeated times in Cornell University with the collaboration of Doctoral Students in order to increase his knowledge in nanomaterials with highly desired characteristics for different purposes. His thesis is being directed to the synthesis of core-shell nanoparticles to combine properties of two different precursors in the developmente of a smart material with medical applications.

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