Functional finishing of linen fibrous supports using ZnO–MCT nanocomposites

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Introduction

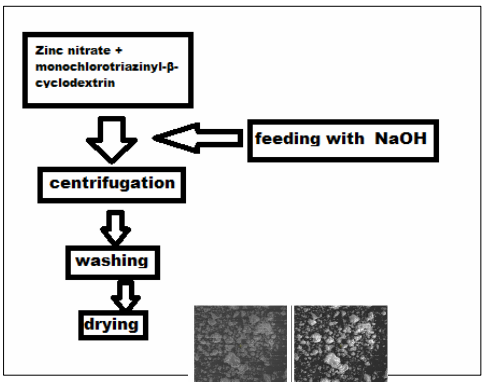
A strong multidisciplinary is required by the increasing demand for multifunctional fabrics meaning approaches as well as the merging of the traditional scientific disciplines. Finishing processes by means of nanoparticles has been the first commercial application on textiles. But this kind of finishes are not washing resistant, due to poor fixing of these nanoparticles on the textile surface. Using functional polymer matrices as host molecules for nanoparticles will result in nanofinishings with improved bonding properties in fabrics and also impart desired wettability with different functional properties like self-cleaning, UV resistance, and flame retardancy which are unique characteristics of different nanoparticles.

Objective

The present study investigates the efficiency of a grafting treatment using a polymer matrix, meaning a cyclic oligosaccharide, β-cyclodextrin (*i.e.*MCT-**M**ono**C**hloro**T**riazinyl-β-cyclodextrin), in enhanced textile nanofinishing.

EXPERIMENTAL APPROACH

The zinc oxide (ZnO - MonoCT) nanoparticles were prepared by wet chemical method as follows:



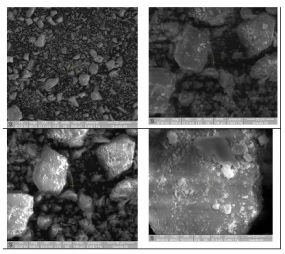
RESULTS AND DISCUSSION

The structure of ZnO – MCT nanoparticles have been analyzed through a co-assisted system: Scanning Electron Microscopy, X Ray Diffraction and ATR-FTIR Spectroscopy.

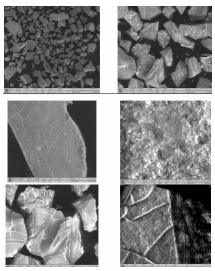
Morphology of ZnO nanoparticles by means of Scanning Electron Microscopy

The distribution of particles reflects lamellar structures. It is noticeable a randomly distributed protruding particles consisting of further nanostructures in polymer matrix, which is equivalent with a good adhesion between the surface of ZnO nanoparticles and MCT matrix.

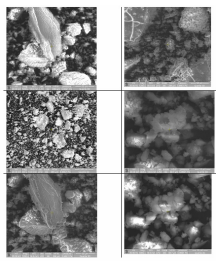
The SEM figures above suggest the implying that a two-length-scale hierarchical structure is formed on the surface. This kind of structures is in according water repellent properties exhibited by the lotus leaf.



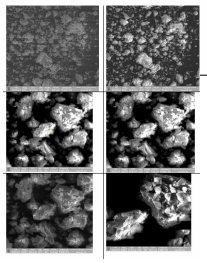
SEM images of nano ZnO-MCT1



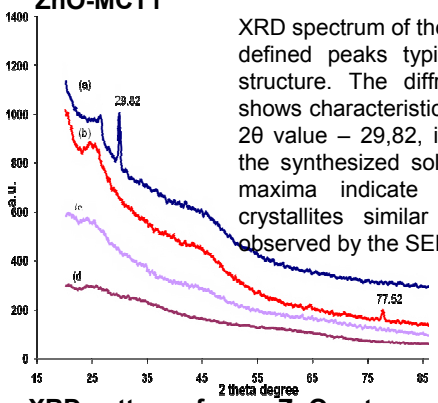
SEM images of nano ZnO-MCT2



SEM images of nano ZnO-MCT3

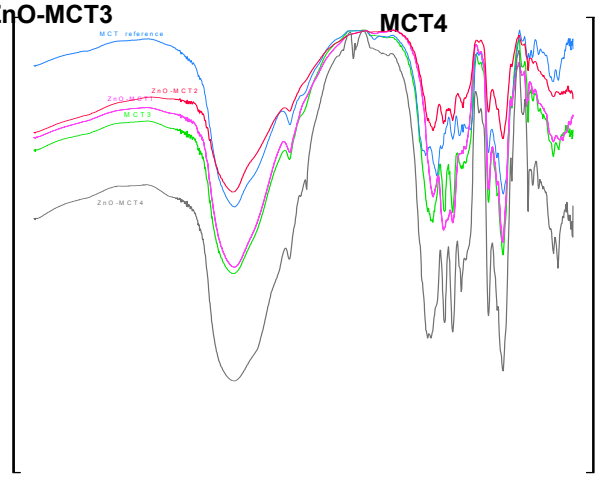


SEM images of nano ZnO-MCT4



XRD spectrum of the ZnO shows well defined peaks typical of ZnO in the crystal structure. The diffractogram of ZnO sample shows characteristic peaks of crystalline ZnO at 2θ value – 29,82, indicating the crystallinity of the synthesized solid. Rather broad diffraction maxima indicate very small size of the crystallites similar to the size of subunits observed by the SEM.

XRD pattern of nano ZnO entrapped in different concentrations of MCT



FTIR Spectra of ZnO nanopowders (ZnO-MCT1; ZnO-MCT2, ZnO-MCT3; ZnO-MCT4

CONCLUSION AND PERSPECTIVES

Based on the analysis of the results of the experimental study the following conclusions can be arrived:

• This research provides a novel and simple method of development of ZnO–(MCT) **M**ono**C**hloro**T**riazinyl-β-cyclodextrin nanocomposites with subsequent application on fibrous fabrics to impart water repellency.

•Undoubtedly, the perspective can be predicted toward the trend of nanocomposites penetration into every area of textile industry. The present work results can be exploited for the commercialization in the case of consumer textile with multifunctional properties such as UV resistance and desired wettability.

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