Electrosprayed silica microspheres modified with triazine moieties for grafting on cellulosic textile

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Abstract

Enhancement of the competitiveness of traditional textile and clothing industry greatly depends on the ability to rapidly response to the customer requirements. The new generation of wearable articles, thus, is expanding into the promising field of multifunctional textiles characterised by added value properties and interactive features [1, 2]. In this scenario, microencapsulation has become an outstanding technology for effectively imparting new properties and related added value on textiles. Progressively, textile industry and clothing companies are experimenting with this microtechnology to produce more attractive and functional articles [3, 4].

In current research, a novel method of covalent grafting solid, hollow or core-shell sub-micronic capsules onto cellulosic fibres from well-established methods for grafting reactive dyes is presented, based on chemical functionalisation of capsule surface with highly reactive triazine moieties. For a proof of concept demonstration, silica sub-micronic spheres were developed by the electrospraying of silica sols prepared via sol-gel process from the hydrolysis of tetraethoxysilane (TEOS) [5]. The chemical-physical properties of the spheres were characterised by Fourier Transform Infrared Spectroscopy (FTIR), Thermogravimetry (TGA) and Scanning (SEM) and Transmission Electron Microscopy (TEM). The microparticles surface was modified with chloro-triazine ligands in two-steps procedure in order to react with the hydroxyl groups in cellulose under mild conditions. As a result, the spheres were firmly anchored to the cotton yarns through the covalent bonds generated by the process herein described.

Finally, it is worth mentioning that this result overcomes one of the major obstacles facing the implementation of microcapsules to textiles, that is the detachment of the capsules caused by friction, washing and use of clothes, thus opening a wide range of potential processes towards smarter functional fabrics.

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References

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Figures

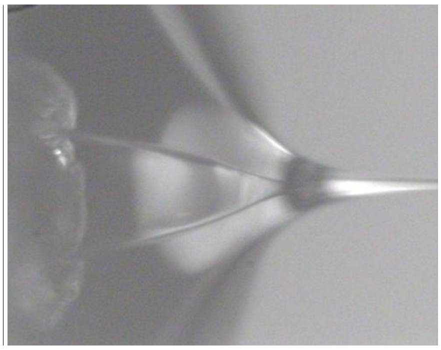

Figure 1. Picture of a compound Taylor cone from which the electrosprayed core-shell silica particles are generated.

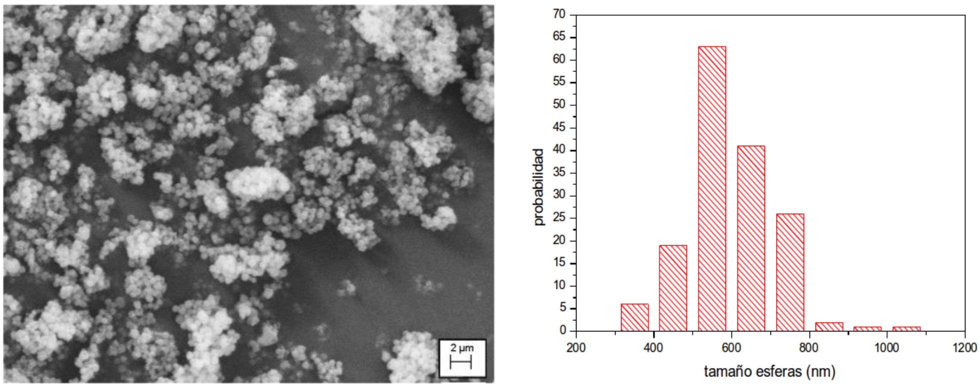

Figure 2. Silica sub-micronic spheres manufacturated by a sol-gel electrospraying process.

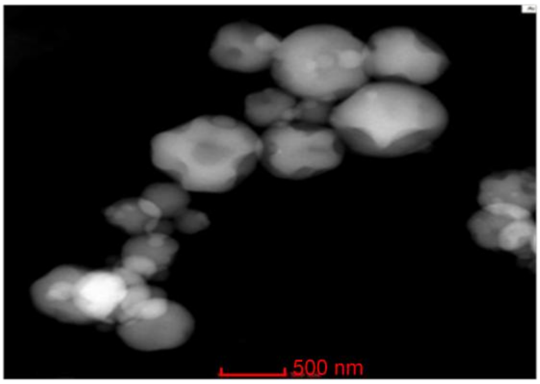

Figure 3. TEM microscopy of the silica microspheres developed by electrospraying.

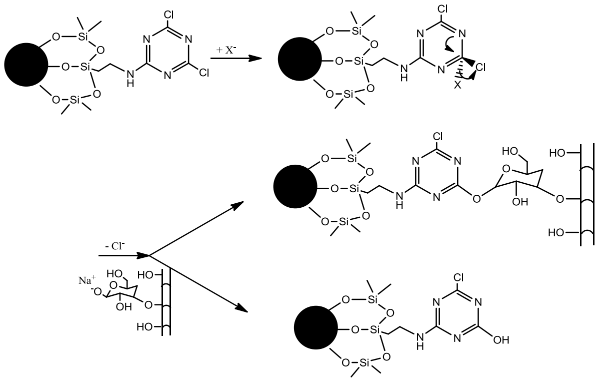

Figure 4. Covalent grafting of solid microspheres on cellulosic textile.