Encapsulation of active principles in PCL for knitted fabric functionalization

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Ada Ferri, Roberta Peila, Naveeta Kumari, Manuela Mihailiasa, Antonello Barresi
Department of Applied Science and Technology, Politecnico di Torino, Italy

Micro- and nanocapsules containing active principles are widely used for dermal and transdermal applications in cosmetics and pharmaceutical preparations. Recently, the dispersion of microcapsules on fabrics have paved the way to new types of products, named cosmeto-textiles [1]. Such products, combining ease of use of a garment and controlled-release from microcapsules, are ideal candidates for complementary therapy of diseases like psoriasis, which require long-term treatment and dedication to the therapy. Nanoencapsulation of caffeine, menthol and melatonin in PCL is discussed in this work, where two different systems for solvent displacement (the **confined-impinging jet mixer** and the **multi inlet vortex mixer**) have been extensively investigated. For each mixer, several process parameters, such as fluid dynamics, type of solvent and polymer-to-drug ratio, have been considered to find the optimal configuration for micro- or nanocapsule formation. In Figure 1, an example of nanoparticles prepared in the same conditions (polymer type and concentration, solvent, mixing conditions) loading different substances in the confined impinging jet mixer is shown. The initial mass ratio (MR) of loading substance and polymer may not be the only or main factor determining final size, as it can be noted that nanocapsule formed by using the triglyceride oil are significantly larger than particles prepared dissolving a solid component.

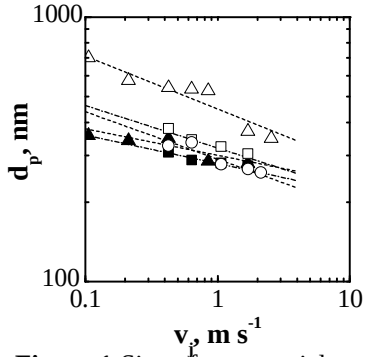

Figure 1 Size of nanoparticles prepared loading PCL M_w= 14000, 6 mg/mL in acetone, with different substances, dissolved in acetone with the polymer :△, miglyol® (MR=2); □, caffeine in acetone and ■, caffeine in water (MR=1.5); ○, menthol (MR=1.27); ▲, melatonin (MR=2).

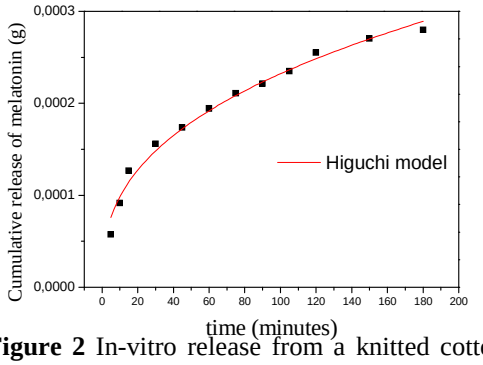

Figure 2 In-vitro release from a knitted cotton fabric with embedded melatonin-PCL nanoparticles (6 mg/ml melatonin- 25 mg/ml PCL).

Complex phenomena can take place during the solvent displacement process, with the formation of a new liquid phase by oiling out: menthol in water/acetone is an example of a substance for which this phenomenon has been observed directly by the authors. Finally, in-vitro release test from fabrics with embedded nanocapsules has been carried out in a Franz cell equipment confirming that fabrics can act as comfortable substrates for controlled release of active principles (Figure 2).

References

[1] S.Y. Cheng, C.W.M. Yuen, C.W. Kan, K.K.L. Cheuk, J.C.O. Tang, Systematic Characterization of Cosmetic Textiles, Textile Research Journal Vol 80 (6): 524–536