Assessment of antioxidant and drug releasing properties of cellulose fabrics

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Assessment of antioxidant and drug releasing properties of cellulose fabrics functionalized with polymeric nanoparticles as potential biofunctional garnments

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Drug administration through skin raised a great interest as a not invasive and sustained method to deliver active substances both at topical and systemic levels. Biofunctional textiles are a new class of materials that combine conventional fabrics with advanced drug delivery systems in order to develop a wearable functional biomaterial [1].
The present research aims to functionalize cellulosic fabrics (e.g. cotton and viscose) with curcumin (CUR)-loaded polycaprolactone (PCL) nanoparticles (NPs) in order to assess their potential as biofunctional garments.
The NPs were produced by the flash nanoprecipitation technique in a confined impinging jet mixer. Such technology was proven to be a simple and scalable approach to produce polymeric nanoparticles; moreover it was successfully applied to curcumin encapsulation [2].
Nanoparticles were then characterized in terms of size and zeta potential by dynamic light scattering (DLS), while the loading capacity (LC%) and encapsulation efficiency (EE%) were measured by exploiting fluorescence spectroscopy.
Cotton and viscose fabrics were functionalized by imbibition with the NPs suspensions and the effectiveness of the treatment was observed under wide-field fluorescence microscopy.
The release properties of the nanoparticles suspensions were studied *in vitro* in a multi-compartment rotating cell, while the curcumin release from textile support was tested *ex vivo* in a Franz diffusion cell using porcine skin as membrane. Furthermore, the antioxidant activity of the NPs and of the functionalized fabrics was measured by electron paramagnetic resonance spectroscopy.
Curcumin loaded NPs were successfully prepared with good control of particle size and loading capacity, high stability over several days and encapsulation efficiency higher than 99%.
Nanoparticles were successfully attached to the textiles material as evidenced by fluorescent imaging. The prepared materials showed an improved antioxidant activity and the capability of controlling curcumin release both *in vivo* and *ex vivo*.
The present research shows the possibility of producing biofunctional materials by simple and scalable process and opens a route for a new generation of garments that can benefit people health.

References

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