

MICROENCAPSULATION OF DEET & CITRIDIOL OIL BY UTILIZING FUNCTIONAL BIOPOLYMERS: A SUSTAINABLE APPROACH FOR MULTIFUNCTIONAL TEXTILES

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ABSTRACT

The growth in technical textiles resulted in an increased demand for multifunctional textiles. Finishing using microencapsulated products can serve as the vital technique for imparting multiple functionalities to textile materials. The microencapsulation of essential oils in core-shell structure has been investigated for protection by evaporation, odor masking, and controlled release. The N,N-diethyl-meta-toluamide (DEET) and citriodiol oil (CO) have been reported to possess excellent mosquito repellent, antibacterial property. However, the rapid volatility is the limitation of CO and DEET exhibit high level of skin penetration, causing allergic to the skin or toxic encephalopathy in children. As a result, the consumers are demanding an alternative to DEET that contains natural ingredients. Therefore, the objective of this study was to investigate the sustainable approach for developing multifunctional textiles.

The DEET - CO microcapsules were prepared by using chitosan and gelatine as a shell material utilizing the highly sophisticated spray-drying technique. The optimum conditions were 0.75% chitosan in 0.5% acetic acid, 0.75% gelatine, 0.5% each DEET and CO with 0.7% tween 80 emulsifiers in distilled water. The surface morphology of microcapsules was analyzed by scanning electron microscopy (SEM) which confirmed the presence of spherical microcapsules with the diameter in the range of 1 and 5 μ m. The encapsulation efficiency (EE) and retention determination (RD) of the microcapsules were calculated as > 90% and >70% respectively. The microcapsules were applied on to cotton fabrics by a pad-dry-cure method. The SEM images of finished fabric showed that the microcapsules were not only tightly fixed on the fabric surface but also inserted in the fibers spacing. The mosquito repellency was analyzed by a screen cage test, which showed 90% inhibition of mosquitoes. The finished fabric also displayed an excellent antibacterial property along with superior antioxidant activity. All the functional properties were retained in the satisfactory level after 5 washes. The superior mosquito repellency achieved using DEET - CO microcapsules finish was likely due to the combined effect provided by the different working mechanisms of the two chemicals i.e. blocking of the receptors on the mosquitos' body by DEET and masking the odor of the human body by CO.