

Development of a smart textile with medicinal properties using lime oil microcapsules

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A smart textile can be defined as a textile that is developed by changing the functionality of common fibers to result in properties useful to the consumer. The present study was focused on using microencapsulation technique to prepare an antioxidant and antibacterial active smart cotton fabric using lime oil (LO). LO microcapsules were prepared *via* the complex coacervation method using chitosan and gum arabic wall materials. UV-Visible spectrometry and FTIR spectrometry was used to verify the encapsulation of LO in microcapsules. Morphology of the LO microcapsules was observed under the optical and scanning electron microscopes (SEM). It was found that the synthesized LO microcapsules were irregular in shape and differed in size between 40-160 μm . The loading of the microcapsules was found to be $2943 \pm 128 \mu\text{L/g}$ with a loading efficiency of $82 \pm 4\%$. The antioxidant activity was monitored using the DPPH radical scavenging assay which indicated a $36 \pm 3\%$ radical scavenging activity for the LO microcapsules. The SEM images confirmed the firm attachment of the LO microcapsules to the fibres of the cotton fabric. With respect to the relevant control samples, the LO microcapsules incorporated unwashed cotton fabric displayed significant antibacterial activity against *Escherichia coli*, *Bacillus cereus*, *Salmonella typhimurium* and *Staphylococcus aureus* bacterial species with inhibition zones of 10 ± 1 mm, 9 ± 0 mm, 9 ± 1 mm and 9 ± 1 mm respectively. After a single wash cycle, the LO microcapsules incorporated cotton fabric still displayed significant antibacterial activity with inhibition zones of 8 ± 1 mm, 7 ± 0 mm, 7 ± 0 mm and 7 ± 1 mm against the same bacterial species respectively.

Keywords: *Smart textiles, Microencapsulation, Lime oil, Antioxidant, Antibacterial*

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