Emerging Nano and Advanced Materials

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Development of Sustainable Mosquito Repellent Textiles using Microencapsulation of Essential Oil

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Abstract

Textile materials, the barrier layer between the human body and the environment, can serve as the protective layer against microbial contaminations and deadly mosquito borne diseases.

In the present work, Rosemary oil (RO) and Cinnamon oil (CO) embedded functional microcapsules were prepared and characterised using SEM technique and prepared microcapsules were applied on the textiles.

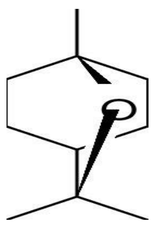
Introduction

Properties of essential oils

- Anti-bacterial, Anti-viral
- Anti-fungal, Anti-oxidant
- Mosquito repellent

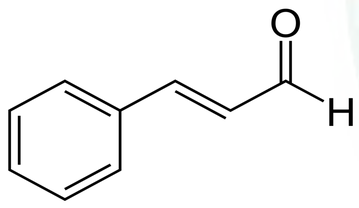
Materials and Methods

Rosemary oil (RO)



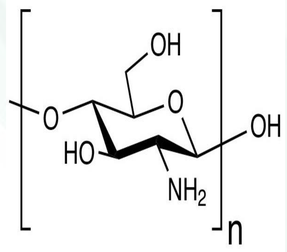
Major Component: (**1, 8-Cineole**)

Cinnamon Oil (CO)



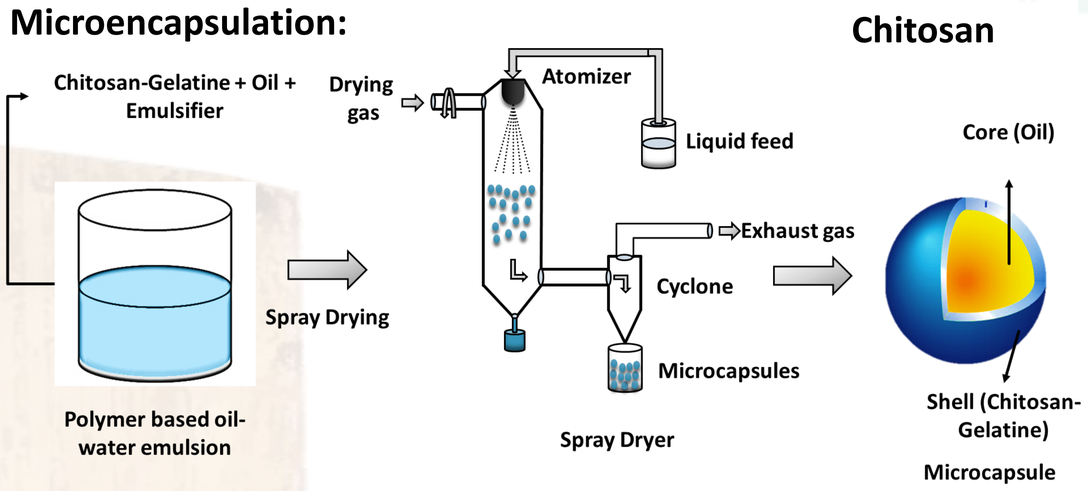
Major Component: (**Cinnamaldehyde**)

Spray Dryer

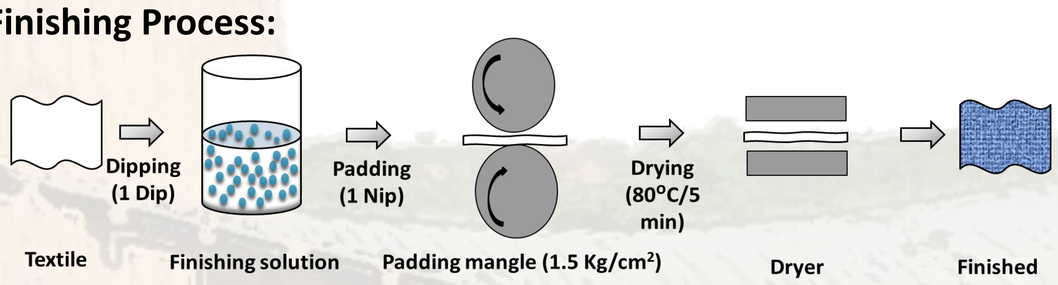


Chitosan

Microencapsulation:



Finishing Process:



Results

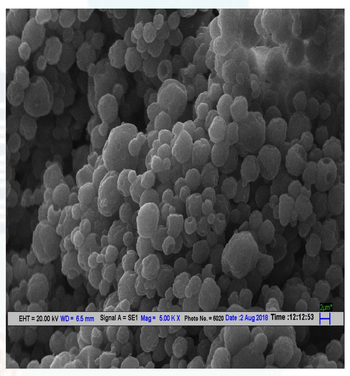
Characterization of microcapsules:

- **Encapsulation Efficiency (EE)**

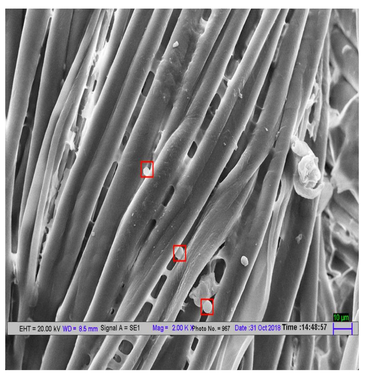
$$\frac{Total\ oil\ content - Surface\ oil\ content}{Total\ oil\ content} \times 100$$

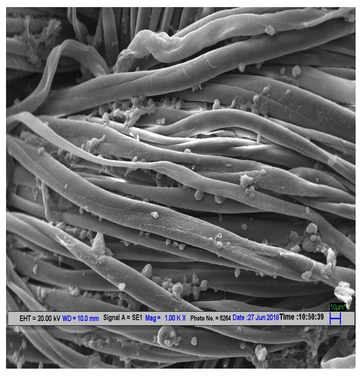
The (EE) > 75% for RO microcapsules and > 78% for CO microcapsules.

SEM Testing:



Microcapsules (1 and 5µm)





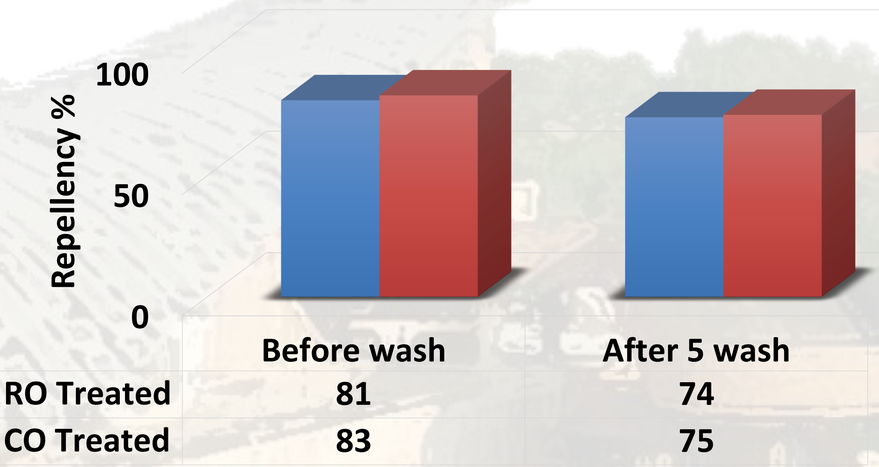
Finished Textile

Functional properties:

Antibacterial values, antioxidant activity and fragrance durability of finished Textile

Sample No	Antibacterial activity (%)		Antioxidant activity (%)		Fragrance Durability	
	E. coli					
Finished Sample	Before wash	After 5 wash	Before wash	After 5 wash	After 5 wash	After 10 wash
RO Treated	95	85	91	83	Yes	Yes
CO Treated	98	89	96	87	Yes	Yes

Mosquito repellent test



	Before wash	After 5 wash
RO Treated	81	74
CO Treated	83	75

Conclusions

- RO and CO embedded microcapsules showed efficient mosquito repellency and antibacterial property.
- These results suggest that, the finished cotton fabric exhibit multifunctional properties which could be used to develop functional clothing, home furnishing and shelter products.

Industrial Significance

Utilization of biodegradable polymers and essential oils in microencapsulation technique has the full potential to introduce new-age multifunctional textile products.

Technology Readiness Level: Waiting for scale up trials

References

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2. S. Li, J. Huang, Z. Chen, G. Chen, Y. Lai, A review on special wettability textiles: theoretical models, fabrication technologies and multifunctional applications, J. Mater. Chem. A. 5 (2017) 31–55.

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