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## **Development of Aroma Curtains using Microencapsulated Geranium Oil**

**K.CHIRSTIE JENNIFER**

(PhD - CDF scholar),

Department Of Costume Design and Fashion,

PSG College of Arts and Science,

Coimbatore- 641014.Tamilnadu, India

**Dr.K.SANGEETHA.,**

Head & Professor

Department Of Textiles and Apparel Design,

Bharathiar University,

Coimbatore- 641046. Tamilnadu, India

### **ABSTRACT**

Value added Functional textiles are being developed in order to provide fabrics with new properties. In past few years home-textiles have experienced considerable advancement both in terms of product diversification and technological aspects for satisfying growing needs of the customers. Aroma finished home textiles is one such instance of high-end product diversification. Curtains a traditional home-textile/home-furnishing item that has started to take important and useful role in creating our home interiors as well as better home ambience. The

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present study envisages development of geranium oil containing aroma microcapsules by complex coacervation method using Gelatin-gum acacia and application of aroma microcapsules on cotton fabric in order to impart durable aroma finish. Characterizations of aroma microcapsules have been carried out using SEM Analysis and human sensory evaluation methods for unfinished, finished and washed samples.

**Keywords:** cotton fabric, Aroma Finishing, geranium oil, microencapsulation, SEM.

## 1. INTRODUCTION

Fabrics that we use in our homes are known as home textiles (**Diamond and Diamond, 2008**). Fabrics used in the home are very important in the sense that it reflects the personality of a person. It controls mood, sets style, indicates taste, it is what is seen and is most maneuverable, the most easily changed, replaced or added ([www.fiberandfabric.com](http://www.fiberandfabric.com)). Curtains play an important role for home textiles like protects interior color from fading, lends privacy to any degree needed, shields people from heat and reduces heat loss in winter and make summer room cooler and reduces an air conditioning load. It increases live ability and workability of a small area, reduces noise, makes music and even speech more resonant (**Ghosh, 2008**). Aromatherapy is art and science of using naturally extracted aromatic plants essential oils to balance, calm, cure infections and promote the health of body and mind. Aromatherapy textile has a diverse use like interior textiles such as sheets, quilt-covers, curtains, carpets and bed sheets and other textile materials (**Srivastava et al**). Aromated home atmosphere is reported to be pleasant and satisfying to our sensory preferences. Microencapsulation could be defined as the process of covering a substance, in the form of solid particles or liquid globules, with materials of different nature in



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order to obtain particles of micrometric size. There are many different microencapsulation techniques. The particles obtained by any of these techniques will be called ‘microspheres’ or ‘microcapsules’ (Garcia Encina *et al*, 1994).

Value added Functional textiles have been studied to satisfy the needs of comfort and safety of consumers. Fragrance finishing of textile material increases the value of the product by adding beneficial factor such factors affects moods of the wearer (Gilbert and Firestein. 2002). Here the study handles vital finish with geranium essential oil on cotton to improve therapeutic effect of the consumers and aroma compound helps to infuse a feeling of well-being and freshness to the wearer.

**The following are the objectives of this study.**

- To select the aromatic essential oil and fabric.
- To optimize the parameters for finishing.
- To develop the microencapsulated aroma finish.
- To evaluate the aromatic finished samples.

## **MATERIALS AND METHODS**

**Essential oils** are volatile and liquid aroma compounds from natural sources, usually plants. These oils often have an odour and are therefore used in textile industry. Geranium (flavour) oil has been taken as it has a sedative effect which is fit for functional finishing of



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curtains. Also open market availability and competitive cost are other decisive factors for selecting Geranium essential oil for experimentation. Geranium oil having consistent aroma intensity is supplied by Organic shop, Chennai. **Fabric material** - 100% Plain weave 30's count cotton fabric were purchased from commercial textile shop, Erode for the present study. **Beta-cyclodextrin** is used as a binder for application of fragranced microcapsules to cotton fabrics as it does not cause irritation, sensitization, does not have mutagenic effect and is also eco friendly. It is also capable of forming inclusion compound with molecules. **Citric acid** is used as cross-linking agent in padding bath for the application of essential oils as it is easily available and cheap.

#### MICROENCAPSULATION METHOD

For preparation of padding bath for microencapsulation method, microcapsule gel is required. For the formation of microcapsule gel of selected essential oils, different variables of microencapsulation process i.e. ratio of oils, gum, gelatin, temperature and pH were selected. 12 g of gelatin was dissolved in 25 ml warm water and stirred with high speed stirrer for 10 minutes. 4 g of core material was added to the solution at 40°C. 12 g of gum acacia was dissolved in 25 ml warm water separately. The gum acacia solution was added to the gelatin solution and the temperature of the solution was maintained at 40°C. The pH of the solution was decreased to 4.5 by addition of dilute acetic acid. The solution was stirred at high speed for 20 minutes and the temperature was lowered to 5°C for gel formation. The pH was increased to 8.5 using sodium hydroxide solution to form microcapsules. 1 ml of alcoholic formalin (17 percent)

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was added to the formed capsules for stabilization. This was used for optimization of other variables of microencapsulation process.

### OPTIMIZATION OF PARAMETERS

For the application of geranium oil on cotton fabrics using microencapsulation method, padding process was standardized for various variables. Different ranges of common variables were tried for optimization on the basis of reviews.

**TABLE – II: OPTIMIZATION OF PARAMETERS**

S. No.	Criteria	Pilot study	Selected parameters
1.	Microencapsulated Gel	30, 40, 50 (g/l)	40
2.	binder	6,7,8 (g/l)	7
3.	Material liquor ratio	1:10,1:20,1:30 (MLR)	1:20
4.	Time	30, 60, 90 (min)	60
5.	Temperature	70°C, 80°C, 90°C	80°C
6.	pH	4-8	7

### APPLICATION OF ESSENTIAL OIL USING OPTIMIZED VARIABLES

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Selected geranium oil was applied on cotton woven fabric using microencapsulation method. Cotton fabric was immersed in padding bath, prepared with optimized ratio of microcapsule gel, binder using 1:20 MLR for optimum treatment duration of 60 minutes at 80°C temperature with occasional stirring and pH level maintained 7. After that Fabric was passed between the rollers of the pneumatic padding mangle. Later the fabric was squeezed dried at 70°C and cured for two minutes at 140°C for each method separately.

- **DEVELOPMENT OF CURTAINS**

Based on the commercial curtains available in the market, the standard size for curtain was selected as 60 inch length and 50 inch width. **A single layer curtain was stitched.**

- **ASSESSMENT OF AROMA DURABILITY OF TREATED FABRIC**

Aroma durability of treated sample in terms of retention and intensity of aroma was assessed. The results specified on assessment of retention and intensity of aroma of essential oils treated samples are presented in Table-2 and 3.

- **RETENTION OF AROMA**

The treated samples after washing, abrasion, ironing and sun drying were evaluated against aroma retention by 25 experts using olfactory analysis (table-2). The treated sample was evaluated within 24-hours. The size of sample was 3x3 cm and it was hung on a clothesline in a room for 1 hour to stabilize the evaporation of fragrance prior to being judged. To get fair judgement the experts were not allowed to enter the stabilizing room and samples were brought

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to the experts. To detect odour, a specimen was put on a desk and the expert used a fingernail to scratch 'X' on the specimen to rupture some capsules and smell the swatch. The responses were recorded as 'Yes' or 'No'.

### INTENSITY OF AROMA

The treated sample was assessed by sensory evaluation qualitatively for intensity of aroma after washing, abrasion, ironing and sun drying by 25 respondents selected purposively from Erode city and the assessment was done on five point quantum scale (table-3).

Weighted mean score (WMS)	Rating
4.2 – 5.0	Very strong
3.4 - 4.1	Strong
2.6 - 3.3	Moderate
1.8 - 2.5	Mild
1 - 1.7	Faint

- **RESULTS AND DISCUSSION**
- **Scanning Electron Microscope study of Microencapsulation Finished Sample**



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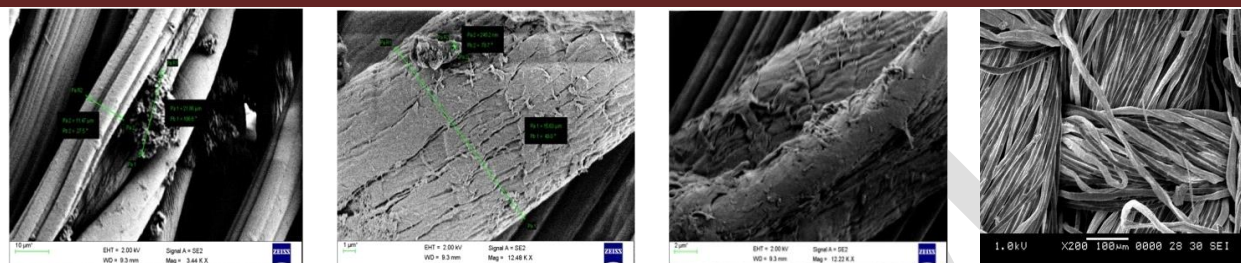
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Scanning Electron Microscope (SEM) reveals very comprehensive three-dimensional contrast imaging of textile and polymer substrates and it can be applied to evaluate the microscopic features and microstructures (Sheraz Ahmad *et al.*,2017). SEM evaluation is used to know the uniformity of coating of finishing, examined to identify morphological structure of finished microencapsulation samples using light microscopy with image processing technique.

- (b) (c) (d)

Fig.1 (a-d) -SEM Analysis of control and finished sample

The surface morphology of the control sample (a), at the magnification level of 100 $\mu$ m and with an accelerating voltage of 1.00 kV, confirmed that unfinished sample fibre was smooth with a spiralled ribbon-like structure caused by twisting of cellulose fibrils. The surface level of modifications of the finished sample fig., (b, c, d) due to finishing treatment were analysed with 1.0  $\mu$ m, 2.0  $\mu$ m and 10  $\mu$ m magnification with accelerating voltage 2.00 Kv. Coarse, dense and bigger bumpy appearance indicates the capsule solution arrangements on the fiber surface.

## EVALUATION OF AROMA

- Retention of aroma





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microencapsulation finished sample was observed after **washing** that the Geranium oil aroma was retained 100 per cent till 5 wash cycles, 72 percent up to 10 wash cycles, 52 per cent retained till 20 washes and 20 per cent retention of aroma was retained up to 30 washes.

After **ironing** the Geranium oil retained 100 per cent after 2 ironings, 88 per cent after 5 numbers of ironing, 72 per cent after 10 ironings and 56 per cent was retained up to 15 ironings.

After **sun drying**, geranium retained 100 per cent after 1 hour, 92 per cent retained after 2 hours, 80 per cent retained after 3 hours and 68 per cent retention of aroma was retained up to 4 hours of sun drying.

- **Intensity of aroma**

Intensity of aroma of before **wash** treated sample with essential oil had very strong rating and after 5 wash cycles the finished sample 4.1 had strong aroma rating. After 10 washes, 3.2 had moderate amount of aroma, after 20 wash cycle's 2.2 had attained mild aroma and even after 30 wash cycles, 1.8 had mild aroma rating.

After **ironing**, Geranium had attained 4.1 strong rating after 2 ironings, after 5 times of ironing 3.3 were observed moderate aroma rating, 2.5 had mild amount of aroma and 1.7 (lavender) observed faint aroma rating after 10 ironing. Faint aroma below the rating 1.7 was observed after 15 ironing in the treated samples.

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The intensity of aroma after sun drying, aroma was 3.9 strong rating after 1 hour of sun drying, 3.3 rating had recorded moderate aroma after 2 hours of sun drying, 2.4 had observed mild aroma after 3 hours and 1.6 rating had attained faint aroma rating at 4 hours of sun drying.

TABLE-2

### Assessment Of Aroma Durability-Retention Of Aroma

Retention of aroma in microencapsulated finished sample (N = 25)										
s. no	Essential oils	Wash cycles	No of respondents	Percentage	After Ironing (no of times)	No of respondents	Percentage	after sun-drying (no of hours)	No of respondents	Percentage
1.	Geranium oil	0	25	100%	0	25	100%	0	25	100%
		5	25	100%	2	25	100%	1	25	100%
		10	18	72%	5	22	88%	2	23	92%
		20	13	52%	10	18	72%	3	20	80%
		30	5	20%	15	14	56%	4	17	68%

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**TABLE-3**

**Evaluation Performa for Intensity of Aroma in microencapsulated cotton Fabrics after Washing, Ironing and Sun-drying**

**(a) Rank order for intensity of aroma in essential oils treated fabrics**

Please give rank order on the basis of Intensity of fragrance:

4.2 – 5.0 - Very strong    3.4 - 4.1- Strong    2.6 - 3.3- Moderate    1.8 - 2.5 - Mild    1 - 1.7- Faint

S.No	Esse ntial oils	Retention of aroma after washing, ironing and sun-drying (n=25)					
		Wash cycle s	Rank order for intensity	After ironing (no of times)	Rank order for intensity	After sun-drying (no of hours)	Rank order for intensity
1.	Gera nium oil	0	5.0	0	5.0	0	5.0
		5	4.1	2	4.1	1	3.9
		10	3.2	5	3.3	2	3.3
		20	2.2	10	2.5	3	2.4

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		30	1.8	15	1.7	4	1.6
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#### 4. Conclusion

In present study, microencapsulated value added aroma finish was applied to cotton fabric using natural essential oil to evaluate the durability of the finished sample. SEM showed the high bondage between the fibre structure and penetration of oil capsules into the inner surface due to the high absorbency. Aroma durability of treated sample in terms of retention and intensity of aroma was assessed after washing, abrasion, ironing and sun drying. The fragrance results lasted after maximum number of washes, ironing and drying after the application. However they continued to provide aroma even after the last evaluation. It was also found that concentration of oil does not affect the intensity of aroma. From the research it was found that cotton curtain shows best receptor of aroma and provides therapeutic benefits.

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