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APPLICATION OF FRAGRANCE FINISH ON SILK FABRIC BY MICROENCAPSULATION TECHNIQUE

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ABSTRACT

Aromatherapy is the practice of using essential oils to promote physical and emotional well being. Essential oils can produce individual emotional responses when inhaled and then noted by the brain. Applying these fragrances on textiles can incorporate aromatheraputic properties of oils into the material. As these essential oils are volatile in nature this finish is not lasting on fabrics even for few washes. Microencapsulation is an effective technique to entrap these volatile oils onto the fabric for longer use.

In this study, optimization of microencapsulation process using simple coacervation technique was done with guar gum as wall material and citronella oil as core material. Microcapsules were prepared by optimized process and coated on silk fabrics which were tested for various physical parameters in order to ensure its suitability as clothing and textile product.

Keywords: microencapsulation, simple coacervation, guar gum, citronella oil, aromatherapy

INTRODUCTION

The treatment of many psychological and physiological conditions using essential oils has become more and more popular over the last few decades. The popularity of complementary and alternative medicine (CAM) type treatments is ever increasing as patient awareness of alternative styles of medical therapy to compliment the traditional approaches are becoming more readily available. These essential oils are lightly fragrant volatile substances, which can occur in various leaves, petals, fruit and roots of plants. Volatile oils have been reported to possess anti-inflammatory, anti-microbial and anti-viral actions. Other possible effects seem to reduce stress and provide psychological comfort. One of the uses of these essential oils is aromatherapy.

Aromatherapy is a form of alternative medicine that uses volatile liquid plant materials, known as essential oils (EOs), and other aromatic compounds from plants for the purpose of affecting a person's mood or health **(Anonymous[1], 2008)**. As the ‘second skin’ of the human body, all types of textile are excellent media for transferring fragrant compounds, and are essential to people according to their preference for them. Microencapsulation is an effective technique to entrap these volatile oils onto the fabric for longer use.

In the present work, process of microencapsulation using simple coacervation technique has been optimised using guar gum as wall material and citronella oil as core. The final finish was applied on the fabric and it was tested for various physical properties in order to see the effect of finish.

METHODOLOGY

1. Materials used

A protein fabric (silk) was selected for the application of finish in the present study. It was degummed before application of the finish of microcapsules. For this study, citronella oil was selected as core material and guar gum as wall material.

2. Selection of microencapsulation technique

Simple coacervation technique was selected for microencapsulation.

3. Optimization of conditions for processing

Concentration and temperature are the conditions which were optimized. The process of microencapsulation was first optimized for concentration. For this microcapsules were prepared using different concentrations in the ratios 1:1, 1:2, 2:1, 1:3 and 3:1 of gum and oil. The optimized concentration process was then subjected to different temperatures ranging from 30°C to 60°C in order to select the best temperature thus standardising the process.

4. Ensuring the presence of microcapsules

During the optimization stage, an optical microscope was used to ensure the presence of capsules at x45 magnification.

5. Application of finish

The optimised process for the combination of gum and oil for simple coacervation was then prepared for application. The finish was applied on the pre-treated silk fabric with the help of padding rollers. After application each fabric was given heat treatment at 80-85°C in an oven for 5 minutes.

6. SEM analysis

Finished samples were analysed with scanning electron microscopy using FET QUANTUM 200 apparatus to ensure microcapsules' presence in the fabrics at magnification of x800.

7. Physical testing of the treated fabrics

Physical properties of both control and treated fabrics were evaluated to compare the changes that have occurred after the application of the finish, hence to ensure their suitability for their intended purpose and expected quality. So for this purpose fabrics were compared by testing various physical properties.

RESULTS AND DISCUSSION

The standard recipe was followed for different ratios of gum and oil. The resultant precipitate obtained from each experiment was analysed under a high definition optical microscope to ensure the formation of microcapsules.

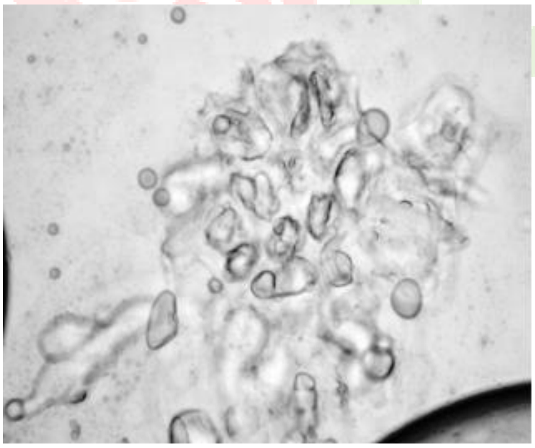
Table-1: Concentration ratios of guar gum with citronella oil

S. No.	Ratios Gum(g): Oil(ml)	Amount Gum(g): Oil(ml)
1.	1:1	0.50: 0.50
2.	2:1*	0.50: 0.25
3.	1:2	0.25: 0.50
4.	1:3	0.25: 0.75
5.	3:1	0.75: 0.25

Ratio selected for citronella oil

It was observed under the microscope that microcapsules of guar gum and citronella were formed with the ratio 2:1 having 0.5 grams of gum and 0.25 ml of oil. This ratio of concentration of guar gum with oil was then further subjected to the process of optimization of temperature.

The optimized gum-oil concentration ratio was then subjected to different temperatures of 30°C, 35°C, 40°C, 45°C, 50°C and 60°C. Microscopic analysis of the precipitate from each experiment showed that lower temperatures of 30°C and 35°C were not able to produce microcapsules. At higher temperatures of 45°C, 50°C and above, the solution began to bubble and microcapsules were not observed to be formed at this temperature. This may be because the high temperature broke the formed capsules. At this temperature the oil, which is volatile in nature, evaporated at higher rate leaving very less quantity to encapsulate hence leading to no formation of microcapsules. At the temperature of 40°C, formation of microcapsules was noted hence it was considered as optimized temperature.



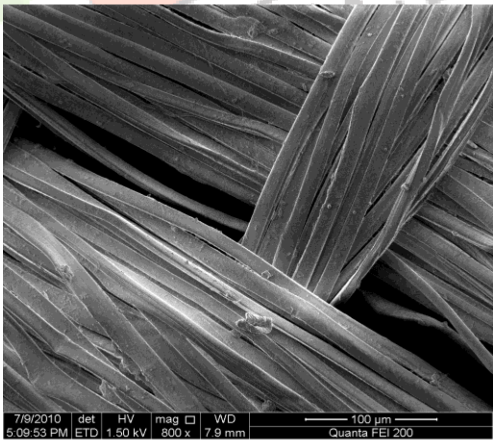


Fig: (A) optical microscopic image of the guar gum-citronella oil microcapsules
(B) SEM image of microcapsules on silk fabric

The optimized process was used to make guar gum- citronella oil microcapsules which were then applied on the fabric. Both control fabric and finished fabric were then subjected to various physical tests.

Table 2: Physical properties of fabrics

Name of the property	Control sample	Finished silk
Fabric thickness (mm)	1.39	1.5
Bending length (cm) *Warp way*	1.1	1.25
Weft way	1.8	2.1
Drape coefficient (%)	51.34	57.96
Abrasion loss (%)	3.56	2.93
Thermal conductivity (clo)	0.169	0.175
Crease recovery angle (^{0}) *Warp way*	100	98
Weft way	86	85
Breaking strength (gm/cm) *Warp way*	10387.854	8908.9
Weft way	39018.9	30811.07
Elongation at break (%) *Warp way*	14.99	13.08
Weft way	10.83	10.98

1. **Thickness**

Thickness of finished sample increased as compared to the control which can be attributed to the coating of finish applied to the fabrics.

2. **Bending length**

Results in the Table 2 show that bending length of the finished sample increased as compared to the control sample of silk fabric which is the degummed fabric. This may be because of the finished applied which caused stiffness in the fabric. Bending length was observed to be more in weft direction as in warp which may be due to the presence of thicker yarns in weft direction as compared to warp.

3. **Fabric Drape**

Drape coefficient of finished fabric increased as compared to the control fabric resulting in stiff handle because of the coating of gum in finished fabrics which collected in the interstitial sites of the fabric samples to make them less drapable.

4. **Abrasion resistance**

Abrasion resistance of finished fabric increased as compared to the control fabric because of the coating of gum in finished fabrics which acted as a shield.

5. **Thermal conductivity**

It was observed that thermal conductivity of finished sample increased as compared to control sample. This was the result of the coating of finish of microcapsules applied to the fabrics as the finish closed the interstitial sites as well as covered the fibres thus reducing the conduction of heat through fibres.

6. **Crease recovery**

Crease recovery angle of finished fabric was slightly lower than control sample in both the directions due to the added stiffness by finish applied.

7. **Tensile strength and elongation**

Decrease in the tensile strength in both ways (warp and weft) finished fabrics as compared to control samples was noted which can be attributed to the use of alcoholic formalin for the formation of microcapsules which may have affected the cross-links of the fibre. From the results it was observed that elongation of the finished fabric slightly decreased as compared to the control fabric which can be attributed to the coating of finish as it restricted the yarns and fibres to show their natural elasticity.

CONCLUSION

Aromatherapy is increasingly popular as one of many approaches to healing with natural substances which are favoured by the public, and make it possible for the individual to attempt self-therapy at home. As close friends of humans, textiles can make aromatherapy easy wherever they are needed. Micro-encapsulation can effectively control the release rate of the fragrance compounds and essential oils as required, which ensures the storage life of volatile substances. We may choose various products such as fibres, fabrics, non-fabrics and garments to enjoy the pharmaceutical and emotional effects of aromatherapic textiles. People will be benifited as this study will ensure increased cultivation of aromatic plants, enhanced rate of essential oil extraction and similar fields associated with this will be rewarded.

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