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Development of Natural Herbal Encapsulated Adhesive Tape for Medical Textiles

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ABSTRACT: Microencapsulation is a process in which tiny particles or a coating to give small capsules with many useful properties surrounds droplets. 'Small is better' would be an appropriate motto for the many people studying microencapsulation. In its simplest form, a microcapsule is a small sphere with a uniform wall around it. The material inside the microcapsule is referred to as the core, internal phase, or fill, whereas the wall is sometimes called a shell, coating, or membrane. Wound healing is a natural process and dressing and medication enhance the process. There has been a sharp increase in the use of wound dressing materials in the recent past. Preparing an adhesive tape that is made of 100% natural bamboo non – woven materials which has been encapsulated with herbs like coffee and green tea for a better antibacterial activity. Coffee and green tea extract were encapsulated to get a better result and also they were tested for antibacterial activity, the outer shell used was sodium alginate. Where the top layer is having a PP laminated and the adhesive used is water based adhesive. The study shows that 100% bamboo nonwoven materials treated with coffee shows the maximum antibacterial activity when compared to 100% bamboo nonwoven material when treated with green tea. There was no allergic reaction seen on skin when tested with the entire two samples on different age and different skin type.

KEYWORDS: Microencapsulation, Wound dressing, antibacterial activity, Green tea, Coffee Adhesive tape.

I. INTRODUCTION

Wound healing is a natural process and dressing and medication enhance the process. There has been a sharp increase in the use of wound dressing materials in the recent past. The modern dressing promote quicker healing of wound and reduce the cost of nursing time says SC Anand (2006).

Bamboo fabric is a natural textile made from the pulp of the bamboo grass. Bamboo fabric has been growing in popularity because it has many unique properties and is more sustainable than most textile fibers. Bamboo fabric is light and strong, has excellent wicking properties and is to some extent antibacterial.

The history of the medical effects on green tea start on the early eighth century with the Buddhist monks who recognized green tea for its medicinal powers, but now a days there is also an increasing interest in the beneficial effects of green tea on health and disease prevention chen et.al. (2002).

Coffee is a very complex mixture of several hundred chemicals which are either naturally occurring or else induced by the roasting process. The chemistry of these substances has not yet been completely elucidated. Most literature reports concern caffeine and its pharmacological effects but recently other bioactivities of coffee have been investigated. Coffee has been found to act as a potent antioxidant and to inhibit peroxidation in model systems. It was shown that coffee possesses antibacterial properties against a number of bacteria such as *staphylococcus aureus* and *streptococcus mutans*.

Microencapsulation is the process of enhancing a core material inside a miniature capsule. These capsules are called microcapsules. The core material inside the microcapsule is usually a solid or a liquid, through a gas may also be used. The capsule wall is made of a variety of material such as gelatine, wax, natural substance, plastic or other compounds says Ruma Chakrabarti (2007).

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II. MATERIALS AND METHODS

A. 100% Bamboo spunlace fabric

Bamboo fiber has particular and natural function of anti-bacteria, bacteriostatic and deodorization. It is validated by japan textile inspection association that even after fifty times of washing bamboo fibre fabric still possesses excellent function of anti- bacteria. Its test result show over 70% elimination rate after bacteria being incubated on bamboo. Spunlacing is a process of entangling a web of loose fibres on a porous belt or moving perforated or patterned screen to form a sheet structure by subjecting the fiber to multiple rows of fine high- pressure jets of water.

B. Solvent extraction of collected herbs

Coffee and green tea was selected as the core material , as they are natural herbs that has antibacterial property in them. Extraction was carried out by dissolving 6 grams of the herbal powders (**Coffee & green tea**) in 50ml of 80% methonal, kept overnight under shaking condition. Then the extract was filtered using whatman no:1 filter paper, filtrate was collected and evaporated at room temperature. The concentrated extract was stored at 4 degree Celsius.



(a)



(b)

Fig. 1: Raw Materials (a) *Green tea* leaves (b) Coffee Powder

C. ENCAPSULATION BY IONIC GELATION

Microcapsules containing extract were prepared. Then 30ml of sample herbs (Coffee & green tea) were added to the polymer solution and mixed thoroughly to form smooth viscose dispersion. This was sprayed into calcium chloride solution by means of a sprayer. The droplets were retained in calcium chloride for 15 minutes. The microcapsules were obtained by decantation and repeated washing with iso propyl alcohol followed by drying at 45 °c for 12 hours. The microcapsules were then used for finishing on the selected fabrics.

D. Exhaust method

The fabric sample was finished with the prepared herbal extracts microcapsules according to the following recipe with 8% binder. One litre of solution containing 700 grams of capsules is used to finish one meter of fabric. The fabric was immersed in the solution for 30mins under 50 °c in oven. After 30 mins, the fabric was removed from the dub and air dried in shade.

III. RESULT AND DISCUSSION

A. ANTI BACTERIAL ASSESSMENT BY EN ISO 20645

The antibacterial activity of the finished fabric (100% bamboo finished with coffee & green tea) were tested according to EN ISO 20645 against *staphylococcus aureus* and *Escherichia coli*. Nutrient agar plates were prepared by pouring 15ml of media into sterile petri dishes. The plates were allowed to solidify for 5 minutes and 0.1% inoculum was swabbed uniformly and allowed to dry for 5 minutes. The finished fabric with the diameter of 2.0 ±0.1 cm was placed

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on the surface of medium and the plates were kept for incubation at 37 °c for 24 hours. At the end of incubation, the zone of inhibition formed around the fabric as measured in millimetres and reduced.

Table 1: Antibacterial Activity of Finished Bamboo Fabric (EN ISO 20645)

S.NO	FABRIC SAMPLE	HERB SAMPLE	ZONE OF INHIBITION	
			S.AUREUS	E.COLI
1	100% BAMBOO	COFFEE	44	39
2		GREEN TEA	42	33

From Table I and it is clear that bamboo fabric finished with coffee exhibited maximum activity of 44mm against S.aureus and 39mm against E.coli and the bamboo fabric treated finished with green tea showed a less activity of 42mm S.aureus against. The above test confirms that bamboo treated with coffee shows the best result.

B. ANTIALLERGY ASSESSMENT OF THE FINISHED FABRIC CONTACT ALLERGY TEST (IN HOUSE METHOD)

Antiallergy assessment of the finished fabric was carried out through contact Allergy test (In House Method). Where the fabric (100% bamboo finished with coffee and Green tea) were patched on the normal skin and observed for the specified period of time for the development of the symptoms leading to contact dermatitis allergy.

Evaluation was done after the contact time, the fabric patches were removed and observed form the following reactions

- (IR) - Irritant reaction
- (-) -No irritant reaction
- (+) - Weak positive
- (++) - Strong positive

Table 2: Antiallergy Assessment of the Finished Fabric

S.NO	SUBJECT	FABRIC S SAMPLE (100% BAMBOO FINISHED WITH COFFEE AND GREEN TEA)
1	Subject 01(female / 21 yrs)	-
2	Subject 02(female /23 yrs)	-
3	Subject 03(female / 27 yrs)	-

From the above table clear that there is no allegeric reaction in three subjects.

C. Thickness Test

Table 3: Thickness Test on Unfinished and Finished Bamboo Fabric

S.no	Sample	Thickness(mm)
1.	B.Nw	0.406
2.	B.Nw C	0.6
3.	B.Nw GT	0.568

From the Table 3 it is clear that bamboo treated with coffee has the maximum thickness of 0.6mm followed by bamboo finished with green tea and the least in unfinished bamboo.

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D. Abrasion Test

Table 4: Abrasion Test for Finished and Unfinished Fabric

S.no	Sample	Abrasion resistance %
1.	B.Nw	23.6725
2.	B.Nw C	52.7475
3.	B.Nw GT	20.3625

From the above Table 4, abrasion resistance of bamboo fabric finished with Coffee is the highest with 52.7475% followed by untreated bamboo fabric with 23.6725% and followed by bamboo fabric treated with green tea with 20.3625%.

IV. SUMMARY AND CONCLUSION

The present investigation aimed at developing a natural wound care dressing from natural herbs. The adhesive tape made of bamboo material which has been coated with microcapsules of coffee and green tea and on one side PP lamination has been given onto the other side ester based acrylic adhesive has been used so that it sticks to the body. It shows that bamboo finished with coffee microcapsules has a better result on the antibacterial test followed by bamboo finished with green tea microcapsules. Whereas all the three type of adhesive tape shows no allergic reaction to the skin.

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