

SPECIMEN FORMAT FOR THESES OF MONTH

Faculty : **Home Science**

Department : **Textiles and Clothing**

Branch/ Area: : **Medical Textiles**

Sub Subject Heading: : **Textile Finishing**

Candidate's Name : **S. Archanaa Preetha**

Candidate's Address with email : **132/1, Miranda Lane, 2nd Cross Street, Old G.H Road, Theni- 625531, archanaxevio@yahoo.in**

Title of the thesis : **Developing Herbal Antimicrobial Finished Cotton Fabric for Wound Dressing**

(i) In Roman Script
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Name of Supervisor : **Dr.G.Bagyalakshmi**

Designation of Supervisor : **Associate Professor & Head**

Centre/department/school in which research was conducted : **Textiles and Clothing**

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Abstract within 300 words:

Abstract:

The plants play an important part in human life by providing their basic needs like food, shelter and clothing; beyond that they are also the sources of large amount of drugs which play a vital role in the medicinal need of the human beings. A wide variety of plant species possess antimicrobial property. The aim of the study was to develop herbal antimicrobial finished cotton fabric for wound dressing. A literature survey and hospital survey was conducted on herbs and antimicrobial finished bandaids. The following herbs are selected for the study *Abutilon indicum*, *Cassia auriculata*, *Tridax procumbens* and *Cassia fistula* polyherbal formation was made and tested against microorganisms such as *Staphylococcus saprophyticus*, *Pseudomonas aeruginosa*, *Escherichia coli*, *Aeromonas hydrophila* and *Candida albicans*. Microencapsulation and Nanoencapsulation of the polyherbal extract was prepared. Fabric of 30s Ne and 10s Ne count was woven pretreated and finished into dip and dry, microencapsulated and Nanoencapsulated polyherbal extracts using different finishing methods such as dip and dry and exhaust method of finishing. The finished fabric was subjected to antimicrobial efficiency against the test organisms and fabric testing was performed. The tested fabric was developed into bandaids and evaluated for microbial filtration test and bandaid toxicity test.

Key words: polyherbal, antimicrobial finishing, microbial filtration test, bandaid toxicity test, bandaid

Major objectives :

- i) To study the availability of wound dressing in market and their demand
- ii) To select the yarn for weaving fabric for wound dressing
- iii) To select medicinal herbs
- iv) To optimize herbal extract concentration and determination of polyherbal formation
- v) To treat the woven fabric with polyherbal extract and test the fabric performance.
- vi) To develop a product and evaluation.

Methodology :

The experimental procedure adopted for the study on “**Developing Herbal Antimicrobial Finished Cotton Fabric for Wound Dressing**” consists of a series of processes, techniques and instruments, which is sub-divided into four phases.

- The first phase consisted of literature survey, collection of information to study the properties of wound dressing band-aids, selection, preparation and processing of herbs, selection of yarns and testing the physical properties of selected yarn, weaving and studying the physical properties of woven fabric and pretreatment of the fabric.
- The second phase included the extraction process of herbs with three different solvents namely Hexane, Ethyl acetate and Methanol.
- The third phase comprised phytochemical screening and selection of solvent for final study was done. Selection of microbial culture, determination of Minimum Inhibitory Concentration against selected microorganisms. Determination of the antimicrobial activity of the selected polyherbal formulation and wound scratch assay for selected polyherbal formulation were also determined.
- The fourth phase involved the preparation of Micro and Nano-encapsules and fabric finishing with the selected polyherbal extract by Dip and Dry and Exhaust methods. The finished fabrics were tested for their physical properties Product development and evaluation were also undertaken.

Findings:

- From the market survey, it was found that the respondents expressed that the herbal antimicrobial band aid for minor cut, burns and scratches should be made with plain woven cotton fabric of yarn count 30's in the warp yarn and 10's in the weft yarn.
- Hydro colloid, Hydrogel, Alginate dressing, Collagen, Foam and Cloth dressings are best for pressure ulcers, painful or narcotic wounds, high amount of drainage and venous ulcers, transplant sites, burns are injuries with large surface areas, absorb exudates from wound surface and cover up wound respectively. Each wound dressing material was different and was used for different kind of wounds. Breathable, comfortable and antimicrobial properties are most desirable factors for wound dressing as expressed by 92% of respondents respectively. This is followed by easy wearable, effectively speeding up healing prevent infection and suitable for sensitive skin type as mentioned by 88, 84 and 80% of the respondents respectively. Considering the standard size of band aids (3/4 inch width and three inch length) three inch length and two inch width had been adopted for the study.

- Considering the percentage yield of herbal concentrate upon different solvents, Methanolic extract with respect to all the selected herbs had better yield when compared to the other solvents. With regard to minimum inhibitory concentration under serial dilution method methanolic extraction of *Tridax procumbenz* showed the breaking point at 500µg/ml whereas *Cassia fistula*, *Cassia auriculata* and *Abutilon indicum* show the breaking point at 250 µg/ml. Among the herbal extracts, *Cassia auriculata* (250µg/ml) indicate better zone of inhibition when compared to other herbs.
- In the case of polyherbal formulation 50 µl, 100 µl, 150 µl and 200 µl of extracts were prepared at the ratio of 1:2:1:1 *Abutilon indicum*, *Tridax procumbenz*, *Cassia fistula* and *Cassia auriculata* concentration of 80 %, in which 200 µl of poly herbal extract showed better zone of inhibition which was followed by 150 µl, 100 µl and 50 µl. The Antimicrobial assessment for polyherbal finished fabric such as Dip and Dry, Microencapsulation and Nanoencapsulation against microbial pathogens were evaluated by AATCC 147 Agar well Diffusion method, and the sample NEF showed the maximum zone of inhibition as 34,33,32,35 and 29 mm against the microbes followed by MEF and DDF.
- The *In vitro* wound scratch assay in fibro blast cell line analysis method proved the development of tissue growth over the scratch ensures the healing property of the herbal extracts.
- Considering the surface morphology of the herbal finished fabric examined through Scanning Electron Microscopy analysis, the range of particle size of herbal extract is observed between 3.328µm of RSD 09 28, similarly the particle size of nanocapsules had been identified as 171.43nm to 345.25nm.
- With reference to the FTIR results the band width spectrum showed the presence of alkaloids, alkyl halides, carbohydrates groups, alkalides, acidhalides, phenolic compounds, carbohydrates, alcohols, alknes, carboxylic, ester acid, ether in various ranges proving the presence of phytochemicals which lay a base for healing property in the polyherbal extract finished fabrics.
- With reference to fabric properties, the result pertaining to weight of MEF fabric showed minimum increase as 175.02 GSM when compared to the C, DDF and NEF samples as recorded to be 174.18, 174.18 and 174.19 GSM respectively. From the analysis of Tensile Strength results obtained in the warp direction, the MEF fabric with 45.52 Kgf showed

maximum tensile strength followed by DDF and NEF with 40.86 and 40.20 Kgf respectively. As far as the strength in weft direction of the fabrics, maximum strength was noted in original fabric with 58.27 Kgf, followed by MEF, NEF and DDF fabrics with 39.47 and 35.96 and 35.33 Kgf respectively. The elongation of the samples along the warp direction increased in NEF sample but decreased in the DDF and MEF samples when compared to the original as noted to be 6.53, 9.73 and 7.57 per cent respectively.

- When considering the sinking time in seconds, the herbal finished fabrics had shown reduction in sinking time than the control. The herbal extract finish has enhanced the wettability of the finished fabric. Sample DDF took two seconds whereas MEF and NEF samples have taken only 1 second to sink. The water holding capacity of the finished fabrics had increased for the herbal finished fabrics. DDF finished fabric had the water holding capacity of 70%. This was followed by MEF and NEF finished fabrics with a holding capacity of 66% and 53% respectively. From the analysis of absorbency tests it could be identified that that the control and the MEF fabric took three seconds to absorb a droplet of water. Whereas, DDF and NEF samples had taken two and one seconds respectively. The wickability of DDF sample was noted as 0.39 minutes along the warp and weft direction. It has increased gradually to 0.410, 0.430 and 0.440 minutes in C, NEF and MEF samples respectively.
- The air permeability of sample C and MEF is 79.3 and 79.1 c.c/cm.sq./sec respectively and hence it could be concluded that the fabrics have good air permeability.
- With regard to Bacterial Filtration test, the samples tested with *Escherichia coli* ATCC 25922, *Staphylococcus saprophyticus* ATCC 6538, *Aeromonas hydrophila* ATCC 100-2004 and *Pseudomonas aeruginosa* ATCC 100-2004 showed better filtration when compared to the control untreated sample. The Dip and Dry finished fabric show 80% to 85% of bacterial reduction whereas Micro encapsulation finished and Nano encapsulation finished samples showed more or less same bacterial reduction properties as 90% to 95% and 93% to 96%.
- With respect to Fungal Filtration test, the samples tested with *Candida albicans* for showed better filtration when compared to the control untreated sample. The Dip and Dry finished fabric showed 85% of fungal reduction whereas Micro encapsulation finished and Nano encapsulation finished samples showed more or less similar fungal reduction properties as 90% and 96%.

- During the toxicity test analysis, the antibacterial agents finished onto the sample swatches (extracts from dip-dry swatch, micro encapsulation and nano encapsulation finished swatches) did not exhibit any toxicity for the mouse fibroblast cell lines (L₉₂₉). All the four samples showed more than 80% of viable cells; and the percentage of cell inhibition was recorded less than 15% for the same type of samples. Thus the samples were proved to be highly biocompatible and non toxic to the users.

Internal Examiner : **Dr.K.Sangeetha**
 Professor and Head
 Department of Textiles and Apparel Designing
 Bharathiar University
 Coimbatore - 641046

External Examiner : **Dr.N.K.Palaniswamy**
 Professor
 Department of Textile Engineering
 College of Engineering and Technology
 Aksum University, Aksum
 Ethiopia