IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

ANTIMICROBIAL FINISHING OF COTTON FABRIC USING ANDROGRAPHIS PANICULATA(NILAVEMBU) FOR PERSONEL HYGIENE PROTECTION AND WOUND HEALING APPLICATION

[1]M.Janarthanan, [2] R.Rajeev, [2]J.Camillus, [2]S.Aravindan

1Assistant Professor, 2Student

Department of Textile Technology, Bannari Amman Institute of Technology,

Sathyamangalam-638401, Erode, Tamil Nadu, India

Abstract: Clothing acts as a secondary skin to our body. It is very important in a man's life and has consistently evolved. Textile merchandises having unique properties are used for varied purposes and one such is antimicrobial coating. Herbal oils and extracted materials are used for imparting exotic finishes to textiles. Microencapsulation, sensory perception technology, liposomes, dyes, and coated textile technology are some of the methods of incorporating herbal extracts on to textile. Textiles are prone to micro-organisms ,their products known to induce infection and intoxication. Textile products such as herbal coated textiles and garment are available to aid healthy lifestyle and hygiene.One of the most popular medicinal plants used for the treating of varied set of diseases such as cancer, diabetes, high blood pressure, ulcer, leprosy, bronchitis, skin diseases, flatulence, colic, influenza, dysentery, dyspepsia and malaria is Andrographis panniculata. In this project, the phytochemical components present in the herb has been analyzed by TLC method . The antimicrobial activity has been tested for both the extract and treated fabric by agar well diffusion method.

Keywords: TLC, Andrographis panniculata, Phytochemical constituents, agar well diffusion method.

I. INTRODUCTION

Clothing acts as a secondary skin to our body. It is very important in a man's life and has consistently evolved. Textile merchandises having unique properties are used for varied purposes and one such is antimicrobial coating. Herbal oils and extracted materials are used for imparting exotic finishes to textiles. Microencapsulation, Liposomes, dyes, sensory perception and coated textile technology are some of the methods of incorporating herbal extracts on to textile. Textiles are prone to micro-organisms, their products known to induce infection and intoxication. Textile products such as herbal coated textiles and garment are available to aid healthy lifestyle and hygiene.

One among the more popular herbal plants for the treating of varied set of diseases is Andrographis panniculata. It has many photochemical constituents with unique and fascinating biological properties. Flavonoids, Diterpenes, xanthones, noriridoides and other components have been separated from the plant parts. Extract material and pure components of the plant have been known for their anti-diabetic, anti-angiogenic, hepato-renal protective, cytotoxicity, anti-protozoan, sex hormone/sexual function modulation, liver enzymes modulation insecticidal, anti-inflammatory, anti-oxidant, immunostimulant, and toxicity activities. The outcomes of various toxicity valuation of extracts and metabolities separated from this plant not shown any ample acute toxicity in sample animals. On mammalian cells and organs a much elaborate and comprehensive toxicity profile is need for future studies.

II. OBJECTIVES

• Herbal extract using Andrographis paniculata using soxhlet apparatus.

• To assess the phytochemical test present in herbal extract using TLC.

• To analyze the antibacterial activity Of Andrographis paniculata (nilavembu) herbal extract and treated fabric by using agar diffusion method.

.

III. LITERATURE REVIEW

3.1.Andrographis paniculata- description

Biological Hierarchy

Order:	Lamiales
Family:	Acanthaceae
Genus:	Andrographis
Species:	A. paniculata

- Andrographis paniculata, native to India and Sri Lank is an herbaceous annual plant in the family Acanthaceae.
- In Southern and Southeastern Asia, this plant is widely cultivated.
- Believed to be a treatment for bacterial infections and some diseases traditionally.
- Mostly the leaves and roots were used for such purposes.

Uses

- Antibacterial and wound healing property.
- Antioxidants and anti-inflammatory compounds.
- Anti-cancer and antiseptic property.
- Immunostimulation.

3.2. Thin Layer Chromatography (TLC)

Thin Layer Chromatography is widely used for the development of organic chemical reactions and assaying the purity of organic compounds in biotechnology and phytochemistry compared to other chromatographic methods. TLC has the affinity to analyse with the stationary and mobile phases to attain the separation of complex mixtures of organic molecules. The advantages of TLC are more rapid runs, improved separations, and the choice between different absorbent. Thin layer chromatography is, simple, economic and easy-to-operate planar chromatography technique. It is used in chemical laboratories for many decades to regularly separate biochemical and chemical compounds.

3.3. Microencapsulation

The process in which tiny particles of important function are surrounded by a coating is called Microencapsulation. It consists of two parts, one is the central core part inside the microcapsule and the other is the outer covering called shell. Textile finishing industry are now using microencapsulation extensively for many speciality finishes like fragrance, antimicrobials, therapeutic oils, moisturisers, adhesives and many more.

Reasons for using microencapsulation in textiles are as follows:

- Incompatible components separation
- Liquids to free flowing solids conversion
- Improved stability
- Elimination of smell, taste and masking of functions of encapsulated materials
- Immediate environment protection against degrading factors
- Active compounds controlled release (sustained or delayed release)
- Release of encapsulated materials at targeted factors.

IV.METHODOLOGY

1. Selection and collection of herbal plants with antibacterial activities
2. Methanolic Herbal extract using Andrographis paniculata using soxhlet apparatus.
3. Assess the phytochemical test and functional compounds present in herbal extract using TLC and FTIR spectroscopy
4. Analyze the antibacterial activity Of Andrographis paniculata (nilavembu) herbal extract by using agar diffusion method
5. Apply microencapsulated extract on the cotton fabric by using pad-dry-cure method.
6. Analyze the antibacterial properties and wound healing properties of treated fabric before and after washing.

V. RESULTS AND DISCUSSION

5.1. Thin layer chromatography analysis of *Andrographis paniculata* extract

In order to test any plant extract for any property, first of all its constituent compounds has to be known. Hence here the TLC test conducted to know the phytochemical groups and the results are tabulated:

Table- 5.1. Thin layer chromatography analysis of *Andrographis paniculata* extract

S. No	Phyto-constituents	Mobile phase	Spraying agent	Rf value	Presence of compounds
1.	Tannin	Methanol	10% Ferric chloride	-	-
2.	Phenol	Ethyl acetate	10% Ferric chloride	0.69	+
3.	Terpenoid	Ethyl acetate	11% Aluminium chloride	0.72	++
4.	Flavonoid	Ethyl acetate	11% Aluminium chloride	0.71	+
5.	Saponin	Methanol	10% Ferric chloride	0.65	+

+ Present, ++ Actively present, - Absent

From the above table we can infer that plant extract in test contains phenols, terpenoids, flavonoids and saponins. Among them terpenoids are most actively present compound. All the four compounds have microbial activity.
Hence from this analysis we can say that the plant extract has antimicrobial activity but the extent of it cannot be determined by this analysis.

5.3.Antimicrobial activity of the *Andrographis paniculata* extract

Table- 5.3. Antibacterial activity of the *Andrographis paniculata* extract

Culture Type	Culture Designation	Test Cultures	Zone of Inhibition (mm)*				
			1	2	3	4	5
Gram-Positive	GP1	Bacillus subtilis	0	0	19	22	25
	GP2	Staphylococcus aureus	0	0	16	19	23
	GP3	Staphylococcus epidermidis	0	0	19	23	26
	GP4	Bacillus cereus	0	0	20	22	25
	GP5	Micrococcus sp	0	0	0	18	22
Gram-Negative	GN1	Escherichia coli	0	0	18	20	22
	GN2	Proteus sp	0	0	16	19	23
	GN3	Pseudomonas sp	0	0	0	20	24
	GN4	Klebsiella sp	0	0	19	21	24
	GN5	Citrobacter sp	0	0	0	19	21
Fungi	F1	Candida albicans	0	0	0	20	26
	F2	Candida tropicalis	0	0	0	21	25

***1,2,3,4,5 : 100µg/ml, 200µg/ml, 300µg/ml, 400µg/ml and 500µg/ml**

Inference: Among the five concentrations of *Andrographis paniculata* extracts, MAXIMUM inhibitory zone was found evident for 500µg/ml concentration against all test cultures

5.4. Antimicrobial activity of Treated fabric

Table-5.4. Antibacterial activity-EN ISO 20645 Test Method

Culture Type	Culture Designation	Test Cultures	Zone of Inhibition (mm)	
			Finished	***Unfinished***
Gram- Positive	GP1	*Bacillus subtilis*	29	0
	GP2	***Staphylococcus aureus***	**34**	0
	GP3	*Staphylococcus epidermidis*	30	0
	GP4	***Bacillus cereus***	**32**	0
	GP5	*Micrococcus* sp	30	0
Gram- Negative	GN1	***Escherichia coli***	**35**	0
	GN2	*Proteus* sp	29	0
	GN3	*Pseudomonas* sp	28	0
	GN4	***Klebsiella* sp**	**32**	0
	GN5	*Citrobacter* sp	27	0
Fungi	**F1**	***Candida albicans***	**34**	0
	F2	*Candida tropicalis*	30	0

Inference: *Andrographis paniculata* capsules finished fabric showed **GOOD** antibacterial activity (5 test cultures selected for wash durability test based on maximum inhibitory zones obtained)

5.5. Wound Healing Testing

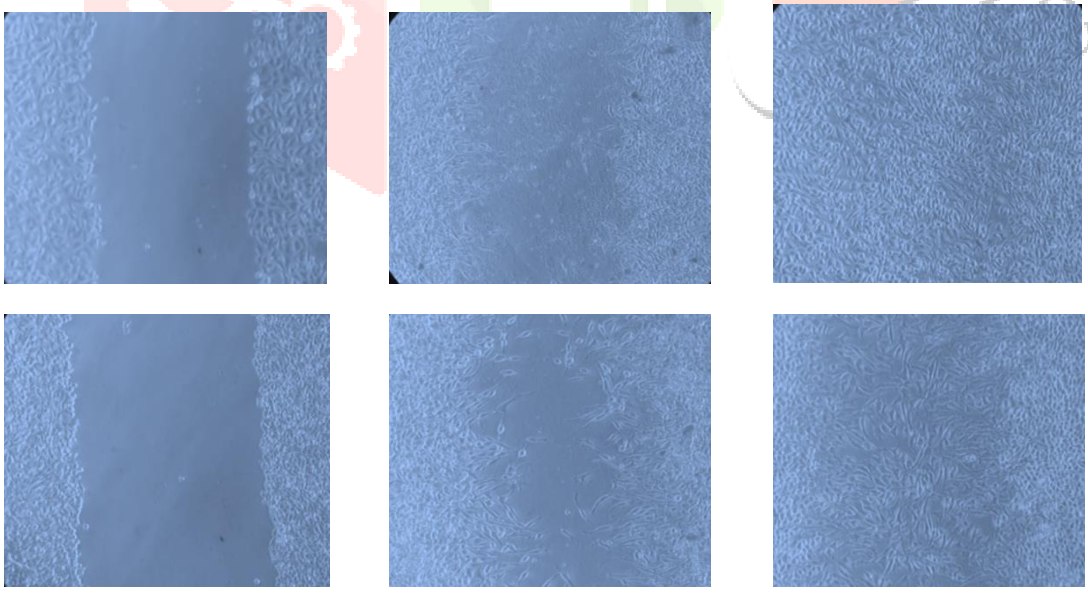
***In vitro* scratch assay**

Cell migration, cell proliferation and wound closure in response to stimulation with specific agents can be measured by in-vitro scratch assays. In this study, the *Andrographis paniculata* extract used for the cell adhesion studies was determined for its capacity to increase wound healing by acting directly on L_{929} mouse fibroblast cells.

A scratch on L_{929} mouse fibroblast cell lines were made and after that the cell migration, cell proliferation and wound closure was measured for a known concentration (100µg) of *Andrographis paniculata* extract at three different time periods (0^{th} hour, 12^{th} hour and 24^{th} hour). Figure- 4.13. corresponding to self-wound healing ability of the developed *Andrographis paniculata* extract showed that, at 0^{th} hour, no cell migration and proliferation was observed for the known concentrate (100µg) including control. At 12^{th} hour, *Andrographis paniculata* extract showed positive cell migration and cell proliferation when compared to the control sample. After 24hours, more cell proliferation was evident and thus indicating the wound healing ability of *Andrographis paniculata* extract. *In vitro* scratch assay could be recorded as an appropriate and inexpensive method for the wound healing potential of *Andrographis paniculata* extract used in the present research.

Figure-4.13. Self-wound healing scratch assay: *In vitro* Wound Scratch Assay

0th Hour **12^{th} Hour** **24^{th} Hour**



A: Control (Distilled water) [Top three pictures]

B: *Andrographis paniculata* extract sample (100µg) [Bottom three pictures]

VI . CONCLUSION

Results obtained for antibacterial and antifungal activity of Andrographis panniculata extract are reported. The data revealed that there are significant antibacterial and antifungal activities of extract . The cotton fabric treated with the extract also revealed considerable antimicrobial activities. The phytochemical analysis and FTIR Test has been carried out to find the biochemical components present in the extract. Additionally, wound healing activity has also been done and discussed for accessing its application in medical field. From the above results, we can infer that the Andrographis panniculata extract can be used for making antimicrobial cotton clothing for medical workers and other sanitary workers for hygiene protection and it also acts as a healing medicine for opportunistic injuries that may be sustained during their live-saving efforts in this time of disease pandemic. Further quantitative study may be required in future in accordance with this project to know the exact extend of amount of microbes inhibition and wound healing cell growth quantity.

REFERRENCES

1. Hossain, M. S., Urbi, Z., Sule, A., & Rahman, K. M. H. (2014). Andrographis paniculata(Burm. f.) Wall. ex Nees: A Review of Ethnobotany, Phytochemistry, and Pharmacology. *The Scientific World Journal*, *2014*, 1–28. https://doi.org/10.1155/2014/274905
2. CHURIYAH, PONGTULURAN, O. L. I. V. I. A. B. U. N. G. A., ROFAANI, E. L. R. A. D. E., & TARWADI. (2015). Antiviral and Immunostimulant Activities of Andrographis paniculata. *HAYATI Journal of Biosciences*, *22*(2), 67–72. https://doi.org/10.4308/hjb.22.2.67
3. Okhuarobo, A., Ehizogie Falodun, J., Erharuyi, O., Imieje, V., Falodun, A., & Langer, P. (2014). Harnessing the medicinal properties of Andrographis paniculata for diseases and beyond: a review of its phytochemistry and pharmacology. *Asian Pacific Journal of Tropical Disease*, *4*(3), 213–222. https://doi.org/10.1016/s2222-1808(14)60509-0
4. Rupiasih, N. N., Ayu Putu Cyntia Dewi, G., Wayan Supardi, I., & Ketut Putra, I. (2019). The Potency of Biologically Synthesized Silver Nanoparticles UsingAndrographis PaniculataExtract (S-AgNp) as an Antibacterial Agent. *IOP Conference Series: Materials Science and Engineering*, *515*, 012013. https://doi.org/10.1088/1757-899x/515/1/012013
5. Prakash, V. (2017). TERPENOIDS AS SOURCE OF ANTI-INFLAMMATORY COMPOUNDS. *Asian Journal of Pharmaceutical and Clinical Research*, *10*(3), 68. https://doi.org/10.22159/ajpcr.2017.v10i3.16435
6. Mahmud, R., & Nabi, F. (2017). Application of Nanotechnology in the field of Textile. IOSR Journal of Polymer and Textile Engineering, 04(01), 01–06. https://doi.org/10.9790/019x-0401010106
7. AS. Negi, J., M. Roxas, J., B. Kligler, C., CJ. Huang, M., WW. Chao, Y., SC. Mandal, A., . . . FL. Lin, S. (1970, January 01). Isolation and identification of Bioactive compounds IN Andrographis Paniculata (chuanxinlian). Retrieved February 27, 2021, from https://cmjournal.biomedcentral.com/articles/10.1186/1749-8546-5-17
8. Singha, P. K., Roy, S., & Dey, S. (2003). Antimicrobial activity of Andrographis paniculata. Fitoterapia, 74(7-8), 692–694. doi:10.1016/s0367-326x(03)00159-x
9. Ajaya Kumar, R., Sridevi, K., Vijaya Kumar, N., Nanduri, S., & Rajagopal, S. (2004). Anticancer and immunostimulatory compounds from Andrographis paniculata. Journal of Ethnopharmacology, 92(2-3), 291–295. doi:10.1016/j.jep.2004.03.004
10. Roy, S., Rao, K., Bhuvaneswari, C., Giri, A., & Mangamoori, L. N. (2009). Phytochemical analysis of Andrographis paniculata extract and its antimicrobial activity. World Journal of Microbiology and Biotechnology, 26(1), 85–91. doi:10.1007/s11274-009-0146-8
11. Admin. (2021, January 28). Thin layer CHROMATOGRAPHY (tlc) - principle, Procedure, applications ON BYJU'S. Retrieved February 28, 2021, from https://byjus.com/chemistry/thin-layer-chromatography/
12. Rajani, M., Shrivastava, N., & Ravishankara, M. N. (2000). A Rapid Method for Isolation of Andrographolide from Andrographis Paniculata Nees (Kalmegh). Pharmaceutical Biology, 38(3), 204–209. doi:10.1076/1388-0209(200007)3831-sft204
13. Sheeja, K., Shihab, P. K., & Kuttan, G. (2006). Antioxidant and Anti-Inflammatory Activities of the PlantAndrographis PaniculataNees. Immunopharmacology and Immunotoxicology, 28(1), 129–140. doi:10.1080/08923970600626007
14. Zhang, C. Y., & Tan, B. K. H. (1997). Mechanisms of cardiovascular activity of Andrographis paniculata in the anaesthetized rat. Journal of Ethnopharmacology, 56(2), 97–101. doi:10.1016/s0378-8741(97)01509-2
15. Lin, F. L., Wu, S. J., Lee, S. C., & Ng, L. T. (2009). Antioxidant, antioedema and analgesic activities ofAndrographis paniculataextracts and their active constituent andrographolide. Phytotherapy Research, 23(7), 958–964. doi:10.1002/ptr.2701
16. Sangeetha, Sundaramoorthy & Rastogi, Archit & , Sathiavelu.A.. (2014). Phytochemical Testing, Antioxidant Activity, HPTLC and FTIR Analysis of Antidiabetic Plants Nigella sativa, Eugenia jambolana, Andrographis paniculata and Gymnema sylvestre. Research Journal of Biotechnology. 9. 65.
17. . G., Aziz, S. A., Munif, A., Sopandie, D., & Bermawie, N. (2013). Isolation and Selection of Endophytic Bacteria Consortia From Medicinal Plant (Andrographis Paniculata) As Plant Growth Promoting Agents. Journal of Agronomy, 12(3), 113–121. https://doi.org/10.3923/ja.2013.113.121
18. Hossain, M. S., Urbi, Z., Sule, A., & Rahman, K. M. H. (2014). Andrographis paniculata(Burm. f.) Wall. ex Nees: A Review of Ethnobotany, Phytochemistry, and Pharmacology. *The Scientific World Journal*, *2014*, 1–28. https://doi.org/10.1155/2014/274905
19. Andrographis paniculata (Burm. f.) Wall. ex Nees: A Review of Ethnobotany, Phytochemistry, and Pharmacology. (2020). INTERNATIONAL JOURNAL OF PHARMACEUTICAL SCIENCES AND RESEARCH, 11(3), 1146–1151. https://doi.org/10.13040/ijpsr.0975-8232.11(3).1146-51