iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 5 **Issue:** XI **Month of publication:** November 2017

DOI: http://doi.org/10.22214/ijraset.2017.11016

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor:6.887
Volume 5 Issue X1, November 2017- Available at www.ijraset.com

Antimicrobial Fabric Coated With Vetiveriazizanioides Extract for Healthcare Application

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Abstract: Vetiver root (Vetiveriazizanioides) is possessing with higher amount of medical properties and it is one of the perennial grasses, can be used to produce the low cost and affordable medical products. The present study aims to design the vetiver extract coated woven textile for hospital usage. In the research work, the researcher used twin approach to produce the extract from vetiver such as aqueous method of extraction and solvent method of extraction from powered form of the dried root. 15% concentrated vetiver power treated with the woven textile fabric of 300 GSM and its zone of inhibition against S. aureus and E. coli were studied. Through FTIR spectra, it is found that significant amount of C-O and O-H group might present in the powder. The treated organic cotton fabric possessed good antimicrobial activity against S. aureus and E. coli and wash test was also conducted to measure the real time utility performance of the fabric. while analyzing the results, ZOI value was high for prewash sample through aqueous extract, but after 5, 10 and 15 washes the performance of solvent extract samples show better than aqueous extract. Hence, the vetiver root extract is suitable for functional finishing of textile and particularly used for hospital usages.

Keyword: Vetiver , Pad-dry-cure method, washing Test, Antimicrobial textile Materials

I. INTRODUCTION

The advantage of treating natural extracts from plants on textile to achieve functional properties is one of the well recognized method due to its non-toxic and eco –friendly nature (Christie and Sangeetha, 2016). The functional properties of the coated/treated fabric are depending upon the recovery method of active components from such medicinal plants and its applications on textile material. This will be accomplished through various extraction techniques (P Ganesan & KJ Vardhini, 2015) and in addition to that extract yield will depend upon the type of solvent utilized for the process too. As reported by Ganesan et (2013) ,the solvent polarity will also influence the solubility of the active component in the medicinal plants. Mostly water or an organic solvent is used as a extraction medium. As reported by Senthilkumar B (2016) the medicinal plants extract on textile provides highest antimicrobial value. vetiver (VetiveriaZizanioides) is one of important medicinal plants grown in river side. The roots of this plant contain oil known as khus oilis used in traditional medicine production such as hyper acidity, urinary tract infection, toothache, fever(Kumar et al.,2014) .Since the vetiver is a perennial grass, can be used to produce the low cost and affordable medical products. In addition to this, many research outcomes proved that Vetiver has commendable property towards antifungal, mosquito repellent and antimicrobial properties. (Krishnaveni,2016). The present research work is focussed on producing low cost antimicrobial treated hospital clothing with vetiver extract.

II. MATERIALS AND METHODS

A. Materials

Scoured and bleached 100% Plan woven cotton fabric of 300 GSM has been purchased from KVIC shop ,Gandhigram. The medical plant Vetiver was sourced around the farming land near the Gandhigram university. A fragrant extract or essential oil obtained from the root of an Indian grass, used in perfumery and aromatherapy. The grass is Vetiveria zizanioides, *family* Gramineae. A member of the Gramineae family, vetiver is native of the South Asian region which includes in many places of India and Ceylon.

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Fig.1: Vetiver Grass (a) Vetiver Roots (b) Component - mono root (c)

B. Power formation

The vetiver root was dried well and cleaned. The dried roots were crushed into fine powder by traditional pounding method.




Fig.2: Vetiver roots-Half grindred (a) Vetiver Roots Powdered (b)

C. Method of extraction of vetiver root powder

Extraction involves solvent penetration into herb cells, solubilisation of secondary metabolites and finally releasing the dissolved secondary metabolites in solvent of extraction. The solvent becomes enriched with extractive substances after penetration and the highest content of extractive substances is found in the solvent stock. The two methods were used to extract the vetiver root powder i.e., aqueous and solvent extraction.

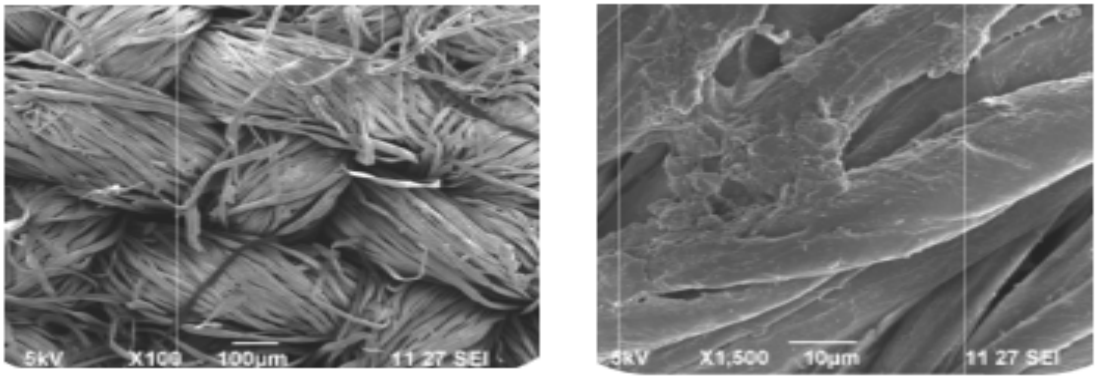
1) *Aqueous method:* 15 gram of vetiver root power was mixed with distilled water with 100 mL and then left it for 24 h .During the time the powered samples were completely blended with the water and the solution was further concentrated to make viscose solution and stored at 40ºc.
2) *Solvent method of extraction:* This vetiver powdered solution was converted into solution from using solvents through soxhlet apparatus in the following manner.15 gram of form of vetriver was dissolved in 100ml of diluted ethanol (ethanol: 80 ml and water: 20 ml) was kept it for overnight. Then the solution was centrifuged in 20 minutes, finally filtrated with Whatsmann no.1 filter paper.
3) *Fabric treatment:* The application of vetriver extract made from both the route on the fabric was done through Pad dry cure method. First the fabric was wetted and treated with 8 % of citric acid as crosslinking agent, the material is immersed in the crude vetriver solution. Material liquior ratio was 1:10 and the temperature of the process was 50ºC.The treated fabric was passed between the pair of squeezing rollers for obtaining better penetration on the fabric .Finally the fabric is dried with the drying section.

III. ASSESSMENT

A. SEM analysis

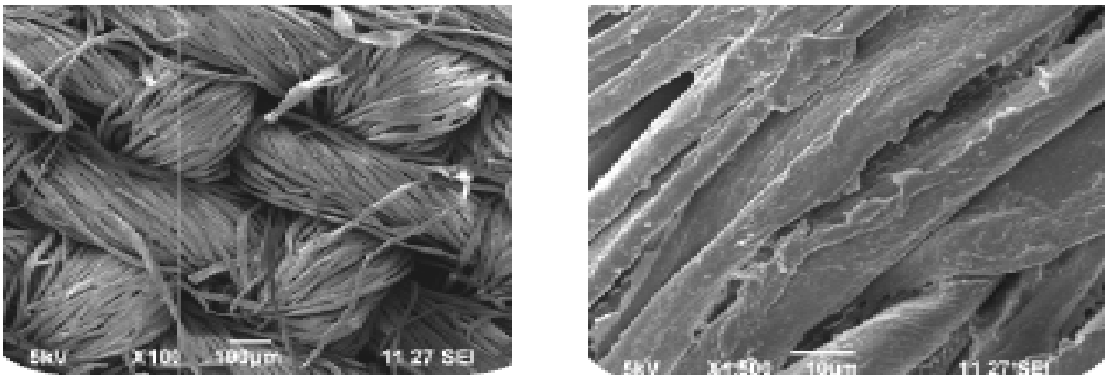
High resolution Scanning Electron Microscope (SEM of *Jeol - JSM-6390O)* was used to visualize the morphological properties of the coated specimen. Before executing the testing process the test specimen is sputter coated to ensure the conductive property of the material. The SEM working on an accelerating voltage range from 0.5-20KV and two kind of magnification was done to view the structure X 100 and X1500.

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A.SEM image of X100 magnification B.SEM image of X1500 magnification

Fig .3: SEM image of vetiver coated sample of aqueous extract



A.SEM image of X100 magnification B. SEM image of X1500 magnification

Fig .4: SEM image of vetiver coated sample of Solvent mode of extract

The treated sample through aqueous method was shown as Figure No.3 and treated sample through solvent extract was shown as Figure no. 4

B. FTIR Spectral analysis

Thus under the chemical compositions inside the vetriver root, the researcher studied the FTIR spectral study of the extract. In the Figure no.5 indicate that C-O and O-H stretch was found at the wave length of 1035 cm-1 and 3396 cm-1 respectively. It is further interpreted that the presence of carboxylic acid group is evident from this understanding. As reported by SakeenaNaikwadi et at (2017) in his gas GCMS spectral analysis, proved that the presence of Diethyl phthalates is more than any other compound is further reconfirmed.

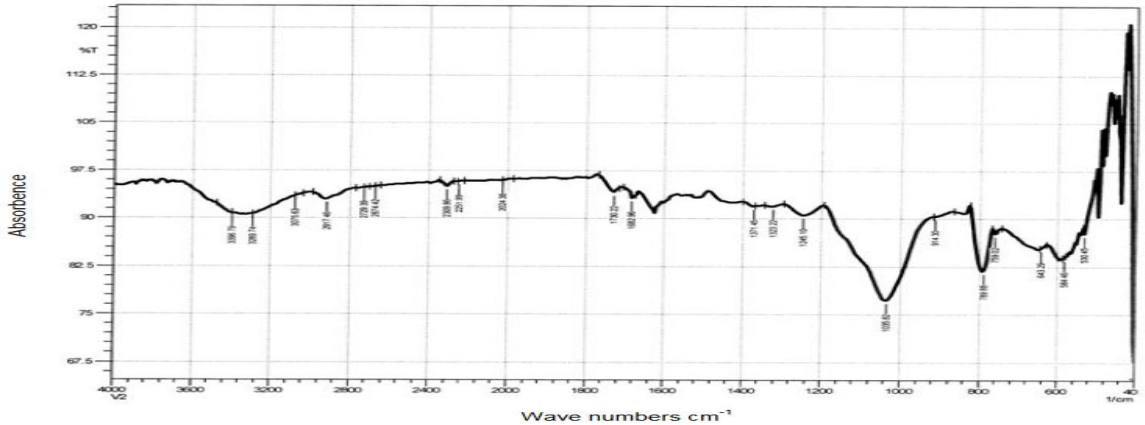


Fig. 5: FTIR Spectral -Vetiver

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C. Assessment of antimicrobial activity

Antimicrobial activity of the treated fabrics was assessed by AATCC 147 test method for the determination of the antimicrobial activity of the treated samples. Agar Diffusion test was carried out to analyze the antimicrobial property of the coated fabric samples. Mostly the microorganism such as Escherichia coli and Staphylococcus aureus were considered as a important pathogen and the former is the representative of gram positive bacteria and the later one is the representative of gram negative bacteria. The vetiver extract treated and untreated samples were inoculated with the test organisms. The figure no 6 & 7 indicate the zone inhibition (ZOI) of E-coli and S.aureus pathogen through aqueous extract coated sample and Solvent extract coated samples respectively.



A. ZOI against E-coli B. ZOI against s.aureus

Fig. 6: Antimicrobial activity –Zone of inhibition of Aqueous extract solution



A. ZOI against E-coli B. ZOI against s.aureus

Fig .7: Antimicrobial activity –Zone of inhibition of Solvent mode extract solution

D. Washing test

The wash durable properties of the vetiver coated samples were also done to measure the effectiveness of treatment during the real usage. To measure this parameter the researcher treated the samples (both aqueous treated and solvent mode of coated) for 5 washes ,10 washes and 15 washes with the distilled water environment and subsequently measure the antimicrobial value through zone of inhibition with agar medium. The ZOI value of treated and after washed samples were presented as table no.1

Table No. 1 Zone of inhibition against E.Coli and S.aureus by the vetiver treated sample

Type of sample	Sample made from Aqueous method		Sample made from solvent extract	
	Zone of Inhibition in mm		Zone of Inhibition in mm	
	E.Coli	s.aureus	E.Coli	s.aureus
Treated sample	45	43	41	42
Treated sample after 5 wash	37	36	39	38
Treated sample after 10 wash	28	22	31	32
Treated sample after 15 wash	15	14	22	24

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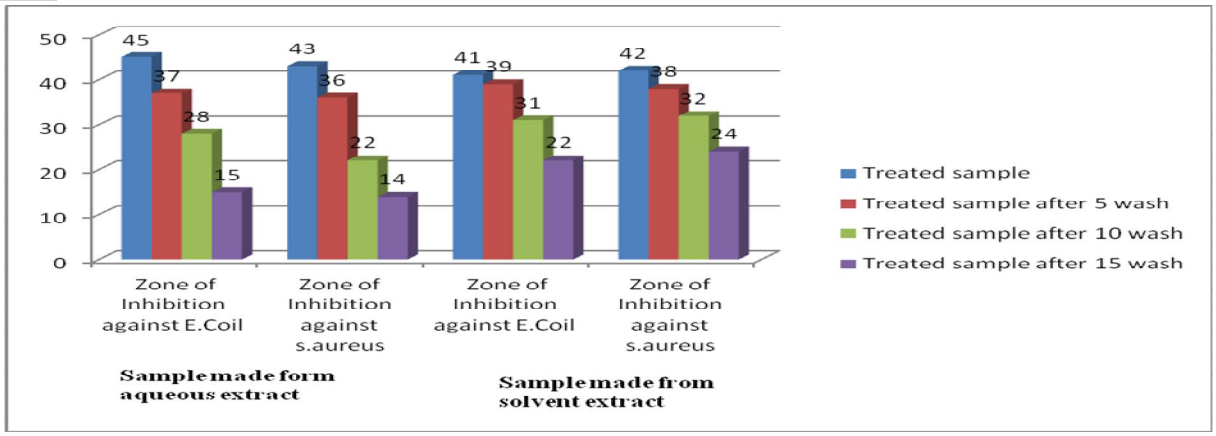


Fig.8: Zone of inhibition against E.Coli and S.aureus by the vetiver treated sample

IV. RESULT AND DISCUSSION

It is understood that the ZOI(Zone of inhibition) for the aqueous samples were high at the initial level ,later on the fabric were subjected to washing test it gets reduced as compared with solvent mode of extraction. It is interpreted that the initial level the surface addition is high in the case of aqueous method, but due to washing herbal particles may be dissolved as compare with the solvent mode samples. Gas- GCMS is proved that the presence of Diethyl phthalate is more than any other compound is further reconfirmed. Finally the Assessment of antimicrobial activity is also traditionally proves by the measure of ZOI values of antibiotic zone scale.

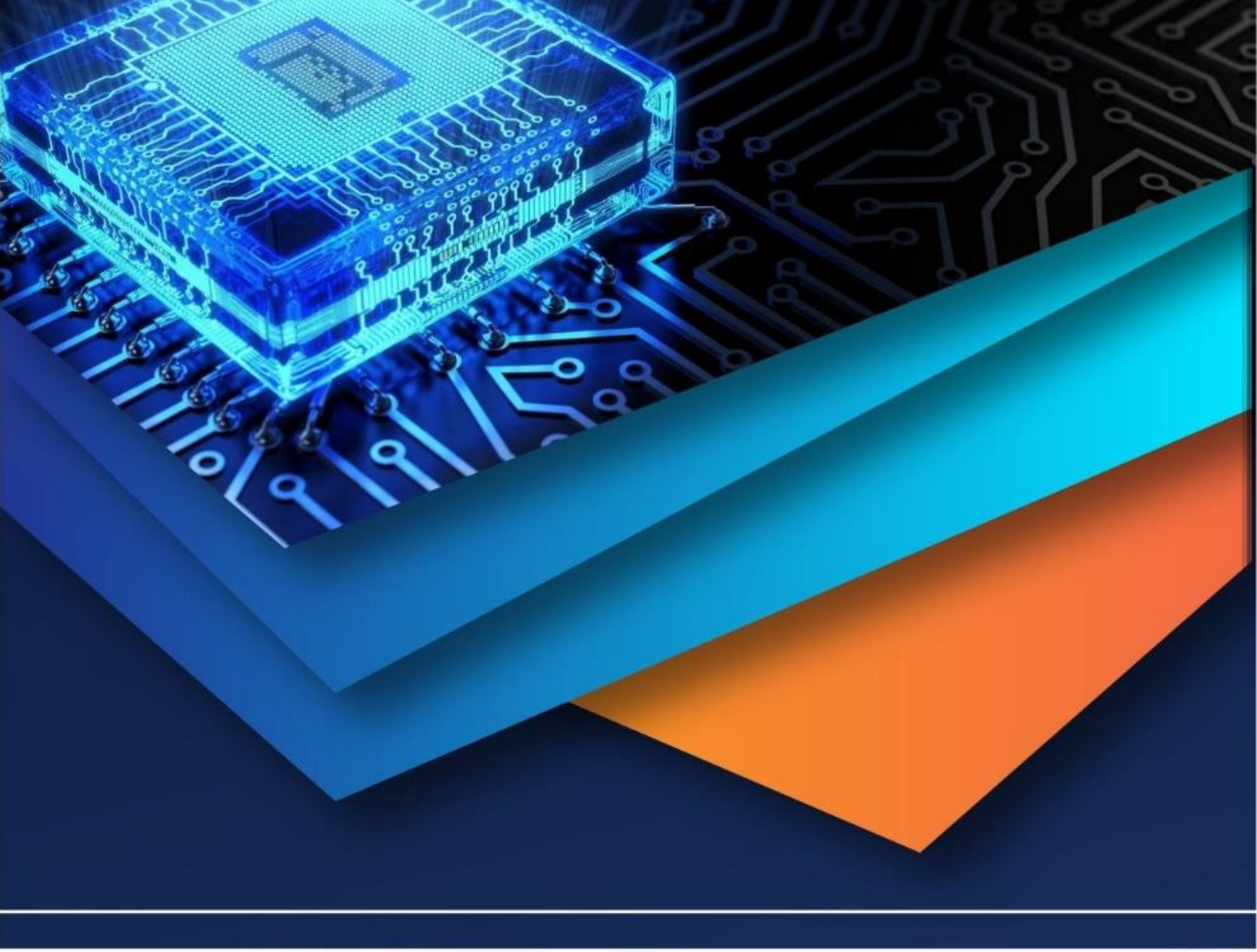
V. CONCLUSION

In this research work the vetiver extract of 15% concentration has been treated over 100% cotton woven textile fabric of 300 GSM. Functional component from the extract was done through aqueous method and solvent extraction method. Coating over the fabric surface was done though pad dry and patch method and SEM analysis were done to understand the coating effectiveness on the fabric. FTIR study also done to analyze the chemical composition present in the side the vetiver power and finally zone inhabitation against the pathogen such as E.coli and S.aureus was studied through Agar Diffusion test. The ZOI for the both the mode of samples were reported as good. But compare with aqueous method solvent method of extraction produces better sustainability due to subsequent washes.

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