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A Comparative study on Antimicrobial Finish using Pisidium Guajava leaf Extraction on Cotton, Organic Cotton and Bamboo Fabrics

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Abstract- *Textiles are indispensable part of human life. Now a days; textile finishes not only enhance the feel and drape of fabrics but can also provide extraordinary hygienic properties like making it antimicrobial in nature. Nature has been a source of medicinal agents for thousands of years and an impressive number of modern drugs have been isolated from natural sources. Pisidium guajava (Guava) leaf family name is Myrtaceae. Leaf and bark extracts have in vitro antimicrobial activity mostly associated with flavonoids such as Morin glycosides, quercetin and quercetin glycosides. Antimicrobial activity of Pisidium guajava, studied from dried leaves.The chemical nature of the extract was determined and extractions of active substance from the leaves were done by using ethanol. The method of application of this herbal extract on cotton, organic cotton and bamboo fabrics using citric acid as cross-linking agent was processed in 80oC for 15 minutes with pH level 4.5. The antimicrobial activity of the finished cotton, organic cotton and bamboo fabrics based on optimized process parameters was assessed against bacteria that normally exist in the textile materials like Gram positive, Staphylococcus aureus and Gram negative, Escherichia coli by paper disc method and also fabrics evaluated objectively.*

Keywords: *Pisidium guajava, herbal extract, antimicrobial activity, optimized process*

I. INTRODUCTION

Textiles are indispensable part of human life. They are mainly to cover the human body for protection against all the adversities[1].Natural textile fibres are more susceptible to attack than synthetic fibres. At the same time human skin supports growth of bacteria, because of its metabolic side products such as acidic, basic perspirations and urine, although it is possible the most important barrier to prevent microorganisms entering the body[2].

Textile finishing is a diversified sector due to the processed raw materials, manufacturing technique and finalized products. Trends in fashion cause continuous changes in colouring and functional finishes [3].natural finishes comprises of those substances that are obtained from plants and animals. Natural finishes have many advantages such as non-toxic, non-irritant, biodegradable, cost effective, easy availability [4].

Moreover, in the present day world most of us are very conscious about our hygiene and cleanliness. Clothing and textile are a very suitable media for the growth of the micro-organisms. They can act as the carriers of some micro-organisms such as pathogenic bacteria, odour generating bacteria and mould fungi. Microbial poses danger to both living and non-living matters.

To overcome the above mentioned fact, here the study handles vital finishes with Pisidium guajava (Guava) leaf to improve antimicrobial activity, which helps in reducing the growth of microbes. Guava leaf finish is given to make the wearer feel cool and the

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finish plays significant role in anti-microbial activity. The following are the objectives of this study.

- To find out the availability of natural Herbal sources
- To optimize the parameters for finishing
- To treat cotton, organic cotton and bamboo fabric using Pisidium guajava (Guava) leaf extracts.
- To study the effect of natural anti-microbial finishes.
- To evaluate the finished samples

II. Methodology

A. Selection of Fabric Formation

The fabric forming process helps to determine the appearance and texture, the performance during use and care. The process often determines the name of the fabric. Hence, planned to select plain weave for fabrication. In view of all the facts, the selected 40's count 100% Cotton, Organic cotton and bamboo yarns were woven for the present study.

B. Selection of Weaving Structure

Plain weave is the simplest form of weaving. It consists of interlacement of warp and weft up and down the entire width of the fabric. Plain weave fabrics are usually reversible and are stronger than the other basic weaves because each thread in each series of yarn supports the consecutive thread of other series.

C. Pretreatment of Fabric

Pre-treatment improves wet ability of fabrics thereby facilitates uniform finishing. The aim of preparatory process is the first step towards quality, which removes the starch, natural impurities and natural yellowish grey coloring matter present in fabric and modifies the fabric for follow up process.

D. Selection of Finishing

Natural finishing has become a part of human life since the time immemorial. India has a rich cultural heritage and the tradition of using finishes obtained from natural sources. There is an increasing realization in the textile industry as well as among the textile consumers to develop and demand eco-friendly methods of finishing textiles.

E. Selection of Natural Source

The present investigation aims at developing an ecofriendly natural antimicrobial finish from an herbal plant of India The guava plant is found to be present in the tropical region and it occurs along the road sides. The leaves were collected in and around the Erode. The collected leaves were shadow dried for one week, and then it was powdered. It was stored in the container box.

Plant name : *Guava(English)*
Family : Mytraceae
Scientific name : Pisidium guajava

F. Pilot Study

Pilot study is preliminary study conducted in a limited scale before the large scale are carried out in order to gain some primary information, on the basis of which the main study would be planned and formulated [5].A pilot study was carried out in direct water soluble method and methanol extraction method in order to select material, optimize the selected herbs, binder, extraction time, temperature and application techniques.

G. Extraction Method

Ethanol is one of the largest volume organic solvents, produced by the fermentation process all over the world. The demand for ethanol has increased in recent years as it is widely used in chemicals, potable industries, medicine and motor fuel[6].The air dried Pisidium guajava leaves were made in to powder form, 100g of the powder was extracted with 500ml of ethanol (analytically grade). The mixture was allowed to stand for 24 hours.The mixtures was now filtered and evaporated carefully and the regulated water bath was maintained at the temperature of 80°c to yield to deep green semi-solid extract weighing 7.5gms. It was stored in a refrigerator at

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4°c. The extraction can be carried out from natural finishing agent by aqueous, alkaline and acidic or alcoholic method. Among these alkaline extractions shows good result.

H. Optimization of Antimicrobial Finish

From Table -I it was clear that herbal extraction solution is mixed with water and one per cent citric acid was added. The temperature was maintained at 80°C for 15 minutes with pH level 4.5. Thus the parameters were selected for the study.

Table I Optimization of Parameters

S. NO.	CRITERIA	PILOT STUDY	SELECTED PARAMETERS
1.	Herbal solution	50, 75 and 100 per cent	100 per cent
2.	Citric acid	7:3,8:2,9:1	9:1
3.	Time	10,15 ,20 minutes	15 minutes
4.	Temperature	70^0c,80°c,90^0c	80°c
5.	pH	4-8	4.5

I. Finishing

The durability of the finish can be enhanced when the herbal extracts of guava leaves are applied on cotton, organic cotton and bamboo fabrics. The fabrics were finished with the optimized solution for 15 minutes at 80°c by pad-dry-cure method. The treated samples were cured in room temperature and dried in shade [7].

J. Evaluation

Objective evaluation includes laboratory tests like mechanical property test, physical property, comfort property, absorbency and antimicrobial tests.

K. Nomenclature

The nomenclature used for various samples are given in table II.

Table II Nomenclature

S.NO	SAMPLE	NOMENCLATURE
1.	GC	Grey Cotton
2.	FC	Finished cotton
3.	GOC	Grey Organic cotton
4.	FOC	Finished Organic cotton
5.	GB	Grey Bamboo
6.	FB	Finished Bamboo

III. Results and Discussion

A. Objective Evaluation Test for Physical Property: Fabric weight

The Table III reveals that the fabric weight of finished Organic cotton sample has maximum weight increased up to 13 per cent when compared with other samples. It was clearly shown that the difference between the grey and finished samples was significant at one per cent level.Thus, it was concluded that the fabric weight increased after finishing because of the fixation of the finishing agent on the fabric.

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Table III Analysis of variance of fabric weight

S.No.	Samples	Mean value in (mg)	Gain or loss over original weight	Percentage of gain or loss over original weight	'f' ratio
1.	GC	122.6	2.6	2.12	784.5862 **
	FC	125.2			
2.	GOC	80.4	11	13.68	
	FOC	91.4			
3.	GB	115.2	0.4	0.3472	
	FB	115.6			

**Significant at one per cent level

B. Test for Mechanical Property Tensile Strength

From the Table IV it was that the tensile strength of the finished cotton sample was increased by 7.253 per cent along warp direction when compared with other samples. It was clear that the difference between the grey and finished samples was significant at one per cent level. Thus, it was concluded that the fabric strength increased after finishing. The tensile strength in the finished cotton sample was increased by 4.938 per cent in weft direction, when compared with other samples. From the table, it was clear that the difference between the grey and finished samples has one per cent significant level. Thus, it was concluded that the fabric strength is increased after finishing in weft side of the fabric. It shows deposit of the finishing agent.

Table IV Analysis of variance of fabric tensile strengh

S.No.	Samples	Mean value in kg		Gain or loss over original		Percentage of gain or loss over original		'f' ratio	
		Warp	Weft	Warp	Weft	Warp	Weft	Warp	Weft
1	GC FC	38.6 41.4	48.6 51.0	2.8	2.4	7.258	4.938	29.7391**	35.6296 **
2	GOC FOC	34.2 35.4	45.2 46.2	1.2	1	3.508	2.212		
3	GB FB	37.6 39.0	48 50	1.4	2	3.723	4.166		

**Significant at one per cent level

C. Comfort Property FABRIC Drapability

The Table V reveals that the drapability of finished samples is 37.83 per cent gain in finished Bamboo sample, when compared with other samples. In table the original and finished sample was compared statistically. The statistical analysis showed significant at one per cent level. Thus, it can be concluded that drapability of these three materials increased after finishing, because of the evenness of finishing agent in to the fabric.

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Table-V Analysis of variance of drapability

S.No.	Samples	Mean value	Gain or loss over original	Percentage of gain or loss over original	'f' ratio
1	GC FC	0.49 0.58	0.09	18.36	83.3801 **
2	GOC FOC	0.51 0.68	0.17	33.33	
3	GB FB	0.37 0.51	0.14	37.83	

**Significant at one per cent level

D. TEST FOR ABSORBENCY CAPILLARY TEST

The difference between the original and finished sample for capillary rise test was given in Table VI.

Table VI reveals that the capillary test of the finished cotton sample shows 42.48 when compared with other sample. Especially the finished Organic cotton was more absorbed in the length of fabric when compared with Grey Organic cotton. From the table it is clear that the difference between the original and finished sample shows significant at one per cent level. Thus it can be concluded that the capillary test of these three materials increased after finishing, because of the application of finishing.

Table-VI Analysis of variance of capillary test

S.No.	Samples	Mean value	Gain or loss over original	Percentage of gain or loss over original	'f' ratio
1.	GC FC	3.06 4.36	1.3	42.48	74.5175 **
2.	GOC FOC	4.10 5.32	1.22	29.75	
3.	GB FB	2.80 3.64	0.84	30	

**Significant at one per cent level

E. Antimicrobial Test

From the Table VII, it is clear that the finished Modal fabric has maximum effect when compared with other samples. Regarding these effects is minimum effect in the finished cotton fabric.

Table – VII Antimicrobial activity of cotton, organic cotton and bamboo fabrics

S.No.	Organism samples	Number of colonies x 10^5 / ml		
		Finished cotton 100%	Finished Organic cotton 100%	Finished bamboo 100%
1.	E.coli	112	41	68
2.	Staphylococcus aureus	98	25	52

Inoculums size: 1 x 10^6 colonies / ml

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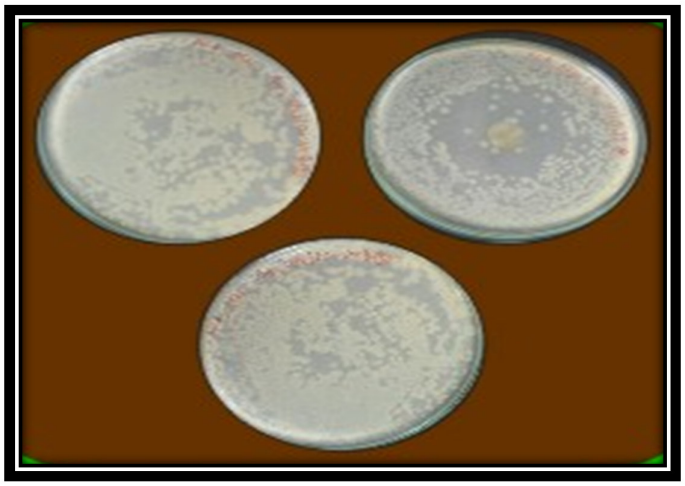

Fig 1-Antimicrobial activity of guava leaf extraction.

IV. Conclusion

Pisidium Guajava is a natural plant source. It is non toxic, non allergic, biodegradable, cost effective and easily available material. It will not cause any harm to humans even from infants to pregnant women. It smells pleasant and is non irritant to human beings.Guava leaf extract has been found to possess antimicrobial character due to the presence of chemical components. The active substance was extracted from the plant leaves using ethanol. The method of application of this active substance on cotton,organic cotton and bamboo fabrics using citric acid as cross linking agent by padding mangle method. The anti microbial assessment was carried out by using standard paper disc method.. From the research it is be found that there is a good anti microbial property in organic cotton fabric after it has been finished, when compared to cotton and bamboo. guava leaves shows better anti microbial activity on both s.aureus and E.coli. Hence, the scope of implementation and commercialization of the herbal extract as an antimicrobial finish in textile is a novel idea.. The finished samples increased in fabric weight, fabric strength, drapability and capillary test. Samples decrease in fabric elongation and abrasion resistance.

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