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Short Communication

Ecofriendly Finishing of Fabric with Jatropha Curcas Leaves

Babel Sudha, Mogra Dolly, Rajvanshi Rupali, Agrawal Neha and Sharma Sangeeta
Deptt of Textiles and Apparel Designing, College of Home Science, MPUAT, Udaipur, INDIA

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Abstract

Earlier researchers have reported antibacterial activity of different specific parts, but none of the reports shows the phytochemical analysis of leaf extract for finishing of fabric. The Objective of present study was find out the phytochemical analysis of Jatropha curcas leaves and to investigate antimicrobial activity. The dried plant powder was subjected to extraction with ethanol 70 per cent, methanol 70 per cent, chloroform 100 per cent, acetone 100 per cent and aqueous solution. These solvent extracts were subjected to a preliminary phytochemical screening to detect the different chemical principles present viz., glycosides, alkaloids, flavonoids, tannins and phenolic compounds. Antimicrobial activity was evaluated by Agar diffusion method. The phytochemical analysis showed the presence of alkaloid, saponin, tanins, terpenoids, steroids, glycosides, phenols and flavonoids. The antimicrobial activity showed by Jatropha curcas leaves was due to the presence of phytochemicals.

Keywords: Jatropha curcas leaves, Ecofriendly finishing, Photochemical screening.

Introduction

industry continuously searches for new technologies in order to accomplish the consumers´ demands. Especially in recent years, new developments allowed the production of functional and smart textiles which are capable of sensing changes in environmental conditions or body functions and responding to these changes. Likewise, consumers' attitude towards hygiene and active lifestyle has created a rapidly increasing market for a wide range of textile products finished with antimicrobial properties, which in turn has stimulated intensive research and development. There is a measureless resource of natural antimicrobial peptides which can be exploited for imparting antimicrobial properties to textile substrates. The main advantage of antimicrobial substances is that they are small molecules that can be impregnated or covalently bound to textiles in a very effective and homogeneous deposition.

The latex of Jatropha curcas contains an alkaloid known as "jatrophine" which is believed to have anti-cancerous properties. Commercially non-edible vegetable oil used as bio-diesel, some countries use Jatropha curcas oil to manufacture soaps, bark of Jatropha curcas is utilized to make dark blue dye for clothing, fishing nets and lines, leaves are used for fumigating bed bugs. Uses of Jatropha curcas curcas are well known but use of Jatropha curcas curcas leaves extract for finishing the fabric is new concept, which is eco friendly not yet explored. At present, little has been reported of its use in textiles as an antimicrobial agent The objective of present investigation is to find out the phytochemical constituent of Jatropha curcas curcas and to apply its extract on cotton fabric for its finishing, to study the total bacterial count and total microbes count after finishing the fabric.

Material and methods

Selection of plant:- A local plant Jatropha curcas were selected on the basis of their medicinal properties against as reported in various literatures.

Collection of plant materials: Jatropha curcas leaves were collection from local area of Udaipur India.

Preparation of plant extract: Plant material was kept for drying for about two weeks, away from direct sunlight below 45c (shade dried). The dried material was crushed in an electric grinder to coarse powder consistency, about 500 gm. The powder material was uniformly stored into an air tight container.

Sample extraction for photochemical screening: Powdered of the Jatropha curcas leaves were weighted 2 gm. each into five containers labeled Ethanol 70 per cent , Methanol 70 per cent, chloroform 100 per cent, Acetone per cent and aqueous solution 100 per cent, respectively for leaves, the solution amount were taken 25 ml. The mixture was left for 24 hours in incubation. After 24 hours the extract was centrifuged and amount of extract was measured. The residual extract was subsequently mixed with 25 ml. of the respective solvent and process repeated for the next 24 hr., after the whole procedure the final extract obtained and filtered with whatman filter paper. The final extract was stored in refrigerator with labeled.

Phytochemical Screening: The extract were tested for the presence of same active chemical compounds such as alkolides , flavanoids, phenolic, tenins, sponins and terpenoids. The analysis was conducted as per universal methods.

Alkolides: A few drops of Mayer reagent was added to 2 or 3 ml. of extract solution in the test tube, the appearance of cream or yellow properties indicated presence of alkaloid.

Flavanoids: the following tests were carried out to assess the process of flavonoids:

Amonia test: Extract was taken in test tube and added the ammonia solution. Appearance of yellow colouration indicated positive result.

Sodium hydroxide test: few drops of 20% NaOH solution was added in extract. The development of yellow color which on addition of hydrochloric acid changed to colourless solution depicts the presence of flavonoids.

Phenolic compounds and tannins: A small quantity of extract was treated with following reagent to test the presence of phenolic compounds and tannins. i. 5% ferric chloride reagent – Dark green colour, ii. 10% lead acetate reagent- Bulky, white precipitate

Saponins: Foam test: In test compounds distilled water was added. The solution was shaked well produced high amount of foam which indicated the presence of the saponins.

Glycosides: extract a sample was dissolved in 1 ml. water and then aqueous sodium hydroxide was added. Formation of a yellow colour indicated the presence of glycosides.

These classes (alkaloids, saponins, tannins, alkaloids and flavonoids) of compounds are known to have activity against several pathogens and therefore aid the antimicrobial activities of J. curcas and suggest their traditional use for the treatment of various illness.

Herbal finishing of cotton fabric for antimicrobial process with Jatropha curcas: Experiment: Chemicals: NaOH.LR, $Na\,CO_3$. LR, H_2O_2, distilled water, $CuSo_4$, $K_2Cr_2O_7$ and acetone LR are the main chemicals used for the experiment.

Preparation of grey cotton fabric: Desizing: the grey cotton fabric was desized with alkali and soap solution. In same bath scouring was also done. The bath composition for desizing and scouring process is as follows: NaOH- 2 g/l, Na_2CO_3- 2 g/l, Soap- 1g/l, Weight of grey fabric- 1 gm., Time for heating- 1 hour, Temperature of the bath – 100˚C

The fabric after desizing and scouring is swilled with water until all alkali and soap is removed.

Bleaching- The post treated fabric bleached with suitable bleaching agent to get a white fabric. The composition of the bleaching bath is given below with experimental conditions: Na_2SiO_3 – 2g/l, NaOH – 2 g/l, Na_2CO_3 – 2g/l, H_2O_2 – 12 ml/l, Weight of grey fabric – 5 gm., Time bleaching – 1 hr., Temperature of the bath- 80˚C

The scoured cotton fabric is bleached with H_2O_2 so as to obtain a clean fabric free from all impurities.

Preparation of Jatropha Curcas extract:- Jatropha Curcas leaves dried and is powdered to get dried powder. This is made into a paste with water. To this paste 10% acetone was added. The solution was diluted and filtered to get a clear filtrate free from residues. A fixing agent like $CuSO_4$ or $K_2Cr_2O_7$ was added and the whole solution was stirred well. In order to get a clear solution. Now this solution is ready for fixing the organic compounds to the fibre. The composition of the finishing bath is as follows: Weight of the fabric- 5 gm., Concentration of the Jatropha Curcas leave Extract- 1.25%, Acetone- 5%, Copper Sulphate (mordant)- .05%

Table-1
Qualitative determination of active ingredients in crude extract of Jatropha curcas leaves

Phytochemical constituents		Methanol	Ethanol	Chloroform	Acetone	Aqueous
Flavo noids	Ammonia test	+	+	-	+++	++
	NaoH test	+	+	++	-	+++
Alkaloids		+++	+++	-	++	+
Glycosides		+	+	-	++	+++
Steroids		+	-	-	++	+
Phenols		+	++	-	++	++
Terpenoids		+++	-	-	+++	++
Saponins		-	-	-	+++	++
Tannins	1.$Fecl_3$ test	+	++	-	++	+
	Lead acetate	+++	++	+	+	++
Cardiac glycosides		-	-	+	-	+

+++ Highly present, ++ Moderately Present, +present – Absent

Table-2
Total Microbes count (TMC) and Total Bactria count (TBC) of controlled and Jatropha curcas leaves extract treated fabric

Source/ Count	TMC				TBC			
	Methanol	Ethanol	Acetone	Chloroform	Methanol	Ethanol	Acetone	Chloroform
Control	1300				4			
Jatropha curcas	3	426	30	3	2	2	2	2

Finishing Process: The Jatropha Curcas leaves extract of 20% concentration to which 1% $CuSO_4$ is added and the solution stirred well so that the added blue vitriol dissolved well. The finished cotton fabric was dipped in this extract and after an hour the material was taken out of the bath washed and dried.

Determination of antimicrobial activity by using agar plate: Potato Dextrose agar was prepared and sterilized at 121˚ C for 15 minutes. Petri plates were autoclaved in hot air oven at 121˚C for 45 minutes. 1x2 cm fabric sample treated with leaves extract and five treated fiber strands of 2 cm were placed in Petri plates. Various test procedures used to test the effectiveness of the antibacterial activity, to evaluate antibacterial fabrics, to protect users and textile against action of antibacterial compounds. Bactria used staphylococcus aureus (Gram positive), Marking was properly done on Petri plate covers to avoid confusion while taking observations. After that 20 ml of potato Dextrose agar was poured into each of these plates and were allowed to solidify. The plates were incubated at 30 ˚C for 70 hours. Similar procedure was carried out for untreated sample of fabric and fiber also. Petri plates were covered, marked and placed in upside down position. After 70 hours observations were compared. This process was repeated five times for accuracy and average colony count is mentioned in table no. 2 for fabric and fiber samples.

Results and Discussion

It is depicted in table that treated samples with Jatropha curcas leaves extract provide less favorable conditions for Microbes and Bacteria growth than Controlled sample. Among the various extract treated fabric Ethanol treated fabric showed more microbial growth than other fabric. The above table clearly indicates that Jatropha curcas leaves extract finished fabric showed less microbial and bacterial count as compared to controlled sample.

Hence it is concluded that Jatropha Curcas leaf, could be a potential source of active antimicrobial agents, and a detailed assessment of its antimicrobial activity towards gram positive and gram negative bacteria is need of time

Conclusion

An ecofriendly natural antibacterial finish can be prepared from the plant extract of Jatropha Curcus for textile application. Herbal extracts from Jatropha Curcas has been applied to cotton fabric by the method of direct application. All the treatments show good antibacterial properties for the fabric. The plant contain compounds like phenolic, terpenoids, flavonoids, alkaloids, glycosides, steroids, tannin, etc. which are acting as antibacterial. Some of them act as bactericides and some act as bacteriostatic. It can be concluded that Jatropha Curcas leaf extract treated fabric show considerable zone of inhibition, this indicates that these herbal extracts act as bactericides as well as bacteriostate.

Since Jatropha leaf are abundantly available in Rajasthan especially in Udaipur region, the scope of implementation and commercialization of herbal extract to impart antibacterial finish in textile is high. Finally, since the raw material is 100% from natural resources, it is ecofriendly having economic, social and environmental benefits.

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