RESEARCH PAPER:

Effect of neem as an eco-friendly antimicrobial finishing agent on naturally dyed and hand woven carpets

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SUMMARY

In today's era of eco-friendly operations, it is necessary that chemicals used for finishing must be biodegradable and nontoxic to the manufacturer, user and the environment. The natural products inhibit or destroy pathogens without toxic impact on the host cells and hence there is an exciting opportunity for the use of such antimicrobial finishes to clothing and to textiles. The study revealed that, more than 2.0 mm inhibition zone was observed in all treated yarns at 10 gpl concentration of neem for *Staphylococcus aureus* Gram +ve bacterium. The untreated samples of yarns showed more growth of *E.coli.* Highly significant difference at 1 per cent level of significance was found between the treatments and also between the different types of yarns for antimicrobial test for the growth of *Staphylococcus aureus* and *E.coli* bacteriae.

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Key Words :
Eco-friendly, Gram +ve, Gram –ve, Treatments, Antimicrobial activities

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Using plant products as antimicrobial agents is an ancient idea. The relatively lower incidence of adverse reactions of herbal products as compared to modern synthetic pharmaceuticals, coupled with their reduced cost, can be exploited as an attractive eco-friendly alternative to synthetic antimicrobial agents for textile applications (Joshi, *et al.,* 2009). In today's era of eco-friendly operations, it is necessary that these finishes be biodegradable and nontoxic to the manufacturer, user and the environment. Natural herbal products can be used for antimicrobial finishes, as there is a tremendous source of medicinal plants with antimicrobial composition. These natural products inhibit or destroy pathogens without toxic impact on the host cells and hence there is an exciting opportunity for the use of such antimicrobial finishes to clothing and to textiles. Besides adding charm and grace to the floor, the carpet should exude a sense of warmth and character and not just become another appendage to the furniture.

Hygiene has acquired importance in recent years. Consumers are looking for solutions to odour and microbial problem and the unique benefits provided by antimicrobial finish (Gopalkrishnan, 2006).The greater incidence and awareness of allergy related complaints have stimulated interest in household textiles and furnishings, which minimize exposure to possible aggravating agents such as dust, mites, water and oil etc. This has stimulated an all-round protection of textiles against microbial infestation and the effects of dirt, water and/or oil.

The neem tree has been venerated through the ages in the Indian countryside as it provided hope in any situation and the faith in the miraculous healing powers of this amazing tree led patients with incurable diseases to adopt neem as way of life. The most important quality of neem compound is that it is less toxic to warm blooded animals like human beings. Thus, considering its less toxicity and effectiveness against micro-organism, neem is expected to be one of the safest and most effective colourant and antimicrobial agents for finishing of textiles. Hence, the study on effect of neem as antimicrobial finishing agent on naturally dyed carpet yarns was taken up.

EXPERIMENTAL METHODOLOGY

Collection of neem seeds :

There are many natural sources which can be used as anti-microbial finishing agents. *Aloe vera* gel, turmeric powder, tulsi leaves extract, azuki beans, prickly chaff leaves extract, neem leaves and seeds and many more natural dyes possess antimicrobial property. The neem seeds are easily available, very cheap source and cost effective when compared to other sources. Neem seeds had less toxicity and their extract did not change the colour of the dyed yarns. It is one of the highest and richest sources containing concentrated active compounds. Hence, a good quality neem seeds *(Azadirachta indica)* were collected from Krishi Vigyan Kendra, Bidar, Karnataka for the purpose of research work.

Preparation of the neem seed extract:

Neem seed extracts are most widely used in various industries. It is one of the highest and richest source containing concentrated active compounds. Neem seeds undergo different extraction methods depending on their use and the active principle or chemical compound required. Neem seeds were extracted by aqueous extraction method.

The neem seeds were crushed or powdered and soaked in cold water with 1: 10 MLR ratio for 12-14 hours. The solution was boiled for an hour and filtered twice using clean muslin cloth and was further diluted as per the requirement (Purwar, *et al.* 2008).

Optimization and treating the carpet yarns with neem seed extract:

The carpet yarns dyed with natural dyes were dipped in 2, 4, 6, 8 and in 10 per cent of the neem solution (by wt. of yarn) and kept for 24 hours in the solution. The yarns were removed from the solution, squeezed and dried in shade. This was carried out to ascertain the optimum percentage of neem extract.

EXPERIMENTAL FINDINGS AND DISCUSSION

The carpet yarns were treated with neem seed extract at 2gpl and 4gpl also but it was seen that there was growth of gram +ve and gram -ve bacterium around the treated yarns. The inhibition zone was seen after treatment with 6gpl concentration. Hence, the reading for 6, 8 and 10 gpl are furnished below:

Detailed description of Table 1 shows that, in all untreated samples a profuse growth of *Staphylococcus aureus* was seen in and around the yarns. At lower concentrations *i.e.* 6 gpl jute yarns showed very less inhibition zone as compared to other yarns. Naturally coloured cotton and sisal yarns showed good inhibition zone even at lesser concentration of neem. At 8 gpl concentration of neem there was a slight increase in inhibition zone exhibited by all treated yarns. At higher concentration of neem seed extract *i.e.* at 10 gpl, jute yarns showed 2.0 mm inhibition zone, naturally coloured cotton yarn 3.5 mm, sisal and dyed cotton yarns 3.0 mm inhibition zone. Whereas, banana yarns showed inhibition zone of 2.5 mm. An inhibition zone of more than 2.0 mm indicated good antimicrobial effect (Aggarwal *et al.,* 2007).

More than 2.0 mm inhibition zone was observed in all treated yarns at 10.0 gpl concentration of neem for *Staphylococcus aureus* Gram +ve bacterium. Neem seed extract has been recognized as one of the most promising sources of compounds with insect control, antimicrobial and medicinal properties (Singh *et al.,* 1996).

The test for analysis of variance showed that, highly significant difference at 1.0 per cent percent level of significance was found between the treatments and also between different types of yarns for antimicrobial test in case of *Staphylococcus aureus*.

Table 2 explains about the antimicrobial activity of neem seed extract finished yarns against *Escheria coli* Gram –ve bacterium. The untreated samples of yarns showed more growth of *E.coli*. Naturally coloured cotton yarn showed good inhibition zone of 3.1 mm, sisal 2.4

Table 1 : Antimicrobial activity of neem seed extract finished yarns against *Staphylococcus aureus* (gram +ve) bacterium

Sr. No.	Sample	Neem seed extract concentration(gpl)		
		6	8	10
1.	Control (without treatment)	Profuse growth	Profuse growth	Profuse growth
2.	Treated cotton yarn	2.4	2.6	3.0
3.	Treated naturally coloured cotton yarn	3.0	3.0	3.5
4.	Treated jute yarn	1.5	1.8	2.0
5.	Treated banana yarn	2.2	2.3	2.5
6.	Treated sisal yarn	2.6	2.7	3.0

Table 2 : Antimicrobial activity of neem seed extract finished yarns against *Escherichia coli* (gram -ve) bacterium

Sr. No.	Sample	Neem seed extract concentration (gpl)		
		6	8	10
1.	Control(without treatment)	Profuse growth	Profuse growth	Profuse growth
2.	Treated cotton yarn	2.2	2.8	3.2
3.	Treated naturally coloured cotton yarn	3.1	3.4	3.7
4.	Treated jute yarn	1.5	1.9	2.1
5.	Traeated banana yarn	2.1	2.1	2.4
6.	Treated sisal yarn	2.4	2.6	2.9

mm even at lesser concentration. At 8 gpl concentration, it was noticed that jute and sisal yarns showed slight increase in inhibition zone. No change was noticed in banana yarn. Whereas, dyed cotton and naturally coloured cotton yarn showed greater increase in inhibition zone.

At higher concentration *i.e.* 10.0 gpl highest inhibition was showed by naturally coloured cotton (3.7 mm) followed by cotton (3.2 mm) and sisal (2.9 mm). Jute yarn showed very less inhibition (2.1 mm) among all the yarns. The antimicrobial activity was due to the presence of most important limonoids azadirachtin, salanin and nimbin. The neem extracts have been therefore widely used in herbal pesticide formulation because of its pest repellent properties and has a potential to inhibit growth of bacteria both Gram positive and Gram negative (Schmutter, 1995).

At 1.0 per cent level of significance, the test for analysis of variance showed that highly significant difference was found between the treatments and also between the different types of yarns for antimicrobial test for growth of *E.coli.*

Conclusion:

In all untreated samples, a profuse growth of *Staphylococcus aureus* was seen in and around the yarns. Naturally coloured cotton and sisal yarns showed good inhibition even at lesser concentration of neem. More than 2.0 mm inhibition zone was observed in all treated yarns at 10 gpl concentration of neem for *Staphylococcus aureus* Gram +ve bacterium. The untreated samples of yarns showed more growth of *E.coli.* Naturally coloured cotton yarn showed good inhibition zone of 3.1 mm, sisal 2.4 mm even at lesser concentration. At higher concentration *i.e.* 10 gpl highest inhibition was showed by naturally coloured cotton (3.7 mm) followed by cotton (3.2 mm) and sisal (2.9 mm). Jute yarn showed very less inhibition (2.1 mm) among all the yarns. Highly significant difference at 1 per cent level of significance was found between the treatments and also between the different types of yarns for antimicrobial test for the growth of *Staphylococcus aureus* and *E.coli* bacterium.

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