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Research Article

Corynebacterium inhibiting *P.grandis* based herbal textile

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Abstract: Antimicrobial finishes have increased its importance in the recent years for several reasons necessitating this research work. Herbal extracts are promising in antimicrobial activity without much side effects. Hence the aim of this work was focused on fabricating antimicrobial textile finishes with antibacterial activity against *Corynebacterium* a common sweat - bacterium posing bad odour and skin problems. Solvent extracts of *P.grandis* coated onto to cotton cloth samples by sonication method were tested for anti- corynebacterium activity by disc diffusion method according to AATCC 147 method. Good antibacterial activity was noted since there was no growth under and above the fabric samples. The leaching of extracts was also not noted as there was no zone of inhibition around the test samples. These results throw open the scope of developing newer antimicrobial herbal textile finishes.

Keywords: *Pisonia grandis, cornyebacterium,* medical textiles, zone of inhibition, antimicrobial

Introduction: The bacterial infections are the world"s leading killing diseases. In recent years drug resistance to human pathogenic bacteria has been commonly reported all over the world. The situation is alarming in both developing as well as developed countries due to indiscriminable use of antibiotics. The present scenario of emergence of multiple drug resistance to human pathogenic microorganisms has necessitated a search for antimicrobial substances from other sources including plants. The quest for a solution to the global problems of antibiotic resistance in pathogenic bacteria has been focused on the isolation and characterization of new antimicrobial compounds.

One of the common problems noted in all age groups is sweating during all seasons. Sweat produces many adverse effects. The bacteria on our skin mix with the sweat and give it a stinky smell. Heavy sweating produces the warmth and moisture in which many bacteria survive. The average person has 2-4 million glands, which secrete colourless liquid that rises to the surface of the skin and evaporates. This process cools the skin to regulate the body"s temperature. Body odour is influenced by the actions of the skin flora, including members of *Corynebacterium,* which manufacture enzymes called lipases that break down the lipids in sweat to create smaller molecules like butyric acid. These smaller molecules smell and give body odour its characteristic aroma. The sweat–eating *Corynebacterium, a* regular skin flora, often found in the armpit is known to cause acne and related skin problems (**Haustein, 1993**).

Bacteria and fungi are microbes that can grow on cloths. Microbial growth, especially bacteria, in cloth materials can result in the deterioration of fabric properties, development of foul smells, skin irritation and cross infections. Some of the functions of antimicrobial finishes include: avoiding cross infection by pathogenic microorganisms, control of infestation by microbes, arresting metabolism in microbes to reduce the odour formation and to safeguard the cloths from staining, discoloration and quality deterioration.

The application of antimicrobial textile finishes includes a wide range of textile products. Fungi, molds or mildew are complex organisms with slow growth rate. They stain the fabric and deteriorate the performance properties of the fabrics. So to make the environment healthy, hygienic and fresh, it becomes very important to have the control over growth of the microbes. Antimicrobial finishes have increased its importance in the recent years for several reasons (**Schindler and Hauser, 2004**). Hence this research work was focused on fabricating antimicrobial textile finishes with particular focus on *Corynebacterium.*

Herbal extracts are promising in antimicrobial activity without much side effects. In this context *P.grandis,* a commonly available ornamental plant was taken up for fabricating antimicrobial cotton cloth. Extracts of *Pisonia grandis* are reported to have appreciable antibacterial activity (**Jayakumari et al, 2014**). Also our earlier work (**Shubashini et al, 2011**) reports the rich presence of allantoin, a proven moisturizer, antifungal and anti-inflammatory (**Kumar et al, 2014**) molecule in the ethanol extracts of *P.grandis.* Hence the solvent extracts of this plant were taken up for study.

Materials and Methods

Collection of plant material

Leaves of *Pisonia grandis* were collected from residential areas in and around Coimbatore. The leaves were washed well and dried under shade at room temperature.

Extract preparation

A weighed amount of the leaves (100g) was extracted with 300 ml ethanol for six hours, filtered and vacuum concentrated to yield a residue. Similarly 100g of leaves was refluxed with water and the procedure repeated as above to yield aqueous extract. These extracts were dried and refrigerated at 4ºC for further use.

Soundwave- assisted fabrication of cotton cloth with solvent extracts of *Pisonia grandis*

The white cotton cloth material was given a primary wash with millipore water, air-dried and then used for finishing and coating with the test substances. The cloth materials (4.5 x 3.3 mm) were coated with the standard ciproflaxin, ethanol and aqueous extracts of *Pisonia grandis* respectively by sonication using ultrasonic bath for 1 hour. The fabricated samples were washed to remove the slack residue of extract on the fabric. The coated fabrics were dried and weighed. The difference in weight of the fabric before and after coating gives the amount of extracts and standard antibacterial molecule coated onto the fabric.

The samples were then tested for their antibacterial activity against *Corynebacterium*, a bacteria normally present in human sweat. Disc diffusion method was employed and AATCC 147 method (**Geethadevi and Maheshwari, 2013**) was used in critiquing the antibacterial nature of the fabricated samples.

Evaluation of antibacterial activity-Disc diffusion method

Inoculum preparation

The inoculums for the experiment were prepared in fresh nutrient broth from preserved slant culture. The inoculums were standardized by adjusting the turbidity of the culture to that of McFarland standards. The turbidity of the culture was adjusted by further incubation to get required turbidity.

Preparation of sterile swabs

Cotton wool swab on wooden applicator were prepared and sterilized by autoclaving the swabs packed in culture tubes.

Sterilization of forceps

Forceps were sterilized by dipping in alcohol and burning off the alcohol.

Experiment

The standardized inoculums were inoculated in the plates prepared earlier (aseptically) by dipping a sterile in the inoculums removing the excess of inoculums by pressing and rotating the swab firmly against the side of the culture tube above the level of the liquid and finally streaking the swab all over the surface of the medium 3 times rotating the plate through an angle of 60º C after each application. The swab was then passed round the edge of the agar surface. The inoculums were left to dry at room temperature with the lid closed.

Each Petri dish was divided into 2 quadrants, with one quadrant for the cloth material or the perspiration pads and one quadrant for the standard ciprofloxacin. The discs were placed using sterile forceps. Petri dishes were placed at room temperature for 1 hour for diffusion. The plates were then incubated at 37 º C for 24 hours. The zone of inhibition produced by leached substance was measured. According to AATCC 147 method, unleached samples do not give zone of inhibition but no growth should be observed above and below the sample cloth and perspiration pads.

Results and Discussion

Cotton cloth was coated with ethanol and aqueous extract of *Pisonia grandis* by sonication. The amount of extract coated onto the fabric materials in the three methods are tabulated (**Table 1**). Ciprofloxacin was used as a standard and was coated onto the cotton cloth by the same procedure when 3. 76 mg of the standard was coated onto the cloth after washing. The fabricated cotton cloth was tested for anti-bacterial activity against *Corynebacterium*. The fabricated cotton cloth was placed on the surface of the Petri dish that has been inoculated with *Corynebacterium* and incubated for 24 hours. No bacterial growth was observed under and on the fabricated cloth (**Figure 1 and 2**). According to AATCC 147 method for a successful result, there should be no bacterial growth observed under and on the test sample. This test is very easy to assess with antimicrobials that leach, as a zone of inhibition. With antimicrobials that are fixed to the fabric, there is no zone of inhibition and no bacterial growth under the test sample. In the present study, there was no leaching of the extracts as was seen from the absence of zone of inhibition. Good antibacterial activity was noted since there was no growth in all the fabric samples, suggesting the successfulness of the study. In the case of standard, there was leaching of ciprofloxacin which was noted by the zone of inhibition (23mm) around the cloth samples.

Table 1. Weight of the extracts and standard coated over the cloth

S.No	Weight of the cloth before coating with extract (g)	Weight of the cloth after coating with extract (g)	Weight of the cloth after washing (g)	Weight of the substance on the cloth (mg)
PGAQ	0.14902	0.16102	0.16098	11.96
PGEtOH	0.17800	0.1938	0.1929	14.90
Standard Ciproflaxin	0.14578	0.14974	0.14954	3.76

Figure1. Antimicrobial activity of PGEtOH against Corynebacterium

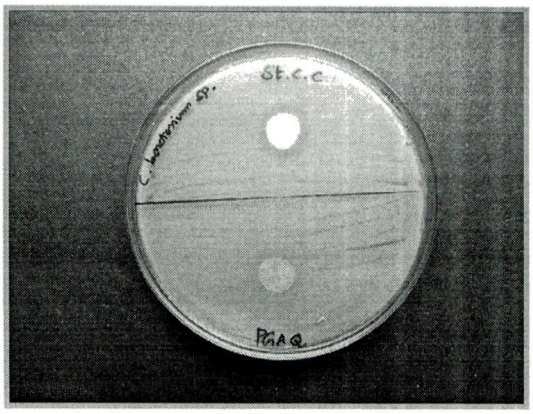

Figure 2. Antimicrobial activity of PGAQ against Corynebacterium

Conclusion

Solvent extracts of *P.grandis*, a commonly available ornamental plant was coated onto cotton cloth samples. Ciprofloxacin was used as a standard and was coated onto the cotton cloth and taken as reference. All the fabricated cotton cloth samples tested for anti-bacterial activity against *Corynebacterium* revealed no bacterial growth under and on the fabricated cloth adhering to AATCC 147 norms. Good antibacterial activity was noted since there was no growth in all the fabric samples, suggesting the successfulness of the study.

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