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Engineering

IMPROVING ANTI MICROBIAL PROPERTY OF VISCOSE- POLYESTER BLENDED FABRIC

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ABSTRACT In hospitals, reusable cotton surgical gowns are used in operation theatres, while performing various surgical procedures. The fabric used to make these surgical gowns does not possess adequate antimicrobial property, which predisposes to the threat of acquiring various hospital acquired infections. In the present study, Viscose-Polyester (80:20) blended hydro entangled nonwoven fabric has been treated with neem seed oil solution prepared in distilled water to make the fabric anti microbial. The fabric sample was kept in the solution for 20 minutes. Treated fabric strip was compared with untreated (control) fabric strip and the treated fabric was found to have antimicrobial property. Hence neem seed oil can prove useful to provide antimicrobial property to fabric in an ecofriendly manner.

KEYWORDS : Viscose, Polyester, Antimicrobial, Neem seed oil.

1.INTRODUCTION:

Medical textiles are one of the upcoming branches of technical textiles. Medical textile branch is also called healthcare textiles. This branch includes hygiene non wovens, bandage materials, sutures, operating room textiles, textile products for surgery, clothing of nurses and doctors, hospital bed linen and blankets etc. Different types of fibres, yarns and fabric structures are in use in production of medical textiles. Textile materials have found their way into variety of medical applications as a result of many researches in this field.[1]

Different types of micro organisms are present in hospitals like bacteria, virus etc. Their growth is dependent according to the surrounding conditions where these micro organisms are present. Acinetobacter baumanni, Enterobacter aerogens, Escherichia coli, Pseudomonas aeruginosa, Staphylococcus aureus, Micrococcus luteus etc. are some hospital borne pathogens. Morphologically either they are G +ve or G –ve and are responsible for various hospital acquired infections (HAI), Pneumonia to serious blood or wound infections, skin and soft tissue infections, UTI, ENTRIC, Hemorrhage and Necrosis ,Atopic dermatitis, Impetigo, Scaled skin syndrome etc.

Researches in this field suggest different textile materials and different fabric treatments to make the medical textile materials antimicrobial. Treatment of textile material with neem seed oil can be useful in medical textiles. Neem seed oil is produced from the seeds of the neem tree (*Azadirachta indica*). This oil is very popular in Ayurveda. Since ancient times, it is said to possess great medicinal value. It is also used in pesticides.

Neem seed oil contains diterpenois and triterpenoids (limonoids); nimbin, gedunin, azadirachtin, nimbidinin, salanin. [2]Azadirachtin is the most well known and studied triterpenoid in neem oil. Nimbin is another triterpenoid which has been credited with some of neem oil's properties as an antiseptic, antifungal, antipyretic and antihistamine. Neem oil also contains several sterols, including campesterol, beta-sitosterol, and stigmasterol.

2.EXPERIMENTAL:

2.1: PREPARATION OF NEEM SEED OIL SOLUTION

To prepare neem seed oil solution, 195 ml distilled water was taken in a glass beaker. Then 5 ml neem seed oil (available commercially) was added to the beaker. The neem seed oil was then thoroughly mixed with distilled water at room temperature in the beaker using magnetic stirrer for 20 minutes and thus homogenous solution was prepared. The solution was then heated to50°*C* temperature for 15 minutes.

2.2: PREPARATION OF SAMPLES

The fabric sample of Viscose-Polyester (80:20) blended hydro entangled non woven fabric was cut from the roll in strips. The strips were then immersed in the warm neem seed oil solution for 15 minutes. During this treatment the fabric strips turned to light green colour from white. After 15 minutes, fabric strips were taken out of the solution using a forceps. The fabric strips were then dried at room temperature.

2.3: STERILIZATION OF SAMPLES

Sterilization process is necessary before performing any experiment. It is used to kill all the living microorganisms, including bacterial spores. The fabric samples used in the study were sterilized in autoclave.

A simple autoclave consists of a vertical cylindrical body with a heating element. It is provided with a tray to keep the articles in proper condition which can be closed by a lid that can be fastened. The safety valve, pressure gauge, and pressure release valve are other attachments provided for proper operation of the autoclave.

The fabric samples were placed inside the autoclave. . The lid was closed but the pressure release valve was kept open and the water was heated. As the water started boiling, the steam drove air out of the pressure release valve. When all the air was displaced and steam started appearing through the pressure release valve, the valve was closed. The pressure inside was allowed to rise up to 15 lbs per square inch. At this pressure the articles were held for 15 minutes, after which the heating was stopped and the autoclave was allowed to cool. Once the pressure gauge showed the pressure equal to atmospheric pressure, the discharge tap was opened to let the air in. The lid was then opened and samples were removed.

2.4: PREPARATION OF CULTURE MEDIUM

- 13 gpl nutrient broth was taken, Nutrient broth had following contents:

(i) Peptic digest of animal tissue - 5 gpl
(ii) Beef extract - 1.5 gpl
(iii) NaCl – 5 gpl
(iv) Yeast extract – 1.5 gpl.

- Heated to boil and pH was adjusted to 6.8 with 1N NaOH solution, stirred constantly.
- Dispensed in 10 ml amounts in conventional bacteriological culture tubes (125×17mm).
- Plug with cotton and sterilize (autoclaving) at 103 kPa (15 psi) for 15 min.
- 1.5% bacteriological agar was added to nutrient broth, Heated to boil, pH was adjusted to 7.1 using NaOH solution.
- Dispensed in 15 ml amounts in conventional bacteriological culture tubes,Plug with cotton and sterilize (autoclaving) at 103 kPa (15 psi) for 15 min.
- Pour sterilize 20 ml amount in conventional bacteriological culture tubes in Petri dish.
- The environment should be kept sterile while making Petri dish which was achieved by working on the lamellar air flow instrument desk (Figure 1).
- The plates were dried in the lamellar flow with UV light and the lid

slightly off for 15 minutes. Drying the plate is very important for storing the plates and growing colonies on them. If not dried, the moisture will evaporate and condense on the lid during storage or during incubation and gives wet plates to work with. At worst the moisture can affect the plating of cells.

- Once prepared, media was held at 4-5 °*C* in the refrigerator for 1-2 weeks.

Figure 1 Laminar air flow Instrument to maintain sterile working environment [3]

1.Testing procedure [3]

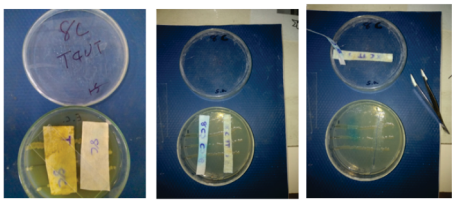
AATCC Test Method 147 was followed, which is used for antibacterial activity assessment of textile materials. The objective is to detect bacteriostatic activity on textile materials. The method is useful for obtaining a rough estimate of bacterial activity in which the growth of the innoculum organism decreases from one end of each streak to the other and from one streak to the next resulting in increasing degrees of sensitivity.

- Specimens i.e. untreated (control) fabric strip and a treated fabric strip were placed in intimate contact with the agar surface of the Petri dishes which had been previously streaked with an innoculum of a test bacterium.
- Glass slides were placed to apply little load on the fabric strips for their proper contact with agar surface. Petri dish was covered and placed in an incubator for 24 hours at 37 °***C*** temperature.
- After incubation, Petri dishes were taken out from the incubator and observed for the growth of Gram positive bacteria (Staphylococcus aureus) and Gram negative bacteria (Escherichia coli).

2.Result and discussion

The photographs of Petri dishes are shown in fig.2.The fabric sample treated with Neem seed oil solution was found to be resistant to bacterial growth. Fig. 2.1 below shows significant growth of E. coli around the control (untreated) sample (on the right side) while this growth is very limited around treated sample (on the left side). It is evident from fig.2.2 and fig.2.3 that the growth of S.aureus bacterium is negligible and insignificant near the treated fabric sample.

Broadly, a clear area of interrupted growth underneath and along the side of the treated strip indicated antibacterial activity of the treated fabric samples.



2.1. 2.2 2.3

Fig.2 Petri Dishes photographs

CONCLUSION:

Textiles have found way into a variety of medical applications such as protective medical apparel, implants, blood filters, suture materials, surgical dressings etc. Medical apparels such as surgical gowns which are included in the category of "health care and hygiene products", must protect the health care professional from contamination by blood and other infectious fluids. They should also prevent microorganisms like bacteria; viruses etc. from passing through the skin. Treatment of viscose polyester fabric with neem seed aqueous solution can provide antimicrobial property to the fabric. This treatment can be utilized where antimicrobial property of the fabric is important like in hospital atmosphere. This treatment is simple, easy, cost effective and most importantly, ecofriendly. Further research in this field can be carried out to improve antimicrobial property of textile materials use in medical field.

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