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Value Addition of Compression Stockings using Herbs

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Abstract

Compression textile is one of the most growing textiles in medical field by providing the needed characteristics of patients against such problems like Deep vein thrombosis, low blood flow etc. and also used in sportswear. A systematic study of the application of herbs to study the effect on compression stockings was conducted. The essential oils of basil, menthol and aloe vera were applied to compression stockings by a dip method and dry method. This study focussed on the effect of herbs in compression textile. The herbal plants used in this study possess various properties which impart an extra-ordinary medicinal uses and show potential as an effective bio-control agent. Therefore, Natural products of plant origin with anti bacterial properties have been tried as an indigenous method for the control of a variety of pests and bacteria in the recent past.

Keywords: Herbs, Compression, Low Blood Flow, Anti-bacterial.

Introduction

Compression garments are garments like socks, pantyhose, sleeves etc that gives support for individuals suffering from vein problems with poor blood circulation. Compression garments worn on the legs can help avert profound vein thrombosis and lessen swelling[1]. Compression garments are used to apply pressure on human limbs for scar management, venous and lymphatic problems, bone and muscle injury, and post cosmetic surgery eye. Pressure garments are produced from elastic knitted structures which extend on wearing and remains in stretched state continuously applying pressure on the human body. As they are worn next to skin so their comfort properties are very important.

Aim and Scope of the Study

The main aim was to study the effects of herbs applied on compression stocking regarding itching problems on skin.

Review of Literature

The history of compression therapy began around 450 B.C. when Hippocrates, a famous Greek physician first mentioned various bandaging techniques in his Corpus Hippocratic[2]. After that various compression gears developed like an adhesive bandage was mentioned for the first time in the mediciofficina[3]. William Harvey discovered the blood circulation, the function of the venous valves and the calf muscle pump. The concept of CT changed enormously in the late 18th century. The first rubber-free stockings were manufactured in 1917. However, these stockings exerted insufficient pressure. The correct compression was achieved only in 1960 with the arrival of the synthetic elastomers. Since then stockings have been manufactured as we know them today[4]. Compression garments are used to apply pressure on human limbs for scar management, venous and lymphatic problems, bone and muscle injury, and post cosmetic surgery eye. Pressure garments are produced from elastic knitted structures which extend on wearing and remains in stretched state continuously applying pressure on the human body. As they are worn next to skin so their comfort properties are very important.

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Fig 1 Compression Stockings

There are some problems associated with compression garments which as the compression garments are too difficult to put on and take off also they are too hot on the legs especially during the summer or in warmer climates. They are uncomfortable to wear as they are too tight and carry less breathability. The stockings slip and cause wrinkles and can make the skin dry and itchy. Compression garments if worn by the patients having wounds chance of infection is more To reduce these problems medical compression garments are finished by chemical finishing as well as herbal finishing but herbs eliminate some drawbacks of chemicals and also contain properties like antimicrobial, anti-allergic, cooling etc. The herbs are applied on compression stockings by dip and dry method. An extensive study was conducted to assess the various properties on herbal finished stockings by employing standard test methods. There are three herbs are used in the study.

Aloe Vera

Basil

Menthol

Materials and Methods

Materials

Knitted stockings of nylon and spandex having gsm 7.29, 20 wales per inch, 30 course per inch and 1.69 mm thickness were used in the present study. The stockings were purchased from Vissco Aids Pvt Ltd.

Aloe vera gel, Basil and Menthol oil were purchased from local market and used as it is. Other chemicals used in the research work were of laboratory reagent grade.

Methods

Finishing of Stockings with Herbs

The finishing was performed by Dip and Dry method. Mild scouring treatment was given to samples before finishing. The recipe used to prepare solution for dipping the stocking is given in Table 1. After dipping the fabric for given time the stockings were gently squeezed and dried a room temperature.

Table 1

Recipe for Finishing the Stockings

Weight of sample	X gm
MLR	1:10
Concentration of Finish (Aloe vera, Basil, Menthol)	10, 30, 50, 70 gpl
TRO(wetting agent)	5gpl
Temp.	Room Temp
Time	120min

Testing

The following tests were carried out for samples.

Add- on of finish on fabric

To calculate add- on % of finish on fabric the change in weight (wt) of sample was calculated by weighing the samples before and after treatment using the following formula:

$$\text{Add} - \text{on}\,\% = \frac{Final\ wt - Initial\ wt}{Initial\ wt} \times 100$$

Air permeability

To check the air permeability of the samples the test was performed according to D737-96 ASTM standard method using FX 3300 Air Permeability Tester[5]. It is generally expressed in cm3 /s/cm^2.

Surface Friction

To check the surface friction of the samples coefficient of friction was calculated using the method given by By Alfred A. Mercier with slight modification[6].

$$\text{Coefficient of friction} = \tan\theta = \frac{P}{B}$$

MVTR *(Moisture vapour transmission rate)*

To check the moisture vapour transmission rate cup method was used in the study[7]. The MVTR of the samples was calculated in terms of water vapour permeability index (WVPI) using the following formula:

$$\text{WVP} + \frac{24M}{A\,t} + \text{g/m}^2\text{/day}$$

Where, M = Loss in mass (g)
t = Time of test (h)
A = Internal area of the dish (m^2)

$$\text{Water vapor permeability index} = \frac{(WVP)_f}{(WVP)r} \times 100$$

Where, $(WVP)_f$ is Final weight and $(WVP)_r$ is Initial weight MVTR and WVPI are inversely proportional to each other. More rate of transmission means more water is getting evaporated leaving behind less mass leading to lesser WVPI.

Anti-bacterial

To check anti bacterial property Methyl Red (MR) test method is used[8]. The test organism E.coli was inoculated in glucose phosphate broth at 37˚C for 2-5 days. Results were interpreted from the colour of dishes having samples after 48 hours.

Results and discussions

Add on %

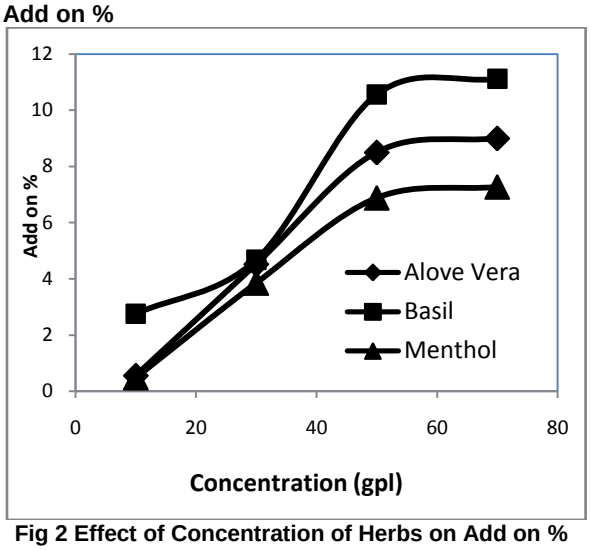

Fig 2 Effect of Concentration of Herbs on Add on %

Effect of concentration of aloe vera, basil and menthol on Add on % is shown in fig 2. It is clear from the figure that with increase in concentration of aloe vera, basil and menthol Add on % increases sharply up to concentration of 50gpl. After that there is no significant increase in Add on % when we increase the concentration upto70gpl it means saturation is achieved.

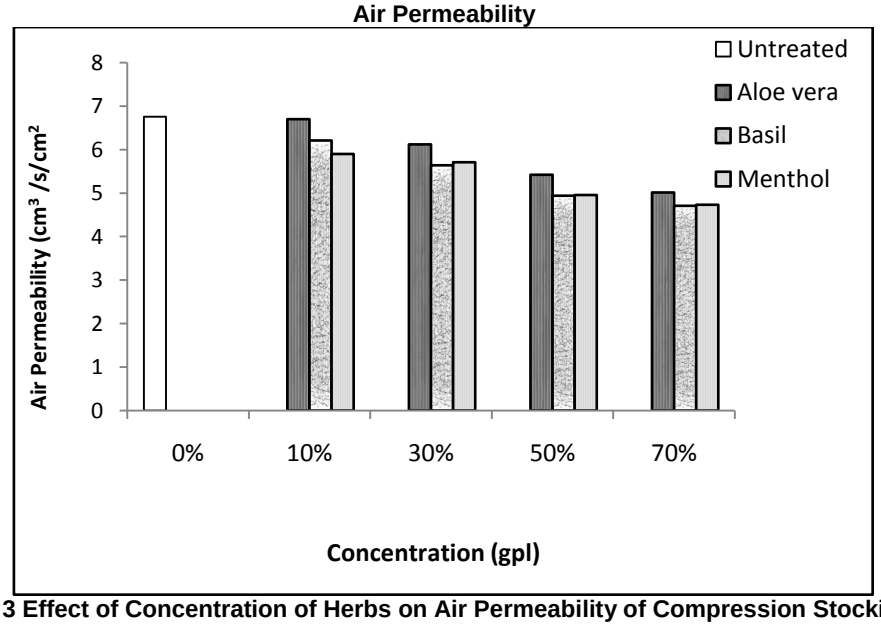

Fig 3 Effect of Concentration of Herbs on Air Permeability of Compression Stockings

Air permeability of any fabric depends upon its porosity. Denser fabrics have less air permeability because of their less porous structure. When we apply finish to fabric surface, chances of blockage of pores is there leading to decrease the air permeability of fabric.

Change in air permeability with increase in concentration of aloe vera, basil and menthol is shown in fig 3. Untreated fabric has 6.754 air permeability values which keep on decreasing as we increase the concentration of aloe vera on fabric. Initially the decrease in values is less but at higher concentration chances of blocking of pores is more leading to only 5.014 air permeability value at 70 gpl concentration of aloe vera. But in case of basil and menthol the decrease in air permeability value is much lower than that of aloe vera. The fabrics treated with basil and menthol at 70 gpl concentration shows 4.708 and 4.732 air permeability value respectively.

Surface friction

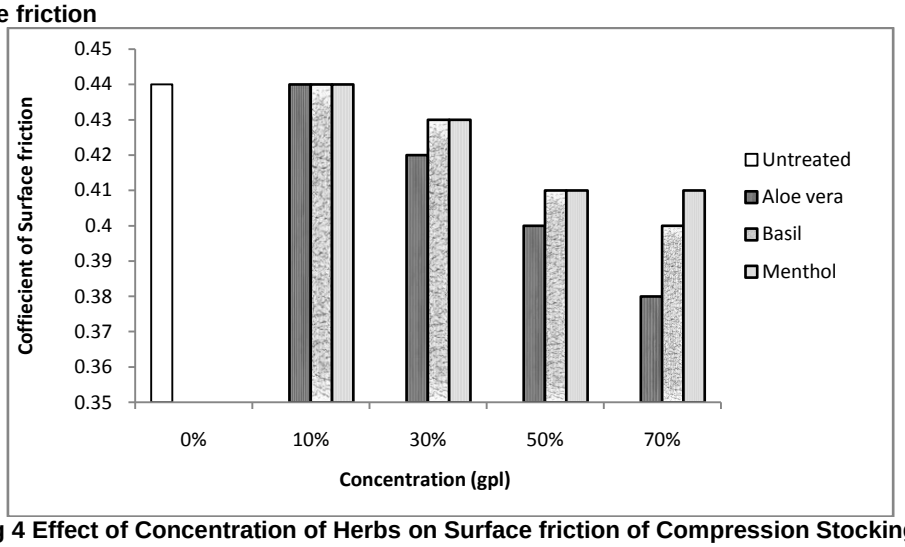

Fig 4 Effect of Concentration of Herbs on Surface friction of Compression Stockings

Surface friction of any fabric is described by its smoothness or roughness. A smooth surface is more slippery than a napped surface. When we apply finish to fabric surface, chances of change in surface characteristics of samples blockage is there leading to decrease the surface friction.

Change in surface friction with increase in concentration of aloe vera, basil and menthol is shown in fig 4. Untreated fabric has 0.44 air coefficient of friction values which keep on decreasing as we increase the concentration of aloe vera on fabric. Initially the decrease in values is less but at higher concentration value of coefficient of friction is lied down to only 0.38 at 70 gpl concentration of aloe vera. But in case of basil and menthol the decrease in coefficient of friction value is less low than that of aloe vera. The fabrics treated with basil and menthol at 70 gpl concentration shows 0.41 and 0.40 coefficient of friction value respectively.

On the basis of combined results of add on, air permeability and surface friction we can say that 50gpl concentration is optimized concentration for all the three finishes, as desired results were obtained on that concentration. So MVTR and Anti Bacterial testing were conducted on samples showing best results.

WVPI

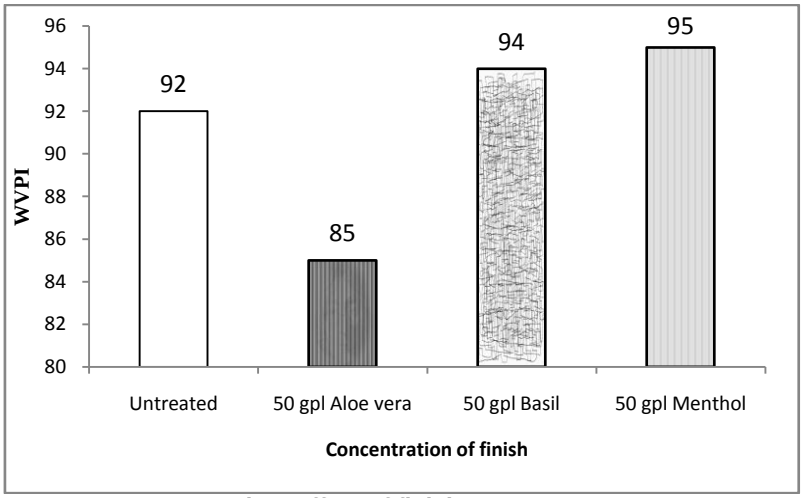

Fig 5 Effect of finish on MVTR

MVTR of treated and untreated samples is shown in fig 5. It can be observed that when we apply finish on samples the MVTR depends upon the nature of applied finish. In case of basil and menthol WVPI higher as compared to untreated sample this may have happened due to the blockage of interstitial gap by the adherence of finish, but in case of aloe vera WVPI is lesser than WVPI of untreated sample. Aloe vera has moisture absorbing property which can be responsible for higher vapour transmission.

Anti Bacterial Property

Fig 6 Untreated

Fig 7 50gpl Menthol

Fig 8 50gpl Basil

Fig 9 50gpl Aloe vera

Anti bacterial property of treated and untreated samples are shown in figures given below. Untreated sample having higher bacteria growth as shown in fig 6, fig 7, 8 and 9 shows anti bacterial property of menthol, basil and aloe vera respectively. Aloe vera and basil having lesser bacterial growth as compared to menthol because both of these herbs carries inherent anti bacterial properties that responsible for reduce bacteria growth and therefore menthol having higher bacterial growth then these herbs.

Conclusion

This study opens the possibility of finishing of compression garments using herbs for various properties. The findings of the work show that essential oils that are used for finishing of compression stockings successfully achieved the proposed goals. Application of these essential oils reduces surface friction and also helps to decrease bacterial growth so as to avoid itching and reduce chance of infection.

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