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A Study on Effect of Punica Granatum Rind Extract on Bed Linen for Preventing Bed Sore

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ABSTRACT
The study was conducted to develop the herbal finish bed linen for bedsore cure. Bedsore, also known as pressure ulcers or pressure sores, are injuries to the skin and underlying tissue resulting from prolonged pressure on the skin. They typically develop in areas where bones are close to the skin surface, such as the heels, ankles, hips, and tailbone, due to sustained pressure from lying in one position for too long. The risk factors for bedsores include immobility, poor nutrition, moisture, and friction. If left untreated, bedsores can lead to serious complications, including infections that can extend into deeper tissues. Therefore, to prevent the risking factors of the bedsore this study is done. In this study, the bed linen is made with the blending of cotton and bamboo fibre to create a sustainable and eco-friendly environment. The bed linen is made from bamboo in the weft and cotton in the warp treated with Punica Granatum rind (pomegranate peel) extract solution. The solution is extracted by saxholet extraction method. The pomegranate peel powder is used for its antibacterial and anti-inflammatory properties. This herbal finish will promote the wound healing process of the bedsore at the early stage.

Keywords: Punica Granatum Peel Powder, Bedsore, Bedlinen and Antioxidant.

INTRODUCTION

Bedsores, also known as pressure ulcers or pressure sores, are a common and often preventable health issue among individuals with limited mobility, such as the elderly or those with certain medical conditions. These ulcers develop when continuous pressure on the skin reduces blood flow to the area, leading to tissue damage and, eventually, ulcer formation. Preventing bedsores is crucial for maintaining the health and well-being of individuals who spend extended periods in bed or seated. Pomegranate peel powder extract has gained attention for its potential health benefits, including its antioxidant, anti-inflammatory, and antimicrobial properties. These properties suggest that it could have therapeutic effects when applied to the skin. The bed linen is made of bamboo and cotton which has bamboo as warp and cotton as weft. Infusing bed linen with pomegranate peel powder extract presents a novel approach to preventing bedsores at the early stage, potentially offering a natural and non-invasive solution to this common problem. This study aims to investigate the effectiveness of bed linen treated with pomegranate peel powder extract in preventing the development of bedsores during early stage. By evaluating the impact of this intervention on skin health, blood flow, and the incidence of pressure ulcers, we seek to contribute to the body of

knowledge on pressure sore prevention and explore innovative strategies for improving patient care and comfort.

MATERIAL AND METHODOLOGY

Selection of fiber.

Twill weave bamboo and cotton blended fabric with cotton as warp yarn and bamboo as weft yarn with 30s count.

Herb particulars. See Table 1.

SI number	Botanical name	Common name	Chemical components
1	Punica granatum	Pomegranate (peel)	Fat, protein, gallotannins, ellagitannins, complex tannins, condensed tannins, flavonoids, antioxidants, phenols, polyphenols and anthocyanins.

Table 1 Chemical components of Punica granatum

Methodology.

The pomegranate fruit is collected. The peel is separated from the fruit and the peels were dried in sunshade and grinded. The fabric is initially tested for AATCC 147 method, to evaluate the ability of the fabric to inhibit the microorganisms, to be bacteriostatics. Then the result is discussed (Table 2). The untreated fabric is initially undergoes testing for tensile strength, pH value and water solubility. Finally the test were discussed.

Parameters	Bacteristatic activity(mm)	Growth under fabric
Staphylococcus aureus ATCC 6538	0	Absent
Klebsiella pneumonia	0	Absent

Table 2 AATCC 147 Antibacterial activity assessment

Finishing Agent.

Methanol extract of Punica Granatum has the antibacterial, anti oxidant and wound healing property. 20 grams of herbal powder is dissolved in 250 ml of methanol and then it is concentrated using Soxhlet apparatus to obtain the extract. The process is run for a total of 24 hours to get a full yield.

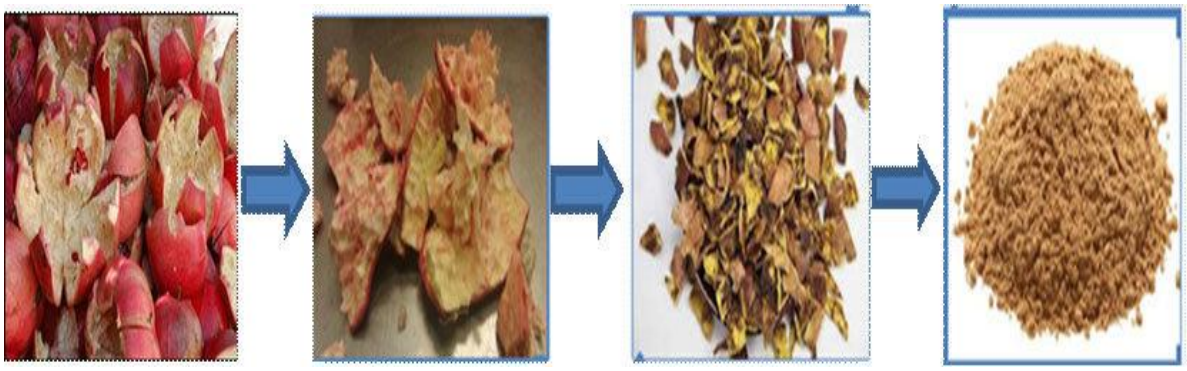


Figure 1. Preparation Pomegranate peel powder

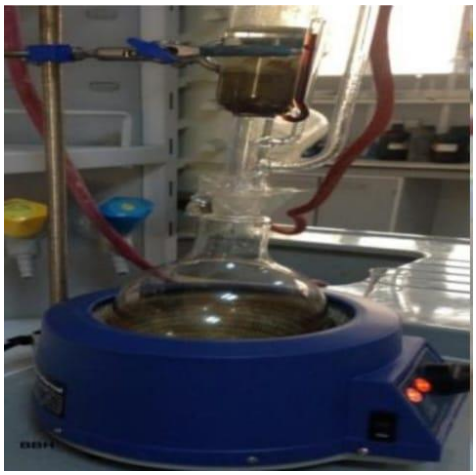


Figure 2. Soxhlet extraction for dried pomegranate peels

Application.

The extracted solution are applied on the fabric by following the pad-dry-cure process under a appropriate condition. Initially the solution is padded on the fabric by padding mangle and then it is dried and cured.

Figure 3 Coating of solution on fabric (Padding Mangle)

Result

Construction of bed linen.

The finished fabric is then measured according to the bed size to make the end product of bedlinen. The bed linen can be the size of 60x78 inch size for a person to sleep.

Figure 4 Final product

Tensile strength test.

It is used to describe how much load a material can withstand when loaded in tension. The tensile strength will shows the strength of the fabric.

Tensile strength test result.

Comparing the five specimen of the fabric as shown in the table 3, the P_1 and P_2 has average result has the good tensile strength which will gives a better result.

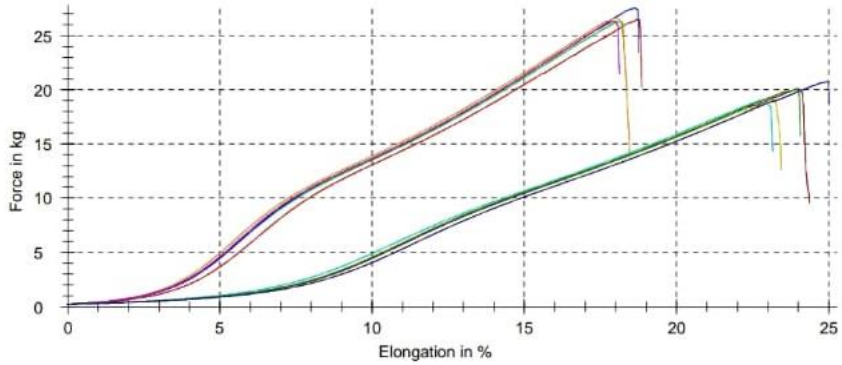
	Before application	
Specimen	**Peak load (kg) P_1**	**Elong. @break % E_1**
1	29.5520	7.9649
2	29.2640	7.7164
3	28.0930	8.1314
4	28.6980	7.9534
5	28.1570	8.2082
Average	**28.7528**	**7.9949**

Table 3 Tensile strength of the fabric between before application

Test results:

No.	Warp/Weft	Fmax kgf	Emax %
1.7	Warp	26.5	18.8
1.8		26.3	18.2
1.9		27.5	18.6
1.10		26.6	18.0
1.11		26.3	18.0
3.1	Weft	19.1	22.8
3.2		18.9	23.2
3.3		20.1	24.0
3.4		20.0	24.0
3.5		20.7	25.0

Series graph:



Statistics:

Warp n = 5	Fmax kgf	Emax %	Weft n = 5	Fmax kgf	Emax %
x̄	26.7	18.4	x̄	19.8	23.8
s	0.514	0.4	s	0.759	0.8
V [%]	1.93	1.96	V [%]	3.84	3.41

Figure 5 Tensile strength result after application

pH value test.

pH value refers to the acid-base degree of the solution. There are some pH limits for different product according to the standards. For the fabric with direct contact with the skin the pH value should be 4.0-7.5.

pH value test result.

Fabric is tested at a particular temperature according to the standards.(Table 4) The pH value of textile material can be measured with a pH meter. The pH of the extracting solution is 6.67. By taking the value of pH value at 30.8°C, the average pH value of the material is 6.51. This result confirms that it is safe for direct skin contact.

pH values	**Fabric**	
	Before application	**After application**
Mean pH values	6.51	3.49
pH of extracting solution	6.67	6.69

Table 4 Comparison of pH value of the fabric between before and after application

Water soluble substance test. This test involves the identification of fiber by treating the fibers in certain solvent. This test gives the accurate analysis in the identification of the fiber.

Water soluble substance test result:

Water soluble substance	**Fabric**	
	Before application	**After application**
Percentage	0.19	0.24

Table 5 Percentage of water soluble substance of fabric

CONCLUSION

In this work, the pomegranate peel extraction is applied to the bamboo and cotton bended bedlinen fabric. The Soxhlet extraction of dried pomegranate peels are applied to the fabrics. Based on the test conducted , the obtained result were shown in the tables and figures. According to the antibacterial test result (Table 2), the fabric shown good antibacterial property. Tensile strength of the fabric before application and tensile strength of the fabric after application is greater. Hence it has good tensile property. The pH value of the fabric before and after application is lesser than 9 which means it is suitable for direct skin contact. Water soluble substance test has the better percentage to indicate the soluble substance present in the material.

So it is concluded that fabric has the good antibacterial property and the pH value is suitable for the usage. And it is suggested that the effect of Punica granatum rind will prevent the bed sore at the early stage. It is also suggested to use in any other home textile and other application. In addition it is environment friendly.

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