Antimicrobial Activity of Walnut Shell Extracts in Dyeing Cotton Fabrics and its Applications in Nursing

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Abstract:

Most types of bacteria are classified, either as Gram-positive or Gram-negative strains. The Gram-positive bug is summarized in the resistance of *Staphylococcus aureus* to methicillin, which is the bacteria that are resistant to many drugs in the event that many types are Gram-negative and difficult to treat because they have anti-drug external membranes. Bacterial infection that infects new born children breast-feeding women and people suffering from chronic diseases such as diabetes, cancer, vascular disease and lung disease. Injecting drug users, those with injuries, intravenous catheters, surgical incisions, and those whose immune systems are impaired due to disease or as a result of immunosuppressive drugs are all at increased risk of developing a *Staphylococcus aureus* infection. Therefore, the aim of the current study was to examine the antimicrobial activity of walnut shell water extracts in dyeing cotton fabrics and its applications in nursing.

The results of the study concluded that copper sulfate (at 30 % concentration) recorded the highest washing stability for all concentrations of the dye under study when used as a dye stabilizer solution. The same solution also recorded the highest stability and the highest bacterial resistance of the tested fabrics. The effectiveness of treated fabrics continued for a period of more

than 4 years under normal storage conditions with a relatively low degree of resistance to bacteria. Overall, using water extract of walnut shell in dying fabrics will give a wide range of protection against pathogens.
Keyword:
Walnuts shell, Cotton, Dyeing, Antimicrobial, and Hospital uniforms.

Introduction

The emergence of antibiotic-resistant organisms is a major public health concern, particularly in hospitals and other health care settings. Antibiotic-resistant organisms appear to be biologically fit and are capable of causing serious, life-threatening infections that are difficult to manage because treatment options are limited. This increase in the prevalence of drug-resistant pathogens is occurring at a time when the discovery and development of new anti-infective agents is slowing down dramatically. Consequently, there is concern that in the not-too-distant future, we may be faced with a growing number of potentially untreatable infections **[1]**.

There are many researches dedicated to the "greening" of textile polymeric supports through the utilization of various bioactive extracts, as well as establishment of antimicrobial potential, such as natural pigments or antimicrobial products, a process referred to as "functionalization" **[2]**.The use of natural dyes in textile application is growing and gaining popularity because of their non-carcinogenic and non-hazardous nature **[3, 4,5].** Natural dyes repeatedly were used for coloring textiles from ancient times till the nineteenth century. Natural dyes are eco-friendly due to its biodegradability, low toxicity, and UV absorbent than synthetic dyes **[6,7].** Walnut shell is one of the most important nut tree crops in worldwide production. The world market for walnut shell is divided into two groups: nuts with intact shells for direct consumption (10 %) and shelled nuts transferred for further technological purposes (90 %) **[8].** Hazelnut shells represented more than 50 % of the total nut weight and they are the major byproduct in hazelnut industry production **[9].**

Fig. 1(a): Wallelnuts shells.

Fig. 1(b): Extract of wallelnuts shells[9].

Their disposal represented both an economic problem for the producers and a serious environmental problem due to the combustion of the crop residues **[10,11].**

Walnut shell are composed of celluloses, lignin with flavonoids are considered as major phenolic compounds and antimicrobial and antioxidant properties **[12]**. Also, walnuts contain tannin as a nature's own mordant. Chemical composition of wallelnuts shells are lignin50.3%, hemicellulose 22.4%, cellulose 23.9%, and ash 3.4. Phenolic compounds are the primary bioactive components in plants. They have a wide range of health benefits, mainly due to their antioxidant properties, such as reactive oxygen species scavenging and inhibition, electrophile scavenging and metal chelation **[13-17]**.

Phenolic compounds also exhibit pharmacological properties, such as anti-carcinogenic, anti-inflammatory, and anti-mutagenic effects, and anti-proliferative potential **[18]**. The current study aims to propose an effective natural alternative that resists bacteria and is low in cost to serve and develop the garment and textile industry, especially in the field of clothing and fabrics that serve the medical sector, including clothes, furnishings, and protective covers for hospital beds that are anti-bacterial, which is the use of walnut husk extract in dyeing cotton fabrics and studying its effectiveness.

Study was undertaken to test almond, cashew, hazelnut and walnut extracts for the ability to inhibit microbial growth against a panel of pathogenic bacteria. The authors found that the bacterial growth inhibitory activities of the methanolic almond and walnut extracts **[19]**.

Textiles made of pure cotton or its blends with synthetic fibers are very popular due to desirable characteristics such as water absorbency, easy dyeing, comfort and stability **[20]**. The chemical composition of cotton are cellulose 91-94%, water 6-8%,0.5-1%, proteins, protoplasm and pectin's 0.5-10.2-1% , and mineral salts 0.2-1%. Most of the natural dyes have no ability for the fiber and are required to be used in conjunction with a mordant. A mordant, usually a metallic salt, is regarded as a chemical, which will be fixed on the fiber and attach the dyestuff**[21].**

Types of Mordant mostly used

Copper mordant, copper mordant is copper sulphate, sometimes it is called blue vitriol because its bright blue crystal. However, the copper mordant produces a dull chestnut color. Alum Mordant, is the most common mordant. It is classified as the brightening mordant, because it usually produces a pale and bright color. It does not affect the color being produced **[22].**

Chrome Mordant, chrome is known as potassium dichromate and is a kind of brightening mordant. It produces a deep version of the prevailing dye color, and leaves fabric with beautiful soft, while other mordants may harden the fabric. Chrome is toxic and can cause irritation to skin **[22, 23]**. The research aims to assess the antimicrobial activity of walnut shell extracts in dyeing cotton fabrics and its applications in nursing.

Using water extract of walnut shell in dying fabrics will give a wide range of protection against pathogens. We propose that the development [engineering] of such natural products have served as a powerful protection against pathogenic bacteria and is the best solution to the rising crisis of antibiotic resistant organisms. The results of this study could be used as a baseline data on validating effectiveness of such natural products in

prevention of potentially untreatable hospital infections. Nursing application of this product in hospital linens and dressing materials could provide protection against pathogen **[24]**.

Research objective

The research aims to assess the antimicrobial activity of walnut shell extracts in dyeing cotton fabrics and its applications in nursing.

Research significance

1. Recycling of useless walnut shells and convert it to valuable uses that serves in broad vital sector of clothes which is hospitals nursery uniforms.
2. Return to nature and avoid chemicals that harm human's skin in dyeing process.
3. Resistance to (+Ve and –Ve) bacteria naturally without toxic materials.

Experimental work

Materials and methods

Cotton fabrics were studied with two different weave structures. The characteristics of the used fabrics are shown in Table 1.

Table 1. Characteristics of the used cotton fabric [25].

Fabric	Specification
Yarn type	Cotton
Weave structure	Plain (1/1)
Mass per unit area	188 (gm/m^2)
Warp yarns/inch	67
Weft yarns/inch	52
Yarn count	30/2

Dyestuff Extraction

The natural dye of walnut shell residues is prepared by an aqueous extraction process. At first, dried pieces of walnut shell were soaked at 25°C for 24 hours, and then boiled at 100°C for an hour. After the solution got cold, it was filtered and the residue was removed**[26]**.

Mordanting Method

Three dye concentrations were prepared as (10, 15 and 20g of walnut shell in 100 ml water), three different salts used as mordants Aluminum sulphate $Al_2(SO_4)$, Copper sulphate Cu (SO_4), and Ferrous sulphate Fe_2 (SO_4). As for the simultaneous mordanting and dyeing processes, the textile material is immersed in a dye bath solution containing Sodium chloride (5 %) and dye solution to each prepared concentration **[27]**.

Dyeing process

The dyeing process was applied by the exhaustion method at 90◦C for 45 min. The dye concentration was in the range of 10, 15 and 20%, and 5% mordant are used. Finally, the dyed samples were rinsed with running water to remove non absorbed dye, and were dried at ambient conditions **[28].**

Fig 2: Drying of cotton fabric dyed with wallelnuts shells.

Colorfastness to washing

The color fastness to washing was determined according to the AATCC Test method 61- 1975 using Launder-Ometer **[29].** The specimens (5 x 10 cm) were sewed between two similar pieces of bleached cotton fabric and wool fabric. The composite specimen was immersed into an aqueous solution containing 5 g/1 soap and 2 g/l sodium carbonate using a material to liquor ratio 1:50. The bath was thermostatically adjusted to 95^{o}C. The test was run for 45 minutes at 42 rpm. The samples were then removed, rinsed twice in 100 ml bath of water at 40^{o}C for one minute with

occasional stirring or hand squeezing, soured in 100 ml of 0.014% solution of acetic acid for one minute at 27^{o}C, rinsed again for one minute in 100 ml water at 27^{o}C followed by drying [30]. Evaluation of the wash fastness was established using the Gray Scale reference for color change **[30].**

Color fastness to rubbing (crocking)

This test is designated for determining the degree of color, which may be transferred from the surface of the colored fabric to other surface by rubbing, according to the AATCC test method 8 - 1977 **[31].**

A colored test specimen fastened to the base of a Crock Meter was rubbed with white crock test cloth under controlled conditions as the following:

Dry Rubbing Test: The test specimen was placed flat on the base of the Crock Meter. A white testing cloth was mounted on the finger of the crock meter. The covered finger was lowered onto the test specimen and caused to slide back and forth 20 times by making ten complete turns at a rate of one turn per second.

Wet Rubbing test: The white test sample was thoroughly wetted out in distilled water to a 65% wet pick up. The procedure was run as before. The white test samples were then air dried before evaluation. The evaluation was done using the Gray Scale for staining.

Color fastness to perspiration

Two artificial perspiration solutions were prepared as follows:

Acidic solution: 0.5g of L. Histidine monohydrochloride monohydrate,0.5 g of Sodium Chloride , 5.0 g of Sodium di-hydrogen orthophosphate were all together dissolved in one liter distilled water. Finally, the pH was adjusted to 5.5 by NaOH solution (0.1N).

The colored specimen of 5 x 4 cm area was sewed between two pieces of uncolored specimens, (so that an area of 5x1 cm of the colored cloth was not in contact with the specimen) to form composite specimens. The composite sample was then immersed (for 15 - 30 minutes) of the above solutions with occasional

agitation and squeezing to insure complete wetting. The test specimen was placed between two glass plates under a force of about 4.5 Kg. The plates containing the composite specimens were then held vertical in the oven at 37^{o}C for 4 hours.
The effect on the color of the test specimens was expressed and defined by reference to the Gray scale for color change.

Bacterial resistance test

The antimicrobial properties of un mordant and mordant dyed fabrics were quantitatively evaluated against Staphylococcus aurous, a Gram-positive bacterium, and Escherichia coli, which are Gram-negative bacteria, according to the AATCC 100- 1993 test method **[32].**

Fig 3: Antibactrial test of wallelnuts shells dyed cotton fabric with s, arrues.

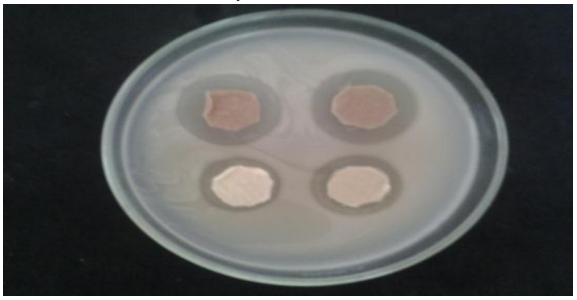


Fig 4: Anti bactrial test of wallelnuts shells dyed cotton fabric with Escherichia coli.

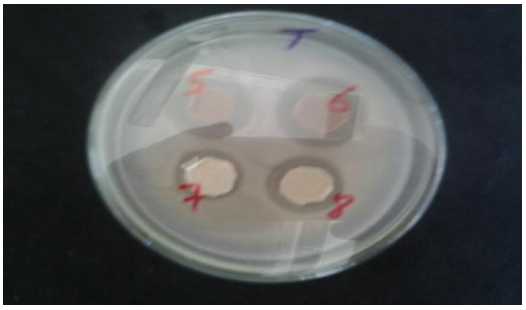
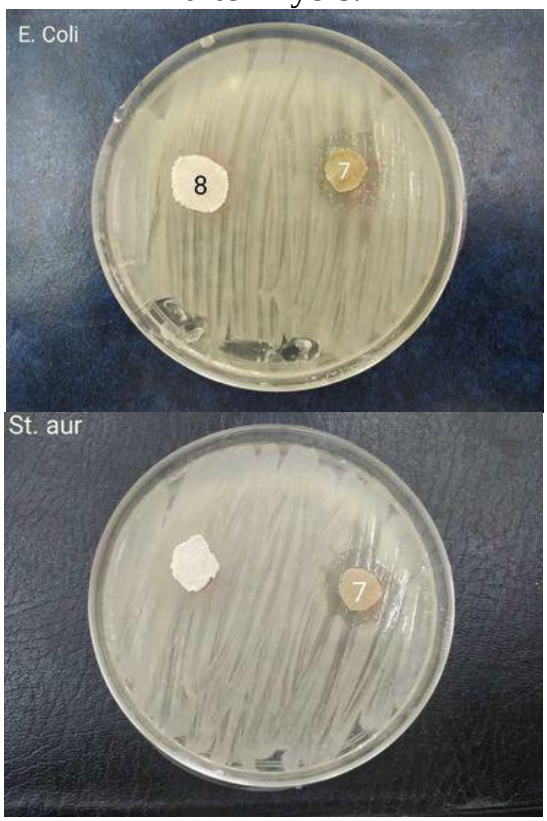


Fig 5: Anti bactrial test of wallelnuts shells dyed cotton fabric after 4 yers**.**



Results and discussion

Effect of dye concentration and mordant type on fastness properties

Dyeing cotton fabric with aqueous extracts of walnut shells are carried out with three concentration (10, 15, and 20%) as shown in figure 3. Three different salts are used as mordants (Aluminum sulphate $\{Al_2(SO_4)\}$, copper sulphate $\{Cu_2SO_4\}$, and Ferrous Sulphate $\{Fe_2(SO_4)\}$. As for the simultaneous mordanting and dyeing, the textile material is immersed in a dye bath solution containing both mordant and dye. A mordant, usually a metallic salt, is regarded as a chemical substance, which will be fixed on the cotton fibers and which will fix the dyestuff. Wash fastness are examined to dyed fabrics, perspiration and rubbing fastness are also tested.

Table 4. Effect of dye concentration and mordant type on wash fastness properties of cotton fabrics.

Mordant type	Wash fastness	walnut shell aqueous extract dye concentration		
		10%	**15%**	**20%**
Ferrous	Wet	3	3-4	-4
	Dry	3-4	3-4	4
Aluminum	Wet	3-4	3-4	4
	Dry	3-4	4	5
Copper	Wet	4	4-5	5
	Dry	4-5	5	5

As is evident from Table 4, the washing fastness of all dyed samples was high, regardless of the types of mordant. It is clear from Table (4) that the copper sulfate mordant recorded the highest degree of fastness for all dye concentrations. This may be due to complex formation between the dye molecules and copper metal ions in the cotton fiber, and that the concentration of 20%gave the highest degree of wash fastness. Based on the previous, highest degree of wash fastness are those samples that were mordanted with copper sulfate and at dye concentration 20%.

Effect of Antimicrobial activity

Antibacterial activities of pristine and dyed cotton fabrics against both *Escherichia coli* and *Staphylococcus aureus* bacteria were examined. The *S. aureus* bacterium is a pathogenic microorganism causing many illnesses such as purulence, toxic shock, fibrin coagulation, endocarditic, and abscess. Furthermore, it is resistant to common antibacterial agents **[33]**. Moreover, *E. coli* bacterium is causes wound infections and urinary tract diseases. **[34].**

Table 5 shows the antibacterial activities (inhabitation zone) of cotton fabrics dyed with the wallnut shell extracts in different concentrations with copper sulphate mordant against *E. coli* and *S. aureus* and comparing the resulting antibacterial effect with cotton samples treated with Silver nanoparticles (particle size < 100 nm).

The antibacterial activity of dyed fabrics showed superior antibacterial inhibition than Silver treated fabrics.

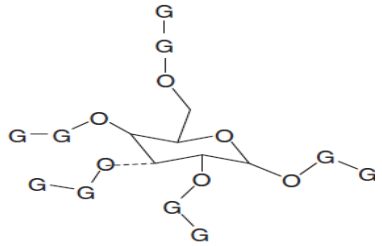
Table 5. Inhibitation zone diameters(mm) of treated and untreated cotton fabrics.

Treatment	Inhabitation zone	
	E-coli	*S. aureus*
Untreated	Not recorded	Not Recorded
walnut shell dye 20% (without mordant)	6	7
walnut shell dye 20% - $CuSO_4$	23	27
walnut shell dye 20% - CuSO4 (after 4 years)	11	12

Based on the obtained results in table 5, walnut dyed cotton showed superior inhibition efficiency against *Staphylococcus aureus* than *Escherichia coli*. Also it showed that using mordant copper sulphate in dyeing gives better antibacterial activity than without mordant. It is well known that the metallic salts used as mordants exhibit toxic effects against the pathogens.

From the previous results, it was proven that walnut shell aqueous extract can be used for dyeing cotton fabrics with high fastness properties- as an alternative to the very expensive, synthetic, and toxic dyes. And that the extracted natural dye gives superior antibacterial properties for cotton fabrics.

The antimicrobial effect of walnut shell aqueous extracts is due to the presence of natural phenolic antioxidants.The reported antioxidant potential of both hazelnut kernel and shell extracts might be related to the presence of phenolic acids and tannins**[35]**.



Tannic acid
G=Gallic acid ester

Results demonstrated showed that walnut shell dyed cotton samples give inhabitation zone increases by increasing dye concentration. And optimum inhabitation zone 25mm *E-coli* and 28 mm *S. Aureus* is achieved with dye concentration 20% with using Copper Sulphatemordant. In general dyed cotton fabrics with walnut shell showed superior antibacterial effects against *Staphylococcus aureus.* Certain groups of people are at greater risk, including newborn infants, breastfeeding women, and people with chronic conditions such as diabetes, cancer, vascular disease, and lung disease. Injecting drug users, those with skin injuries or disorders, intravenous catheters, surgical incisions, and those with a weakened immune system due either to disease or a result of immune suppressing medications all have an increased risk of developing staph infections **[36].** Therefore the present study suggested to using walnut shell treated cotton fabrics as antibacterial materials in medical textile sector such as hospitals nursing uniforms, and bed linen.

Conclusion

- Walnut shell aqueous extracts are used as a natural dye for woven cotton fabrics.
- The copper sulfate mordant recorded the highest degree of fastness for all dye concentrations. This may be due to complex formation between the dye molecules and copper metal ions in the cotton fiber, and that the concentration of 20% gave the highest degree of wash fastness.
- Fastness to washing showed that there was a good fixation of the dye in the fabric. Therefore, it was concluded that the cotton fabric is easily dyed with extracts of walnut outer shell providing different brown shades color.
- Walnut shell extracted dyed cotton achieved excellent degree of alkaline perspiration fastness (change) in woven cotton fabrics. And dyed cotton achieved very good degree of acidic perspiration fastness for both change and staining condition.
- The antibacterial activity of dyed fabrics (walnut) showed superior antibacterial inhibition, and the effect of dying

process as antimicrobial treatment to cotton fabrics are re-tested after 4 years from treatments and still effective.

- Based on the obtained results, specimens showed better efficiency against *Staphylococcus Aureus in* comparison with *Escherichia coli.*
- From the previous results, it was proven that walnut shell aqueous extract can be used for dyeing cotton fabrics - with high fastness properties- as an alternative to the very expensive, synthetic, and toxic dyes. And that the extracted natural dye gives superior antibacterial properties for cotton fabrics.
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References

1. Carvalho C, and Santos G. Global Communities, Biotechnology and Sustainable Design – Natural / Bio Dyes in Textiles, Procedia Manufacturing, 3:67-78 (2015).
2. Shahid A, Gulzar T, Bhatti IA, Qaiser S, and Abid A. Dyeing Behaviour of G-Irradiated Cotton Using Amaltas (*Cassia fistula*) Bark Extracts. Asian Journal of Chemistry, 25: 5-2739 (2013).
3. Fazal-ur R, Adeel S, Shahid M, Bhatti IA, Nasir F, Akhtar N, and Ahmad *Z*. Dyeing of γ-irradiated Cotton with Natural Flavonoid Dye Extracted from Irradiated Onion Shells (*Allium cepa*) Powder, Radiation Physics and Chemistry, 92: 71-75 (2013).
4. Abdullahi UI, and Wong YC. Fastness Properties of Colorant Extracted from Locust Beans Fruits Pods to Dye Cotton and Silk Fabrics. Environmental Management and Sustainable Development, 2, no. 1: 67-78 (2013).
5. Ghaheh FS, et al. Assessment of Antibacterial Activity of Wool Fabrics Dyed with Natural Dyes. Journal of Cleaner Production, 72, 139-145 (2014).
6. Mirjalili, M. and Karimi, L. Extraction and Characterization of Natural Dye from Green Walnut Shells and Its Use in Dyeing Polyamide: Focus on Antibacterial Properties. Journal of Chemistry, (2013). Article ID: 375352.
7. Król K, GantnerM. and Piotrowska A, Morphological Traits, Kernel Composition and Sensory Evaluation of Hazelnut (*Corylusavellana L.*) Cultivars Grown in Poland. Agronomy, 9: 703-711, October (2019).
8. Caglar A, andAydinli, B. Isothermal Co-pyrolysis of Hazelnut Shell and Ultra-high Molecular Weight Polyethylene: The Effect of Temperature and Composition on The amount of Pyrolysis Products. Journal of Analytical and Applied Pyrolysis, 86(2), 304-309 (2009).
9. https://images.app.goo.gl/BZ7mxJaP5XyLyMhW8

10. Piccinelli, AL, Pagano I, Esposito T, Mencherini T, Porta A, Petrone, AM, Gazzerro P, Picerno P, Snsone F, Rastrelli, L, et al. HRMS Profile of Ahazelnut Skin Proanthocyanidin-rich Fraction with Antioxidant and Anti-Candida Albicans Activities. J. Agric. Food Chem., 64, 585–595 (2016).

11. Wijngaard, H, Hossain, MB, Rai, DK, Brunton N. Techniques to Extract Bioactive Compounds from Food by-Products of Plant Origin. Food Res. Int., 46, 505–513 (2017).

12. Giménez-Martín, E, López-Andrade M. Moleón-Baca JA. López, MA. Ontiveros-Ortega A. Polyamide Fibers Covered with Chlorhexidine: Thermodynamic aspects. *J. Surf. Eng. Mater. Adv. Technol*, *5*, 190–206(2015).

13. Baaka, N, Ksibi, I E, Mhenni MF. Optimization of The Recovery of Carotenoids from Tomato Processing Wastes: Application on Textile Dyeing and Assessment of its Antioxidant Activity. *Nat. Prod. Res*, *31*, 196–203(2017).

14. Zhou Y, Yang ZY, and Tang RC. Bioactive and UV protective Silk Materials Containing Baicalin—The multifunctional Plant Extract from *Scutellaria baicalensis* Georgi. *Mater. Sci. Eng. C*, *67*, 336–344(2016).

15. Xu Y, Sismour, EN, Parry J, Hanna MA, and Li H. Nutritional Composition and Antioxidant Activity in Hazelnut Shells from US-grown Cultivars. *International Journal of Food Science & Technology* ,5: 45-56 (2012).

16. Kumar S,and Pandey AK. Chemistry and Biological Activities of Flavonoids: An overview. *Sci. World J*, 4: 34-45 (2013).

17. Esfahlan AJ, Ostadrahimi A, TabibiazarM. and Amarowicz RA. Comparative Review on the Extraction, Antioxidant Content and Antioxidant Potential of Different Parts of Walnut (*Juglansregia L.*) Fruit and Tree, Molecules, 24, 2133-2137 (2019).

18. Randhir R, Lin YT, & Shetty, K, Phenolics, Their Antioxidant and Antimicrobial Activity in Dark Germinated Fenugreek Sprouts in Response to Peptide and Phytochemical Elicitors. Asian Pacific Journal of Clinical Nutrition, 13(3), 295-307 (2014).

19. Kaliora, AC, Kogiannou DA, Kefalas P, Papassideri IS, and Kalogeropoulos N. Phenolic Profiles and Antioxidant and Anticarcinogenic activities of Greek Herbal Infusions; Balancing Delight and Chemoprevention? Food Chemistry, 142, 233-241 (2014).

20. Mirjalili Mo, Yaghmaei N, and Mirjalili M. Antibacterial properties of nano Silver Finish Cellulose Fabric, Journal of Nanostructure in Chemistry, 3:43-53 (2018)

21. Lebaratoux P, Sirdaarta J, Rayan P, McDonnell PA, Cock IE, An Evaluation of the Antibacterial, Anti-Giardial, Anticancer and Toxicity Properties of Selected Nut Extracts. Pharmacogn. Commn. 6(3) 174-184 (2016)

22. Coman D, Vrînceanu N, Oancea S, and Rîmbu C. Coloristic and Antimicrobial Behaviors of Polymeric Substrates Using Bioactive Substances, Materials Science and Engineering ,5:145156 (2016).

23. Coman D, Vrînceanu N, Oancea S, Rîmbu C. Coloristic and Antimicrobial Behavior of Polymeric Substrates Using Bioactive Substances. IOP Conf. Ser. Mater. Sci. Eng, 145, 032003(2016).

24. Spellberg B, Guidos R, Gilbert D, et al. The epidemic of antibiotic-resistant infections: a call to action for the medical community from the Infectious Diseases Society of America. *Clin Infect Dis* 2018;46:155-64

25. Vir SS, and Purohit MC. Applications of Eco- Friendly Natural Dye on Wool Fibres Using Combination of Natural and Chemical Mordants. Universal Journal of Environmental Research & Technology ,4(2),3-11(2012).

26. Miah MR, Telegin FY, Miah MS, Shahid MA, Rahman MS, and Ran J. Comparative Analysis of Color Strength and Fastness Properties on Extracts Natural Dye from Onion's Outer Shell and Its Use in Eco-Friendly Dyeing of Silk Fabric. International Journal of Photochemistry and Photobiology, 2(1), 1-8 (2017).

27. Ashraf R. Cotton fiber structure and its properties, National Textile University, Pakistan ,5(2) ,33-38 (2014).

28. Ramakrishna S, Fujihara K, Teo WE, Lim TC, and Ma Z. An Introduction to Electrospinning and Nanofibers, World Scientific Publishing, ISBN 978-981-256-415-3, (2015).

29. Ashish KSV, Rathod D, SinghS, Ninganagouda, P, Kulkarni J, Mathew and M, Haq. Bioactive Silver Nanoparticles from an Endophytic Fungus Fusarium Sp. Isolated from an Ethanomedicinal Plant Withaniasomnifera (Ashwagandha) and it's Antibacterial Activity. International Journal of Nanomaterials and Biostructures, 5(1), 15-19 (2015).

30. Sonal SB, Swapnil CG, Aniket KG, and Mahendra KR. Rapid Synthesis of Silver Nanoparticles from Fusariumoxysporum by Optimizing Physiocultural Conditions. Hindawi Publishing Corporation. The Scientific World Journal,5(2)37-41 (2013).

31. Zhang M, Gao Q, Yang C, Pang L, Wang H, Li R, Xing Z, Hu J, Wu G. Preparation of Antimicrobial MnO_4^- doped nylon-66 Fibers with Excellent Laundering Durability. *Appl. Surf. Sci*, *422*, 1067–1074(2017).

32. Gong P, Li H, He X, Wang K, Hu J, Tan We.a. Preparation and Antibacterial Activity of Fe and Ag Nanoparticles, Nanotechnology, 18, 604-611 (2017).

33. Oberdörster G, Oberdörster E, Oberdörster J. Nanotoxicology: An Emerging Discipline Evolving from Studies of Ultrafine Particles, Environmental Health Perspectives, 113, 823(2015).

34. Knetsch M, Koole L, New strategies in the Development of Antimicrobial Coatings: The Example of Increasing Usage of Silver and Silver Nanoparticles, Polymers-Basel, 3, 340-366 (2017).

35. Antony J, Nivedheetha M, Siva D, Pradeepha G, Kokilavani P, Kalaiselvi S, Sankarganesh A, Balasundaram A, Masilamani V, Achiraman S. Antimicrobial Activity of Leucasaspera Engineered Silver Nanoparticles against Aeromonashydrophila in Infected Catlacatla, Colloid Surface B, 109, 20-24(2013).

36. Mahanty A, Mishra S, Bosu R, Maurya U, Netam S, Sarkar B. Phytoextracts-synthesized Silver Nanoparticles Inhibit Bacterial Fish Pathogen Aeromonashydrophila, Indian J Microbiol.53, 438-446 (2013).

إستخدام مستخلصات قشور الجوز (عين الجمل) كمضادات للبكتيريا فى صباغة الاقمشة القطنية وتطبيقاتها فى مجال التمريض

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الملخص:-

تصنف معظم أنواع البكتيريا، إما موجبة الجرام او سالبة الجرام و تتلخص مشكلة البكتريا إيجابية الجرام فى مقاومة المكورات العنقودية الذهبية للميثيسيلين وهي البكتيريا المقاومة للعديد من العقاقير في حال أن العديد من الأنواع سلبية الجرام ومن الصعب علاجها لامتلاكها أغشية خارجية مضادة للعقاقير ومن أهم تلك الأمراض الناتجة عن العدوى البكتيرية تلك التى تصيب الأطفال حديثي الولادة والنساء المرضعات والأشخاص الذين يعانون من أمراض مزمنة مثل السكري والسرطان وأمراض الأوعية الدموية وأمراض الرئة. متعاطي المخدرات عن طريق الحقن، والذين يعانون من إصابات أو اضطرابات جلدية ، والقسطرة الوريدية ، والشقوق الجراحية، وأولئك الذين يعانون من ضعف في جهاز المناعة بسبب المرض أو نتيجة الأدوية المثبطة للمناعة، جميعهم معرضون لخطر متزايد للإصابة بعدوى المكورات العنقودية لذا **تهدف الدراسة الحالية** الى اقتراح بديل طبيعى فعال مقاوم للبكتريا وقليل التكلفة لخدمة صناعة الملابس و النسيج و تنميتها خاصة مجال الملابس والاقمشة التى تخدم القطاع الطبي من ملابس مضادة للبكتيريا وهو استخدام مستخلص قشرالجوزفى صباغة الاقمشة القطنية و دراسة فاعليته فى مقاومة البكتريا موجبة الجرام و ذلك يفيد فى التنبؤ بتاريخ انتهاء الفاعلية ، هذا و قد تم استخدام ثلاث مثبتات للصبغة الطبيعية (كبريتات الحديدوز – كبريتات الامونيوم – كبريتات النحاس) واستخدام ثلاث تركيزات مختلفة للصبغة المستخلصة. **و خلصت النتائج الى**: مثبت كبريتات النحاس سجل أعلى درجة ثبات للغسيل لجميع تركيزات الصبغة محل الدراسة كما أن تركيز ٢٠% سجل أعلى درجة ثبات و اعلى درجة مقاومة للبكتريا للاقمشة المختبرة. كما استمرت فاعلية الاقمشة المعالجة لمدة زادت عن ٤ سنوات تحت شروط التخزين العادية مع انخفاض نسبى فى درجة مقاومة البكتريا، و اجمالا فإن الأقمشة المصبوغة ستعطي مساحة واسعة من الحماية ضد مسببات الأمراض.