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ANTIBACTERIAL TEXTILES SURFACE VIA SYNTHESIZED OF NANOPARTICLES FROM BRASSICA RAPA VAR. JAPONICA LEAF

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ABSTRACT

Extracted green AgNPs from Brassica rapa var. japonica leaf application is really outstanding way to functionalize wool fabric surface. This research aims to investigate/analysis the antimicrobial activity, antioxidative & UV resistance of wool fabrics surface after treated with synthesized Brassica silver nanoparticles via exhaustion methods.

This is 1st time ever, wool fabric surface functionalized by synthesized AgNPs from Brassica rapa var.japonica green leaf extracts. In this study we have analyzed surfaces after treated by green silver Nanoparticles onto the wool fabric via various ways (UV performance evaluated according to Australia/New Zealand Standard AS/NZS 4399:1996 (AS/NZS4399)and the antibacterial activity evaluated according to GB/T 20944.3-2008 (eq. ISO 20743-2007) against bacteria i.e. Escherichia coli (E. coli).

The results indicated that silver nanoparticles (AgNPs) were successfully assembled on wool surface without any adverse effect on the surfaces of fabric by exhaustion method where Liquor, pH and temperature of application medium were adjusted to 4 and 45 ºC, respectively for 115-20min and proved that AgNPs are antibacterial, antioxidative, UV resistance properties and such fabric may be useable as anti-Hygienic or medical textiles for future textiles wearer .Thus, this finding may be a matter of interest for the consumer products production as an antibacterial and UV resist textiles which is known as medical textiles.

KeyWords:

Brassica Rapa var. japonica leaf, Antibacterial, Antioxidative, UV resist, Wool fabric, Exhaustion method, Medical Textiles.

1. Introduction:

An extremely important part of Bangladesh economy is textile [1].The dramatic increase in the popularity of knitted fabrics during the last three decades provides a vivid example of the interrelationships between lifestyle, technology and fashion[2] and the GDP share of RMG of Bangladesh was 14.07% in 2013-14 [3, 4]. Not only the textile industry plays a vital role to augment the socio-economic development of Bangladesh but also pose major public health problem[5] also. Surface smoothness is one of the important qualities and requirements imposed by the consumer. As clothing remains next to human skin it is very sensitive issue to ensure this quality properly [6], because Bacterial contamination is one of the drawbacks from TEXTILE materials [7]. The large area of

textile is conducive also to microorganisms' growth, such as fungi and bacteria, which can be found almost everywhere and are able to quickly multiply, depending on the moisture, nutrients and temperature levels and one single bacteria cell can increase to 1,048,576 cells in just 7 h, finally causes a range of undesirable effects on the textile itself but also on the user.[8] In recent years, numerous conventional methods are reported for AgNPs synthesis such as chemical reduction, electrochemical and sono-chemical processes. However, green synthesis method is being prominent as it is eco-friendly, cost effective and rapid with high substrate availability. Green synthesis of AgNPs was firstly reported by Gardea-Torresdey et al. Chandran et al. synthesized AgNPs using Aloe vera plant extract and described that the presence of ammonia in the Aloe vera facilitated the bioreduction of Ag+ ion for the formation of metallic AgNPs. The studies evaluated the use of plants and their tissues for AgNPs synthesis. Aloe vera leaf, Musa paradisiaca peels, Cocos nucifera coir, Annona squamosa peel, Citrus aurantium peel, and Citrullus lanatus rindextracts mediated synthesis of AgNPs have been reported. It is worthwhile to develop suitable method/s for the synthesis of AgNPs, which would be less toxic. Moreover, AgNPs having antibacterial activity could promote the safe use in dietary supplements, food packaging, cosmetics and anti-acne preparation. Consequently, it is important to establish a synthesis route of AgNPs having less toxicity with high antibacterial activity for the safe use of them in terms of human health concerns. Brassica rapa var. japonica grows almost round the year in Japan, China and Korea and it is very popular in salad, soup and hot pot. Therefore, Brassica rapa var. japonica leaf extract can be a potential candidate as a source of reducing and capping agent for the green synthesis of AgNPs because it is less toxic, antiviral and can be used to consumer product production [9-21]. Nowadays Textile materials have wide application not only for conventional dress but also smart applications for various purposes for various properties e.g. gynecologic, virus filter, antibacterial, UV protection, synthetic polymer i.e. PCL is used to fabricate Nano fibers as scaffold, PEEK polymer for hydrophilic, biocompatible properties to use as biomaterial, electrical fields, bioactive antibacterial textile to sensitive skin as a medical textile purposes [22-31, 7]. However, among all-natural protein fibers Wool is superior material for winter and medical textiles due to its resilience and comfort properties and also recommended that can be achieved by acquiring multifunctional performance such as antiviral and UV protection for the sake of health consideration. The successful green AgNPs synthesis replace conventional chemical synthesis of NPs and UV protective and antiviral wool fabric surface produced via exhaustion methods **[32-35].** On the other hand, manufacturing plants including textile wet processing industries are trying to best use the water by imparting process modifications due to environmental and commercial concerns**[6]** because gradually increasing use of deep water in industries especially in textile industries which is a big threat for our ecological balance & environment**[36].**

My aim of this study is functionalized wool fabric surface by Brassica rapa var. japonica leaf extract (Brassica AgNPs) via exhautsion methods to produce antiviral (E.coli bacterial) and UV resistance wool fabric surface as an anti-hygienic wool textiles surface which is totally eco-friendly for environment also.

2. Experiment & Methodology:

2.1 Materials: Wool fabric, Rapa var. Japonica leaf from China, Lab grade chemicals reagents & some machines etc.

2.2 Preparation of (Green-Ag) Nano particles:

Leaf have been prepared for removal dust and dirt via distil water then dried leaf, finally made powder of Brassica leaf by blender machine. We have used lab grade chemical reagents, Powder:water liquor ratio 50:1 then boiled 100^{0c}near about 10 min and filtered. Finally, Silver nanoparticles (AgNPs) were successfully synthesized from the reduction of Ag^{+} to Ag^{0}_{ions} using AgNO3 solution as a precursor and Brassica rapa var. japonica leaf extract as a reducing and capping agent and green AgNPs [21].

2.3Preparation of functionalized wool sample:

To prepare functionalized wool fabric surfaces there are several steps followed such as dust dirt oil removal by washing process, synthesized AgNPs assembled on the wool surfaces by exhausting process which are described bellow briefly.

2.3.1Dust/dirt removal process:

Wool fabric non-ionic detergent wash with 50:1 liquor ratio; both normal hot and cool wash have been done near about 20min to remove waste and dust particles perfectly then dried 5 min at 120^{0c}**.**

2.3.2 Surface functionalized process:

PH value has been fixed up (4) using formic acid into aqueous solution of AgNPs and wool fabric bath. Green Nano particles (AgNPs) have been treated onto fabric surface by following exhaustion method or Wool fabric surface factionalized where treatment done with several concentrations under liquor ratio (M: L 90:1), Run time 12O min at 45^{0}c temperature. Finally treated wool sample has been rinsed wash via demonized water also.

2.4 Surface properties:

Surface properties evaluated by various ways for various properties in this work such which are introduced bellow.

2.4.1: antibacterial properties: antibacterial activity evaluated according to GB/T 20944.3-2008 (eq. ISO 20743-2007), Scanning electron microscopy (SEM) etc.

2.4.2: UV-resistance properties:
UV performance evaluated according to Australia/New Zealand Standard AS/NZS 4399:1996 (AS/NZS4399) UV-Vis, spectroscopy etc.

2.4.3: Antioxidative properties:
Bio-chemical reagent, to ensure antioxidative properties test done by chemical reagent test.

4. Result and discussion:

4.1Effect of synthesized AgNPs on Surface:
We have investigated fiber surface via SEM tester and found AgNPs are well spread on to the fiber surface without any adverse effect on wool fibers morphology as well as surfaces. R. Perumalraj reported [37] that AgNPs have no any effect on wool fiber surface and produced better tensile strength, lower crimp %, color strength and moisture regain% due to Ag.

4.2 UV-protection properties:
Ultraviolet radiation ranges between 100 and 400 nm and subdivided into UV-C (100-280 nm) stopped in the stratosphere, UV-B (280-315 nm) and UV-A (315-400 nm). It is known that overexposure UV -A and UV-B can cause harmful effects such as premature aging and skin cancers. In order to avoid these effects, the UV radiation exposure needs to be reduced, for example, with textile clothing [38-40**].** Here in The UV resistance ability of textile is influenced by Brassica AgNPs also in this study where 70ppm AgNPs showed outstanding UV resistance surface among 3 samples 35 ppm, 50ppm and 70 ppm. Finally, these results encourage & indicate the use of the Brassica rapa Var. Japonica leaf extract as simultaneously impart Brassica AgNPs and UV protective effect onto textiles.

4.3 Antibacterial Properties:
The term 'antibacterial' refers to an agent that either destroys various bacteria or slows down their growth. More specifically, there are several ways antibacterial agents may inhibit bacterial growth; for example, by cell wall damage, inhibition of cell wall synthesis or inhibition of the synthesis of proteins and nucleic acids or the Drugs which prevent their multiplication or growth, destroy microbes or prevent their pathogenic action [41,42] . On the other hand, due to unique properties of Ag NPs against microorganisms, they are in high demand in consumer products such as medicine and medicinal devices, foodstuffs, cleaning agents, and clothing [43-46,8]. After microscopic test from various fabrics from various sources found bacterials contamination (Table-1) that bacteria has immansive advers effect on human health as well as skin [7].

Table-1: Contaminants present in the Textiles or Garments

SN	Microscopictest:	Microbial quality:	Effects on:	Materials:
1	aerobic hetero-trophic	bacterial count (TVBC),	Health skin	Various Garments
2	coliform,	total coliform count (TCC),		
3	fecal coliform	total fecal coli-form count (TFCC),		
4	staphylococcus aureus	total staphylococ-cus count (TSC),		
5	Fungi etc.	total Shigella-salmonellae and total fungi count (TFC)		

In this study, the application of Brassica AgNPs was investigated by growing E. coli on agar plates. When Brassica AgNPs were present on agar plates then they completely inhibit the bacterial growth smartly. Finally evaluated antiviral activity of wool surface showed outstanding antibacterial activity (around 90 %) and can be used as antibacterial as well as medical textiles. The current work also raises the question of using diabetic person's socks for better skin health perpose as researcher has already obtained better respons to use wool for foot skin health of diabatic patiens [47].

Conclusion:

This research mainly provided Green leaf extracted AgNPs have versatile properties to fulfill promising Medical Textiles, it may be avoiding infection to wearer because the presence of the Ag-NPs on the surface acting as antibiotic, there is no any adverse effect on surfaces also. However, more coated AgNPs wool surface showing excellent properties because inhibition may also depend on concentration. This study was thus undertaken to better understand or increasing encouraged the important of antibacterial fabric manufactured from wool surface modified substance and application on the skin health of people such as diabetes mellitus.

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