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Effect of biosynthesis shaped copper nanoparticle on antimicrobial property of cotton textiles

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Abstract — *In the present scenario of environment consciousness, the new quality requirements not only emphasize on the intrinsic functionality and long service life of the product but also production process that is environment friendly. In the present study an attempt was made to finish cotton textiles with herbal based, copper nanoparticles with different sizes and shapes to impart the antimicrobial finish. Copper nanoparticles were synthesized with plant sources as a core material and the variation of concentration of the leaf/petals extract with the reducing agent has yielded different shapes and sizes of nanoparticles. Transmission electron microscopy (TEM) images at 30 and 40 magnification, showed the size and shapes of the NPs between 90-98nm from all plant sources and the shapes obtained were spherical, oval, multiple, rod and hexagonal.*

Keywords- *Antibacterial, metal nanoparticles, copper, eco-friendly, Biosynthesis*

I. INTRODUCTION

Traditionally, textiles were considered as low technology domain as their primary functions are protection of modesty, providing microclimate and good look. With the intensification of global competition, textile manufacturing companies from developed countries are competing for a significant share of the global market by developing new technologies or new products. Companies are trying to differentiate their products with specific and special functions based on need and requirements of consumers (Kathirvelu, *et al* 2008). Antimicrobials are used on textile to control bacteria, fungi, mold, mildew and algae and the problems of deterioration, staining odour, and health concerns that they cause. For many decades, mostly chemicals are used, to add antimicrobial property to the textiles. Chemicals which are being used for antimicrobial property of textiles are toxic to humans and are difficult to degrade within the environment.

The textile industry continues to search for eco-friendly materials and processes as substitutes for toxic textile chemicals. An increasing interest has been noticed in the functionalization of environmentally-friendly and biodegradable reagents. From this perspective, it is found that nanoparticles from herbal sources have excellent antimicrobial property and are also eco-friendly in textile finishing. Nanoparticles are attracting increasing attention on account of their potential applications and unique properties, which are strongly influenced by their size, morphology and structure. In recent years, much attention has been paid to metal oxide nanoparticles that give rise to unique electronic and optical properties that are useful for a variety of new technologies. (Gopalakrishnan *et al.*, 2012). The need for biosynthesis of nanoparticles rose as the physical and chemical processes were costly and non eco-friendly. Therefore eco-friendly sources were sought after to impart antibacterial property; and today, copper is used as a water purifier, algaecide, fungicide and nematocide and as an antimicrobial and antifouling agent. (Anita *et al.*, 2011).

II. MATERIAL AND METHODS

Thus copper nanoparticles (NPs) were biosynthesized from five different plant varieties (Plant sources are Tulsi leaves(T), Neem leaves(N), Guava leaves(G), Ashoka leaves(A), and Rose petals(RP)) with different shapes (Spherical, Oval, Multishapes, Hexagonal and Rod shapes). The nanoparticles were subjected to TEM analysis to analyze the size and purity of copper nanoparticles. Mill scoured and bleached 100 % cotton fabric in plain weave was desized by boiling the fabrics in mild alkali (Sodium hydroxide) at 1gm/l and detergent 2gm/l for 1 hour. Copper nano particles were applied with 5% concentration to the fabrics by pad-dry-cure method. Fabric was kept for 5min in the copper nano bath and was passed through a padding mangle with an expression of 70% and material(m), liquor (l) ratio of 1:20 (m:l). Fabric was air dried and was cured for 3min in hot air oven at 140^0C. Wash analysis was done for treated samples for antimicrobial property by using a neutral soap solution at 40ºC for 30 minutes. Standard qualitative test method AATCC 147-2004 is used to test the antibacterial assessment of woven fabric.

III. RESULTS AND DISCUSSION

It is to be noted that the untreated, woven cotton (100%) fabrics were kept for antibacterial assessment; and it is observed that they did not show any zone of inhibition against both gram positive and gram negative bacteria cultures.

The effect of copper nanoparticles (with 5% concentration) on woven fabric with respect to their plant sources and shapes found is as given below.

- The Zoi is clearly observed against both gram negative and gram positive bacteria cultures, in all the treated fabric samples for all plant varieties and shapes studied.
- Among all varieties of Cu NPs prepared, Spherical shape Cu NPs synthesized from Ashoka leaf extracts have shown highest Zoi, which is against S.aureus; and second highest Zoi was exhibited by spherical shape Cu NPs synthesized from Tulsi leaf extracts, which is also against S.aureus.
- The highest Zoi observed against E.coli is on the fabric, which is treated with spherical shape Cu NPs synthesized from Neem leaf extracts.
- Spherical shape Cu NPs synthesized from Neem leaf extracts found to be more effective against both gram positive and gram negative bacterial cultures, before washing and also after 1st and 5th washes.
- With respect to plant variety & shapes, it is found that (i) spherical shape NPs are more effective among all the shapes synthesized from Tulsi plant source, (ii) spherical shape as well as hexagonal shape NPs are more effective among all the shapes synthesized from Neem plant source, (iii) spherical shape NPs are more effective among all shapes synthesized from Ashoka plant source, (iv) spherical shape NPs are more effective among all the shapes synthesized from Guava plant source, and (v) spherical shape NPs are more effective among all the shapes synthesized from Rose plant source.

Woven Fabric Treated With CuNPs at 5% Concentration : Zoi in mm																
Plant Names	**Shapes**	**Spherical**			**Oval**			**Multi-shape**			**Rod**			**Hexagonal**		
	Organisms	**W**	**1st**	**5th**	**W**	**1st**	**5th**	**W**	**1st**	**5th**	**W**	**1st**	**5th**	**W**	**1st**	**5th**
T	***E.C***	1.15	1	0	0.8	0.5	0	0.8	0.5	0						
	S.A	12	9	7	8.2	5.1	3.7	5	4.3	2						
N	***E.C***	5	4.2	2.8	2.5	1.9	1							3.7	2.8	1.5
	S.A	10.8	7	4.9	7.3	4.7	2.9							10.2	9	5.1
A	***E.C***	1.3	0.5	0	0.5	0	0				0.5	0	0			
	S.A	12.1	9.4	7.9	7.1	4.8	2				7	5	4.2			
G	***E.C***	1.2	1	0.5	0.5	0	0	0.5	0	0						
	S.A	11.5	9.6	5	7.3	6	5.1	4.2	2.5	1.6						
RP	***E.C***	2.4	1.7	1.1				2	1.6	0.9						
	S.A	4.8	3.5	2.1				4	3	1.8						

Table: 1. Antibacterial property assessment of the treated samples

IV. CONCLUSION

There is demand for eco-friendly textiles because of growing needs of people in aspects of health and hygiene that can be fulfilled by use of antimicrobial treated fabric in an organic way using plant source at nanolevel. Nanoparticles of Neem, Tulsi, Ashoka, and Guava, were found to act as barrier against microorganism in cotton fabric. And it was also found that the spherical shaped NPs showed excellent biocidal action because of shape dependent interaction of NPs against E. *coli* and S. *aureus.* The antibacterial activity of woven fabric increased when the size the particle decreased of all plant sources. Neem CuNPs of all three shapes were found to possess antibacterial activity against both organisms.

REFERENCES

1. Y. Abboud, T. Saffaj, A. Chagraoui, A. Bouari, K. Tanane, and B Ihssane, "Biosynthesis, characterization and antimicrobial activity of copper oxide nanoparticles produced using brown alga extract" Applied Nanoscience. 1-5, 2013.
2. J. R, Aspland, "Direct Dyes and Their Application. Textile Chemist and Colorist" 23(11):1-6, 1991.
3. D. Broadbent ,"Basic Principles of Textile Coloration. Society of Dyers and Colourists", England, 2000
4. J.E. Booth, "Principles of Textile Testing- an introduction to physical methods of testing textile fibres, yarns, and fabrics", Butter worth's publications, London: 209, 1983.
5. D.P. Chattopadhyay, "Effect of Nanosized Colloidal Copper on Cotton Fabric", Journal of Engineered Fibers and Fabrics. 5(3): 1-6, 2010.

