Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.47750/jptcp.2023.30.07.028

Using of Nanotechnology to improve the properties of children's clothing fabrics who are unable to express

Nouf Nawar Mohsen Alotaibi[1], Wafaa Mohamed Ibrahem Elbana[2*]

[1]Assistant Professor of Special Education, College of Education, Najran University, Saudi Arabia

[2]Associate Professor of Textiles at the College of Education - Najran University, Saudi Arabia

***Corresponding author:** Wafaa Mohamed Ibrahem Elbana, Associate Professor of Textiles at the College of Education - Najran University, Saudi Arabia, Email: wmalbana@nu.edu.sa

Submitted: 24 February 2023; Accepted: 16 March 2023; Published: 08 April 2023

ABSTRACT

Nanotechnology is a modern technology based on understanding and studying Nanoscience and other basic sciences rationally and creatively, to ensure obtaining distinct and unique products employed in various applications. The current study aims to take advantage of nanotechnology in improving the properties of children's clothing fabrics who are unable to express, where the study of the effect of Nano-metric tin oxide on improving the properties of children's clothing who are unable to express their feelings of pain and discomfort. The study relies on the experimental descriptive method, where the research deals with the treatment of used fabrics (internal - external) for deaf and mute children and others with special disabilities and who are unable to express themselves, where the treatment was done with Nano metric tin oxide with different concentrations (100 ml/L-200 ml/L-400 ml/L) to determine the effect of each of them on some of the protective properties (resistance to bacteria - fungi) of the fabrics used for them, The study used a suggested raw material for underwear, which is knitted weft cotton, and another for outerwear, which is plain cotton fabric 1/1. The selected samples were subjected to study and treatment with Nano metric tin oxide (in various concentrations) to test the resistance of bacteria and fungi to reach the extent of the effect of nanometer tin oxide on the resistance of bacteria and fungi and what is the best concentration of Nano metric tin oxide on the fabrics subject of the study. The results of the study fulfilled the hypotheses that there were significant differences between the resistance of bacteria and fungi and the treatment material (tin oxide nanometers).

Keywords: *Clothing, Fabrics, Treatment, Material, Results*

INTRODUCTION

Nanotechnology and its applications have brought about a modern scientific revolution that heralds a huge leap in the branches of science in general, and in the field of textile industries in particular, including the introduction or production of nanoparticles in textile materials during manufacturing or processing.

And with the great scientific development in the field of textile equipment and the increase in health awareness and individual safety, it has forced us to strive to keep pace with the continuous development. Keys to developing new products in the textile arena (Mahmoud, 2018).

Nano materials of all kinds have unique physical, chemical and mechanical properties that are reflected in the efficiency and performance of the final product that is manufactured, as it has properties that cannot be available in traditional materials products (Mohamed Al-Iskandarani, 2010). Through nanotechnology, we can change the properties of any material and modify its features, by rearranging its atoms in a way that gives distinct properties that are completely different from their original features before being reconstituted (Hijazi, 2012). The world directs its attention to the child by striving in all ways, ways, and means to fulfill the needs of children and achieve well-being for them. If this attention extends its efforts with the average child, what is the case with the child with special needs, (Baghida, 2019). In spite of the foregoing, we find a lack of studies that concern the child who is unable to express his suffering, whether this suffering is a result of skin infections, infection with a virus, exposure to bacteria, or immunodeficiency This child may be under three years old, have a hearing disability, or have one of the syndromes. There are some studies that show the therapeutic uses of fabrics, as the study (Al-Shura'an, 2016) approved the effect of anti-bacterial treatment on the physical and mechanical properties of cotton fabrics used in the manufacture of ready-made clothes. A study (Pharaoh, 2010) also aimed to use the technology of production and the use of smart clothing for added value patches in ready- clothing factories, as the study used new types of antimicrobial technology by using equipment materials that combat unpleasant odors. It is worth mentioning that clothes have a great impact on human health, and an important source of protection and prevention from various factors that harm his health, and despite that, they are also considered one of the first and most important causes that may bring many diseases such as allergies, asthma and some skin diseases, and among the most prominent diseases that are directly affected By clothes are skin diseases. (Al-Dasouki, 2021) Therefore, this study dealt with the innovation of some new health additives that help the wearer to protect health from some skin infections using nanotechnology, with the aim of contributing to achieving the wearing comfort of the clothes used for children who are unable to express themselves

Research problem

Nametric tin oxide is characterized by its antimicrobial use on the surface to prevent microbes from sticking to it, so it remains clean. This cover is a very gentle layer of tiny silver oxide particles that are similar to the size of microbe cells, enabling them to easily penetrate the microbe's wall and disrupt its functions. This "anti-microbial" cover is distinguished by its inexpensive, easy to maintain, pure, resistant to natural environmental changes, self-perpetuating and durable in function, thus it is environmentally friendly, non-toxic and harmless to humans and retains its vitality and beauty throughout its use. Benefiting from nanotechnology to provide the properties of comfort and increase immunity to infections resulting from the multiplication of bacteria for fabrics used for children with special needs, therefore, the research problem is determined by answering the following questions:

What is the effect of weave structure treated with Nano - metric tin oxide and the resistance to bacteria and fungi?

Is there an effect between the degree of with Nano - metric tin oxide and the resistance of bacteria?

Is there an effect between the degree of with Nano - metric tin oxide and the resistance of fungi?

Research Objectives

Highlighting the suffering of children with special needs resulting from the physical damage that befalls them from unhealthy clothes, and contributing to reducing it.

The use of Nano metric tin oxide to improve the functional properties of children's clothing fabrics.

Directing researchers to pay attention to Nano metric tin oxide and its role in the resistance of bacteria and fungi.

J Popul Ther Clin Pharmacol Vol 30(7):e238–e244; 08 April 2023.

The importance of studying

Highlighting the role of protective fabrics in preserving human health and safety.

Highlighting the role of smart fabric production in health and occupational safety.

Shedding light on the importance of scientific research in the field of medical and protective fabrics.

Draw attention to the need to take care of the clothes of children with special needs.

Research hypotheses

There are statistically significant hypotheses between the type of textile composition (gel knitwear - plain cotton 1/1) treated with tin oxide and the resistance to bacteria and fungi.

There are statistically significant hypotheses between the degree of tin oxide concentration and the resistance of bacteria.

There are statistically significant hypotheses between the degree of Nano metric tin oxide concentration and fungicide resistance.

Research limits

The research is limited to the following limits

Objective limits

These were knowledge and skill limits.

Knowledge limits

(enriching the role of technical fabrics in resisting bacteria and viruses)

Skill limits

- The use of Nano metric tin oxide in the treatment of cotton fabrics used for clothes of children with special needs
- The use of Nano metric tin oxide with different concentrations in the treatment of cotton fabrics used for clothes of children with special needs.

Research tools

Cotton fabrics with a weave Structure (Cotton single jersey for underwear - plain cotton 1/1 for outerwear) treated with nanotechnology

Research terms

Nanotechnology

The nanometer is a billionth part (one thousandth of a million) and the nanometer is used as a unit to measure the lengths of very small things that can only be seen under a microscope (electronic microscope) and this unit is used to express the dimensions of this unit to express the dimensions of the diameters and sizes of atoms and molecules of composite materials and microscopic particles Like bacteria and viruses, one nanometer equals a part of a thousand million (billion) part of a meter. Nanotechnology is that advanced technology based on understanding and studying Nano science and other basic sciences mentally and creatively, with the availability of the technological ability to synthesize nanomaterial's and control their internal structure to ensure obtaining distinct and unique products employed in various applications.

Children who are unable to express themselves

Some of them are deaf and dumb who do not have a sense of hearing that helps them to integrate into normal life before learning to speak, or this ability has been lost before learning to speak, which impedes verbal communication. Including various syndromes and people with mental disabilities and children under three years.

Bacteria

Microscopic single-celled organisms that are not seen with the naked eye, but are seen with a high-magnification microscope. They multiply rapidly by simple cell division, so the bacteria grow from one germ to millions of germs. Every 20 minutes, their reproduction multiplies at a high speed through cell division (Ahmed, 2015).

Research Methodology

The current research uses two approaches, a descriptive approach related to defining the theoretical skills and knowledge associated with technical fabrics, an experimental approach regarding the research experiment and evaluating the effect of of using Nano metric tin oxide on the resistance of bacteria and fungi.

Theoretical framework

Nano technique

It is the science, engineering, and technology that gives it the ability to directly control atoms, molecules, materials, structures, and devices whose dimensions are less than 100 nanometers, by observing, measuring, and studying their physical, chemical, magnetic, mechanical, and electrical properties, and the ability to manufacture them, and use their applications in scientific fields, (Tawaher, 2022).

Use of nanotechnology in textiles

Many Nano textile manufacturing companies are working to gain added value that far exceeds the primary use by adding new functions to textile raw materials. Therefore, the physical, chemical and biological properties of textile raw materials can be developed and improved to suit the purpose of final use to ensure that the industry obtains a competitive advantage (Mohammed, 2018)

The most common nanomaterial used in textiles

Silver, silicon dioxide, titanium dioxide, zinc oxide, aluminum oxide, carbon nanotubes, (Federal, 2013). One of the most important properties that can be acquired for textiles using nanomaterial. Resistance to fungus and bacteria, self-cleaning, durability, moisture absorption, resistance to ultraviolet rays, resistance to combustion, and many other important properties for the purpose of end use (Mohammed, 2018)

The use of nanotechnology in the production of children's underwear

Nanotechnology has been used in the treatment of children’s underwear to combat bacteria and microbes that cause some skin diseases. These microorganisms, which sometimes cause serious skin diseases, are difficult to get rid of and treat, especially when they affect children. Treating these fabrics that are directly attached to the skin against all kinds of microbes, especially bacteria (Ahmed, 2015) By equipping them with antimicrobials, this firstly protects the skin from infection with those diseases, which prevention is much better than treating them after aggravation, in addition to that these chemical treatments against bacteria and microbes can also contribute to accelerating the recovery process from these diseases. Secondly, preventing the growth of these microorganisms on treated fabrics makes them maintain their functional properties for a longer period (Aleamny, 2019).

Raw materials used in children's underwear fabrics

And she - theatrical cotton. - Combed cotton - Combined cotton - Viscose and the following structural compositions - Bells - Rib. - Interlock (Abdo, 2021).

SnO2 nanoparticles

SnO2 nanoparticles are characterized as external semiconductors, where oxygen acts as electron donor atoms, so it is used in membrane engineering, as catalysts, as anti-reflection coatings in solar cells, in the manufacture of gas sensors, optoelectronic devices, resistors, and retarders to give textiles resistance to bacteria.

Laboratory experiments

The treatment was carried out using Nano metric tin oxide with a concentration of (100 ml/L-200 ml/L-400 ml/L) on single bell weft knitting (from fabrics used for underwear) and the number of samples was 3 samples. The treatment was also done on plain cotton fabric 1/1 (used for outerwear) and the number of samples is 3 samples.

First: Specifications of the materials used in the Research

TABLE 1: Specifications of the materials used in the Research

m	The material	Specification
1	Cotton single jersey	weft knitting 100% cotton white The square meter weight is 145 g/m2 Thread number 40/1 EN Canvas thickness 0.52 mm
	Plain weave 1/1	100% cotton The weight per square meter is 175 g/m2 Thread number 40/1 EN Canvas thickness 0.58 mm
	Nano metric tin oxide	Nano metric tin oxide was used in concentrations (100 ml / liter - 200 ml / liter - 400 ml / liter).

Second: Preparation of a suspension of Nano metric tin oxide

A suspension of Nano scale tin oxide was prepared at a concentration of (100 ml/liter-200 ml/liter-400 ml/liter) using polywater with polyglycol to obtain a white-colored suspension

Third: Preparation of fabric samples

The samples of fabrics under study are immersed in the suspended solution of Nano metric tin oxide and left for 24 hours, with stirring from time to time to ensure homogeneous distribution of tin oxide within the fabrics under study. This research uses the technology of "anti-microbial tin oxide nanoparticles" to protect surfaces exposed to contamination with microbes and organic materials. It is based on "anti-microbial tin ion technology", in which tin ions are placed on the surface to be protected, where these ions activate and release slowly when they come into contact with moisture. Existing in the surrounding environment, causing an exchange between the sodium ions present in the moisture, where the microbe is attacked, and the tin ion released at a regular rate to ensure continuity until the microbe is exterminated

TABLE 2: specification of samples under research

sample number	Weave Structure	The degree of concentration of the treatment material (ml / liter)
Sample 1	Plain weave1/1	100
Sample 2		200
Sample 3		400
Sample 4	Cotton single jersey	100
Sample 5		200
Sample 6		400

Laboratory experiments

Testing the resistance of fabrics to bacteria

The test was conducted in accordance with AATCC TM 100-2012 to measure the resistance of the fabrics used to bacterial activity. Testing two types of bacteria (Escherichia Coli and Staphylococcus).

The test was carried out using agar plates containing a culture of bacteria (Gram positive, Gram negative) and left in the incubator for 24

hours at a temperature of 37◦ followed by measuring the bacterial killing rate.

TABLE 3: Measuring the bacterial resistance of samples after treatment

sample number	Gram positive	Gram negative
	S. aureus	E. coli
1	4	1
2	10	9
3	19	15
4	8	6
5	16	12
6	26	20

Fungi resistance test

How to prepare Fungi

Mushrooms were prepared on a liquid medium containing 2g/l of malt extract, 8g/l glucose, 2g/l yeast, and 3g/l peptone. The medium was sterilized before bacterial injection (mushroom injection). It was incubated at a temperature of 28◦C for a week. The effect of the treatment solution on fungi was tested using a scanning electron microscope (SEM).

TABLE 4: Effect of Nano metric tin oxide treatment on fungi

sample number	Anti-fungal
	Aspergillus Niger (After 4 days)
1	14
2	25
3	30
4	16
5	22
6	36

RESULTS AND DISCUSSION

Treatment with Nano metric in oxide for Cotton single jersey with gram-positive bacteria achieved the highest effect of treatment up to 26 cm, and it also achieved with gram-negative bacteria by up to 20 cm, which confirms the effect of nanometer tin oxide on bacteria, and we also find that the effect of treatment on the histological structure of the plains 1/1 achieved the highest treatment effect of up to 19 cm, and it was also achieved with gram-negative bacteria by up to 15 cm, which confirms the effect of nanometer tin oxide on bacteria for histological structure 1/1. The treatment with Nano metric tin oxide for Cotton single jersey with fungi achieved the highest effect of treatment up to 36 cm, which confirms the effect of nanometer tin oxide on fungus resistance, and we also find that the effect of treatment on plain weave structure 1/1 achieved the highest treatment effect up to 30 cm, which confirms the effect of Nano scale tin oxide on the resistance of fungi to the histological composition of PAD 1/1. It is clear from the foregoing that the first hypothesis has been fulfilled by the presence of statistically significant hypotheses between the types of textile composition (single jersey knitting - plain cotton 1/1) treated with tin oxide and the resistance of bacteria. We also find that treating the fabric under study with Nano metric tin oxide at a concentration of 400 ml / liter with gram-positive bacteria achieved the highest treatment effect, reaching 26 cm for Cotton single jersey and 20 cm for gentlemen 1/1 fabrics, as it was achieved with gram-negative bacteria at a rate of up to 20 cm and comes in the second place. A

concentration of 200 ml / liter, then less resistance to bacteria to a concentration of 100 ml / liter, which confirms the effect of the nanometer tin oxide concentration on the resistance of bacteria, and this fulfills the second hypothesis. We also conclude from the results shown in Table 4 that treating the fabric under study with Nano metric tin oxide achieved a high resistance to fungus with high rates of up to 36 cm for jersey fabrics, and 30 cm for plain 1/1 fabrics, which confirms the presence of an effect of Nano metric tin oxide on fungus resistance.

RECOMMENDATIONS

The use of Nano-tin oxide for fabrics to treat underwear fabrics for children who are unable to express themselves, metric to resist bacteria and fungi

The use of Nano-tin oxide for fabrics to treat outerwear fabrics for children who are unable to express themselves as a metric for resisting bacteria and fungi

Urging the production of fabrics with special advantages for people of determination

ACKNOWLEDGMENTS

The authors are thankful to the Deanship of Scientific Research at Najran University for funding this work through grant research code Nu/NRP/SEHRC/11/1

REFERENCES

1. Ahmed, Reham Mahmoud Ahmed. The Effect of Antibacterial Preparation on the Functional and Performance Properties of Cotton Knitwear for Children, Master Thesis, Faculty of Home Economics, Helwan University. 2015; Page 3 and Page 52
2. Abdo, Noha Muhammad. Benefiting from the natural dye extracted from the tamarind plant in the manufacture of knitted fabrics used in making children's clothes," Minia University, Faculty of Specific Education. 2021; Page 35 and Page1687
3. Al-Dasouki, Heba Assem. Contribution to the treatment plan for patients with skin allergies using a cloth treated with some natural herbs, Assiut University, Faculty of Specific Education, Hawar Janoub Magazine. 2021; Page 10 and Page 211
4. Ali, Iman Mohamed. Improving the Properties of Surgical Bandages to Meet the Purpose of Functional Performance for End-Use. Master Thesis - Unpublished -, Faculty of Applied Arts, Helwan University. 2003
5. Al-Iskandarani, Muhammad Sharif. Nanotechnology for a Better Tomorrow," World of Knowledge, first edition, Kuwait. 2010; 111.
6. Al-Shariaan, Enath Lavie. the effect of antibacterial treatment on the natural properties of cotton fabrics used in the manufacture of ready-made garments. Journal of Specific Education. 2016; 4. Faculty of Specific Education, Port Said University.
7. Al-Yamani, Eman Khaled Noman. Employing anti-bacterial fabrics in kindergarten clothes, Scientific Society of Designers, International Design Journal. 2019; 8: 3-55
8. Bagheeda, Ibrahim Fawzi. An analytical study of children's drawings in the light of modern artistic methods to reduce aggressive behavior among the deaf and dumb in the kindergarten stage, Childhood and Education Journal, Alexandria University - Kindergarten College. 2019; 11: 40.
9. El Gohary, Fatma Said Hasan. Achieving the Scientific Standards to Use Lycra in the Production of Denim Fabrics for Worker Clothes, Master of Science, Faculty of Home Economics, Helwan University, Egypt. 2007.
10. Federal Environment Agency (Umweltbundesamt), Fact Sheet Nano Products (use of nanomaterial in textile), April 19, 2013.
11. Hijazi, Ahmed Tawfiq. Nanotechnology, the New Technological Revolution, Dar Treasures of Knowledge for Publishing and Distribution, Amman, first edition. 2012
12. Mahmoud, Rania. The effect of the type of weft thread material on the antimicrobial resistance of cellulosic fabrics treated with nanoparticles - Faculty of Specific Education, Journal of Research in the Fields of Specific Education. 2018; 17: 162
13. Muhammad, Ola Abdel-Salam. Opportunities and risks of nanotechnology and the changes it causes in some of the main properties related to the feeling of comfort in cellulosic materials. The Arab Society for Islamic Civilization and Arts, Journal of Architecture, Arts and Humanities. 2018; 11: 426
14. Pharaoh, Suzanne. Technology for the production and use of smart clothes with added value in the Egyptian ready-made garment factories", master's thesis - unpublished, Faculty of Home Economics, Helwan University. 2010.