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A STUDY ON CONTRIBUTION OF NANOTECHNOLOGY IN TEXTILE PROCESSING

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ABSTRACT :

Nanofabrics are textiles engineered with small particles that give ordinary materials advantageous properties such as super hydrophobicity, lotus effect, odour and moisture elimination, increased elasticity & strength and bacterial resistance Depending on the desired property a nanofabric is either constructed from nanoscopicfibres called nanofibres or it is formed by applying a solution containing nanoparticles to a regular fabric. Application of nanofabrics have the potential to revolutionize textile manufacturing. Nanotechnology is a part of science of technology about the control of matter on the atomic and molecular scale this means things that are about 100 nanometers or smaller. It includes making products that use parts very small, such as electronic devices. catalysts, and sensors etc. Nanotechnology is defined as the study of structures between 1 nanometer and 100 nanometers. A fibre that has a width of less than 1000 nanometers (1000 mm or 1 um) is generally defined as a nanofibre. Nanoparticles on the nanoscale have a very high surface area to volume ratio where as this ratio is much lower for objects on the macroscopic scale. A high relative surface area means that a large proportion of a particle's mass exists on its surface which create many special properties exhibited by nano fabrics. Nonotechnology has nano materials which can be classified into one, two and three dimensions nano-particles. This classification is based upon different properties it holds such as scattering of light absorbing X-ray transport electric current or heat. The aim of the present study is to see the role of nano technology especially in Textile Processing. The experiments were carried out. The selected sample was treated for scouring, Bleaching, Peach- finish-dyeing, Pre-testing, Nanofinishing and Post testing. The results revealed that the tear strength was found to be very good. While tearing strength was decreased and the pH content was good, &a absorbency was about 5 to 6. So it was concluded that the nanofinished fabric was good in all aspects compared with conventional fabric.

Key Words :

Textile processing - Nanofabric – Nanofinishing, Hydrophobicity.

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INDRODUCTION :

The application of nanotechnology in the field of textiles has led to the development of nanofibres, nano-compositions, nano-polymers &nanofinisher. The first commercial application of nanotech in the textile of clothing industry is found in the form of nanoparticalsome times called nano bead through a finishing process which is generally known as nonofinishing. Tiwan born Dr. David Soane Started the first nanotechnology based company Nano-Tex in 1998 to specifically catering to textile industry. The new functions which can be developed with textiles due to nanofinish are wearable and energy storage, crease resistant, good air permeability, toxic free, manufacturing cost is low, adding value to the products, & have environment friendly properties.

Types of Nanofinishes :

Sol-gel Finish : The sol gel process is used to create gel- like solutions which can be applied to textiles as a liquid finish to create nanofabrics with novel properties. The process begins with dissolving nano-particles in a liquid solvent, often an alcohol. Once dissolved, several chemical reactions take place that cause the nanoparticles to grow and establish a network throughout the liquid. It transforms the solution into a colloid with a gelatinous texture. The Sol-gel process is used in a similar fashion to make polymer nanofibres, which are long, ultra-thin chains of proteins bonded together.

Electro Spinning : It extracts nanofibres from polymer solutions and collects them to form nonwoven nanofibrics . A strong electric held is applied to the solution to change the polymer strands. The solution is put into a syringe and aimed at an oppositely charged collector plate. When the force of attraction between the polymer nanofibres and the

collector plate exceed the surface tension of the solution, the nanofibres are released from the solution and deposit on to the collector plate.

Drug-delivery:

Nanofabrics used in medicine can deliver antibiotics, anticancer drugs, proteins of DNA in precise quantities. Electro spinning, creates porous nanofabrics that can be loaded with the desire drug which are then applied to the tissue of the targeted area.

Tissue Engineering: Non woven fabrics made by electrospining have the potential to assist in the growth of organ tissue, bone, neurons, and ligaments. Polymer nanofibrics can act either as a scaffold to support damaged tissue or as a synthetic substitute for actual tissue. Depending on the function the nanofabric can be made of natural or synthetic polymers or a combination of both.

Hydrophobic Nano Finish: Hydrochloric surfaces can be produced mainly in two ways by creating a rough structure on a hydrophobic surface and by modifying a rough surface using material with low surface free energy. The water- repellent property of fabric by creating nano- whiskers, which are fluorocarbons and 1/1000 of the size of a typical cotton fiber that, are added to the fabric to create a peach buzz effect without lowering the strength. Thus a rough hydrophobic layer is formed. Flurocarbons are a class of organic chemicals that contains perfluroalkylrecidus in which hydrogenatom have been replaced by Fluroine. These chemicals have very high thermal stability is low reactivity.

Lotus Leaf Effect: The self cleaning property of plant leaves rough surface was investigated. They observed that on water repellent surface water concentrated to form spherical droplets. It came of the leaf very quickly even at light angle of inclination out leaving any reside. Lotus plant have super hydrophobic surface which are rough and textured

once water droplet fold onto them, water droplet bead up and if the surface slopes slightly, will roll off. As a result the surfaces stay dry even during a heavy shower. The droplets pick up small particles of dirt as they roll and so the leaves of the lotus plant keep clean even during light rain.

UV – Protection: Now a days UV blockers are usually certain semiconductor oxides such as Titanium Dioxide, Zinc Dioxide, Silocon dioxide of oxide and Aluminum Dioxide an commonly used. The nano particles have a larger surface area per unit mass and volume than the conventional materials, leading to the increase of the effectiveness of blocking UV radiation. UV blocking treatment for cotton fabrics was developed using the gel method. A thin layer of Tio2, is formed on the surface of the treated cotton fabric which provide excellent UV – Protection.

Anti Bacteria Finish: Neither natural nor synthelic textile fibres are resistant to bacterial or pathogenic fungi. Therefore, antibacterial disinfection and finishing techniques have been developed for many types of textiles metallic ions and compounds display a certain degree of sterilizing effect. The use of nano sized particles per unit area is increased and thus anti bacterial effects can be maximized. Nano silver particles have an extremely large relative surface area thus increasing their contact with bacteria or fungi. It is very reactive with proteins and inhibits the multiplication and growth of those bacteria and fungi which cause infection, odour, itchiness.

MATERIAL AND METHOD :

The main aim of the nano finishing is the precise manipulation of individual atoms of molecules to create a structure. The research methodology is based on experimental procedure and discussed under the following steps.

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Souring → Bleaching → Mercerizing → Peach finish → Dyeing → Pre- Testing → Nano Finish → Post – Testing

RESULT AND DISCUSSION :

Nano – Finishing – Recipe

Fluowet U D - 01 qm/lt. (wetting Agent)

NTEX 600 - 10 gm/lt. (Fluoro chemical)

Mechatech MF - 11.5 gm/lt. (Cross linker)

Phobotex JVA - 60 gm/lt. (Extender)

Ultratex REP - 15 gm/lt (silicon- solffener)

Fixade- FBE - 28 gm/lt (Catalyst)

Any Cons Acid - 105 ml/lit

The selected sample was treated with the above solution in a specially designed machine. Where the temperature was adjusted to about 100^0c to 180^0C and the speed of the machine was 20 meter/mint. and dried fully for the post testing.

Post –Testing Methods:

Tear Test: A fabric which tears easily is usually regarded as an inferior product except bandages & adhesive tapes. So it is an especial property for textile material concerning its durability. For this test the 'Shirly' Double Pendulum Ballistic Tester was used. The observations of the test are described in table No. I

Table- I Showing Results of Tear – Test

Sr.No.	Warp Way Tear		Weft Way Tear	
	Before Finishing	After Finishing	Before Finishing	After Finishing
1.	1685 gm	3157 gm	1354 gm	2753
2.	1513 gm	3042 gm	1412 gm	2802
3.	1502 gm	3020 gm	1386 gm	2783
Average	1566	3073	1384 gm	2779 gm

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The table shows that the average tearing the strength in warp way is grater than weft way and increased by 1,507 gminwarp way and 1395 gm by weft way after nanofinishing.

Tensile Strength Test :

This is the load at which the specimen breaks, usually expressed in kgs. & pound. The tensile strength of fabric is the main criteria. For this "Eureka" Single Breaking Strength Tester was used. The observations of the test are described in

Table No. II

Table – II Showing Results of Tensile Strength.

S.No.	Warp Way Tear		Weft Way Tear	
	Before Finishing	After Finishing	Before Finishing	After Finishing
1.	71.06 kg	58.84 kg	36.72 kg	29.38 kg
2.	71.08 kg	59.72 kg	35.54 kg	31.39 kg
3.	69.32 kg	57.32 kg	34.63 kg	32.58 kg
Average	70.68 kg	58.62 kg	35.63 kg	31.11 kg

The table shows that the average tensile strength in warp way is greater than weft way and it decreases by 12.06 kg and in weft way by 4.52 kg after nanofinishing.

Core pH Test : The pH is measured by pH meter. The specimen is boiled in distilled and dionized water. The water extract was collected to room temp and the pH is determined.

The pre-cove pH was 5.5 and post core pH was 6.3.

Absorbency Test: For this Teflon Test was conducted. After the nanofinish application the rating for oil is 5 and of water is 6 that means both the rating for oil of water is good and it remain after 25 washes.

Percentage Alkalinity Test : This method is used to determine the total alkali content of wet processed textile The percentage of alkali can then be calculated from the amount of acid used of the weight of the specimen. The material was having 0.05% alkalinity.

Extraction: In this water and enzyme in materials are removed from test specimen by trichloroethane and after nanofinish water repellency was observed. It was found to be very good.

CONCLUSION:

Thus the nanotechnology is playing very important role in textile processing. The textile field would be definitely benefited by the use of nanotechnology in the coming future. Nanofinish is the ideal in clothing such as outdoor clothes, sports wear, men's fashion, women's, wear, carrier apparel also in home furnishing. This technology is every developing because their environmental impact is way low & helps to the society in many ways.

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