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Brief Report

A Brief Report on Antimicrobial and UV Protection Functional Finishes on Textiles

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INTRODUCTION

In recent years, due to aggravation in health-related issues, the collaboration between medical personnel and textile chemical technology has led to the evolution of innovative medico-functional applications for textiles. Such applications include the incorporation of pharmaceutical herbal ingredients into the clothing to protect the skin and human body from environmental hazards such as Ultra Violet (UV) rays and microbes. Many chemical substances such as quaternary ammonium compounds which act as antimicrobial agents and titanium dioxide and ceramic materials which are UV protective's available for textile finishing [1]. These products are of synthetic nature; however, natural products are also gaining significant importance. Application of natural extracts not only provides protection from environmental hazards but also safeguards the environment, prevents pollution and promotes eco-friendly processing of textiles. Use of such products ensures the health benefits to the individual as well as the masses. Such textiles prevent pollution by avoiding the use of common lethal chemicals. The textile industry has continued to search eco-friendly processes as substitutes for toxic textiles [2]. In last decade, an increasing interest has been noticed in environmentally friendly and biodegradable functional reagents applications.

In a changed world of pandemic and global warming, functional fabrics are trending as they include finishes with antibacterial and UV protection capabilities. By imparting antimicrobial efficiency and ultraviolet protection to textiles using different natural products over synthetic chemicals is a breakthrough for textile users to compete in the tough global market place. This will add values to textile in the direction of protection and safety [3]. This mini review paper is directed toward novel finishing of textiles with future trends and challenges to meet functional and environmental demands to extend their high impart applicable properties. UV protection and Antimicrobial functionality imparted to textile materials provides protection to human being from ill effects of UV radiations and various microorganisms, respectively. Synthetic as well as natural bioactive products are available for this purpose. Various application techniques are known to impart such functionality.

UV PROTECTIVE TEXTILES

UV protective textiles have recently become the focus of great interest, particularly in connection with environmental degradation on ozone layer depletion. Nowadays in an increasingly health conscious era, there is a growing demand for casual and active apparel textiles with high comfort and greater levels of UV protection with ecofriendly finishes [4] (Table 1).

Table 1: UPF classification system according to AS/NZS and ASTM standards.

Sr. No.	UPF range	UVR protection category	Effective UVR transmission(%)	%UV Radiation Blocked
1	40-50, 50+	Excellent protection	<2.5	97.5 or more
2	25-39	Very good protection	4.1 to 2.6	96-97.4
3	15-24	Good protection	6.7 to 4.2	93.3-95.9

UV protected fabric properties can enhance the performance and lifespan of consumer products. Organic UV absorbing agents have attractive features, such as low cost, high transparency, and ease of application. However, they suffer from critical drawbacks, such as poor light fastness and toxicity. Inorganic UV absorbing agents have advantages over organic agents in terms of photostability and safety. High transparency can be obtained by reducing the size of particles to nanoscale. Nanosize particles offer additional advantages, such as enhanced UV shielding effect and higher affinity toward fiber surfaces. Future challenges lie in how to reduce or eliminate the photocatalytic capability from the inorganic nano UV blockers, and improvement of wash fastness of organic UV absorbers and inorganic UV blockers in achieving practical UV blocking textiles. Potentially challenging issues are the health and safety risks of manufactured nanoparticles. UV protective textiles with multifunctionality can be realized in the near future. Also,

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excessive avoiding of sunlight causes vitamin D deficiency because UVB portion converts our cholesterol into vitamin D [5].

VARIOUS FACTORS AFFECTING UV PROTECTION ON TEXTILE MATERIALS

UV radiation causes degradation of textile materials, due to excitations in some parts of the polymer molecule and a gradual loss of integrity. UV radiation is also responsible for causing many skin problems, including sunburns, age spots, wrinkles, freckles, allergic rashes and UV radiation is the major cause of skin cancer. During selecting garments we should consider the following factors. A highly dense, weight fabric can save us from the harmful effect of UV rays [6].

Effect of clouds and elevation interface on UV transmission, it has been determined that for each kilometer above sea level, there is a 6% increase in the magnitude of UV. It is also known that UV radiation is absorbed by clouds, which reduces the intensity of UV that hits Earth's surface. According to the 'Environmental Protection Agency(EPA)':100% of UV transits when no clouds are present, 89% transmitted when clouds are spotty, 73% transmitted through broken clouds and 31% transmitted when it is completely overcast [7].

MICROORGANISMS AND ANTIMICROBIAL TEXTILES

The purpose of imparting antimicrobial activity to textiles is to protect the material from microbial attack, prevent the transmission and spreading of pathogenic microorganisms inhibiting odour from microbial degradation. Ideal antimicrobial finishing needs to fulfill a number of requirements in order to achieve the maximum benefit from antimicrobials functionalized textile products [8].

Along with the growth, antimicrobial industry players have a set of challenges too. Out of all the market challenges, the biggest one is strict environmental regulations on antimicrobial fibers made by hazardous chemicals. The antimicrobial fabric of the market also depends on the price and availability of raw materials. These raw materials include cotton, which is treated with antimicrobial agents such as silver, zinc, copper, quaternary ammonium compounds. Longer durability functional finishes is very essential to be achieved by imbuing finishing agents into the structure of fibers rather than depositing them on the surface [9].

Among all the methods Pad-dry-cure method (using crosslinking agents), nanotechnology, exhaust method and microencapsulation are widely used to impart natural finishing agents. Chitosan [poly-_ (1-4)-d-glucosamine], a cationic polysaccharide, obtained by alkaline deacetylation of chitin, the principal exoskeletal component in crustaceans provides good results, due to its combination properties such as water binding capacity, fat binding capacity, bioactivity, biodegradability, non-toxicity, biocompatibility, acceleration of wound healing, antifungal activity and radiation protective. Controlled release systems like microencapsulation and surface modification systems like plasma are also very good processes for eco-friendly finishes. The plasma technique has been proved very effective as it consumes low energy and chemicals and there is no problem with the disposal of waste. Microcapsule of natural agents is a tiny capsule and its preparation procedure, called encapsulation, can endow various traits to the core material in order to add secondary functions and compensate for shortcomings. Various biocides, depending on the particular fiber, can be used either as finishing agents or incorporated into the fiber during extrusion [10].

A possible future development for both would be the microencapsulation of natural biocides. Benefits may include better durability and greater safety. Natural products, like neem extract, aloe vera extract and chitosan, can be effectively used as protective agents; further research is to be carried out for their successful commercial use. The current efforts in the development of new technologies for implementation of sustainable biopolymers in the real market of antimicrobial textiles do not guarantee economic viability yet. Nevertheless, application of these agents in the development of bioactive textiles is a promising prospect. The main problem is the availability of natural products in required quantity and compared to synthetic it can withstand less number of wash cycles. But the Implementation of natural agents as antimicrobial and UV protective agents is a cost-effective method when it is obtained from natural sources [11].

The sources of natural bioactive products are plants, animals and microorganisms. Among them, natural herbs (plant extracts) are more reliable for its renewability and therefore considered as catalyst for human welfare. They are the primarily required materials for health care system in some parts of the world. Natural biocides have their own self defense mechanism and protect themselves from UV rays and microbes due to the presence of substances known as phytochemicals. Thus, natural bioactive finishes gives best protective results against harmful UV radiation, bacteria and fungi.

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