

# Unique surface coating with nano particles for multi-function textiles

## 나노미립자 코팅에 의한 복합다기능 Smart-tech 의류소재

Kim Sideuk, Park Beop, Koo Kang, Park Youngmi<sup>1,\*</sup>

School of Textiles, Yeungnam University, <sup>1</sup>Research Institute of Clothing & Textile Science, Yonsei University

### 1. Introduction

Nanotechnology refers to manipulating matter atom by atom where measures are made in nanometers. The goal of nanotechnology is to construct minuscule machines with extraordinary properties that promise to radically change manufacturing, information technology, and medicine over the next decade creating a passage of future innovations. Nanotechnology allows nanoscale materials to be embedded into existing fibers or mixed with textile to create fibers with a range of innovative properties affecting performance and a range of sensory aspects. Therefore, nanotechnology is being employed in textile industry to develop fibers with permanent properties heretofore only available as textile coatings. A bicomponent antibacterial fiber consisting of a PP core with a PP/Ag sheath has demonstrated effectiveness against microorganisms including *Staphylococcus aureus*. The same technology is being used to develop fibers to resist countless bacterial, microbial and other toxic agents.

This study was focused on development of multi-functionalized sports wear which complex coated with natural nano-sized antimicrobial agent, and then investigated its several performance.

### 2. Experimental

Used materials in this research is natural BINEX(BINEX Co, Korea), synthetic VINYZENE(10, 10'-oxybisphenoxyarsine (OBPA), Nomura Jimusho, INC., Japan) and the four different kinds of nano materials is supplied by KINGPRIZE (Korea). Before coating, the fabrics with antimicrobial agent and nano agent was tested by water repellency, water resistance and bonded strength, and then the EDS(HORIBA, EX-250, Japan), DSC (Dupont, TA Instrument 2010, USA), water penetration resistance and water moisture transpiration of coated fabrics were measured.

### 3. Result and discussion

The alga-extracted natural antimicrobial agent was selected with named BINEX-A. After the experimental repeating in laboratory scale, it has developed that the coating adaptability of nano particle to fabric is much better in dry coating than wet coating. In an earlier report, dry coating as well as wet coating, we give recognition that the waterproof-breathable fabric was adequate to cold-resistance by these complex coating based on thermal enhanced materials, showing the increasing of 20% of thermal efficiency. Even though we obtained 99.9% of antimicrobial activity, the complex-coated results were reconsidered that the most essential needs in fabric was water-vapor permeability and water-penetration resistance, as compared to wet coating. In results, the control material for antimicrobial additives with synthetic Vinyzene, no physical change before and after coating found as add-on of BINEX-A. As seen in Table 1, in DSC results, nano based materials preserved thermal stability containing absorption latent heat. However, the far-infrared emission rate and energy of Ag based nano materials come to no good results.

**Table 1.** Far-infrared emission rate, emission energy, endothermic and exothermic energy of nano-coated fabrics

Nano materials	Main ingredient	Emission rate (5~20 $\mu$ m)	Emission energy (W/m <sup>2</sup> · $\mu$ m)	Endothermic energy (J/g)	Exothermic energy (J/g)
Control	-	0.86	330	21.50	23.93
AZT	Ag nano	0.83	321	21.77	23.19
ASI	Ag nano	0.84	322	23.14	23.35
CACO	Carbon	0.90	346	22.65	23.81
SIW-20	Silica	0.89	342	21.47	21.06

### 4. Conclusions

The natural antimicrobial agent used in this technology consist of extraction of algae, and the nano materials, whose protecting to environment change take place in a temperature range close to that of the human skin. For coating applications, the nano-sized materials and BINEX with PCM microcapsules are dispersed in a PU coating which is then applied to a fabric. Textile structures with nano capsules for multi-functional clothing have following interactive functions: absorption of surplus body heat; an insulation effect-caused by heat emission of the PCMs and nano materials in to the textile structure; a thermoregulation effect-which keeps the microclimate temperature nearly constant; antimicrobial activity which keeps the antimicrobial activity up to 99.9% and good peel strength, water resistance as well.