전기방사를 이용한 PS/Silver nanoparticles 복합체의 제조

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Preparation of PS/Silver Nanopaticles Composites vis Electrospinning

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1. Introduction

Polymer Polystyrene (PS), transparent to a little bright opaque, colorless and brilliant material, is one of the most useful plastics. It has very high electrical resistance and dielectric loss [1-5]. Silver has been well proved for its antibacterial properties and thus is widely used in medical and health care [4,7]. Silver is skin friendly and does not cause any itching [3]. Moreover, chloroform $CHCl_3$ has been a more appropriate solvent for producing electrospun biomaterials. Its low boiling point decreases the chances of solvent remaining trapped in the fibers [1,4,5,6]. The excellent surface-area-to-volume ratio and sub-cellular scale nanofibers produced by the electrospinning make nanosilver particles best choice for its use in health care. In this study, we prepared polystyrene/silver nanoparticles composite using electrospinning process.

2. Experimental

2.1. Materials

Polystyrene was purchased from Sigma-Aldrich. SNSE (Super Nano Silver Ethanol) colloid was supplied by NP-Tech Co. Ltd., Korea for this study. All chemicals were used without further purification.

2.2. Preparation of Polystyrene/silver nanoparticles composites

To conduct this study, 20% w/w solution was prepared by dissolving polystyrene chips/pellets and ethanol based silver nanoparticles colloid in Chlorofrom ($CHCl_3$) at room temperature and solution was magnetically stirred for 24 hours. The polystyrene/silver nanoparticles solution was pumped with a 10 ㎖ syringe by using a microsyringe pump at the rate of 1.5 ㎖/hr. The needle was charged to 20 KV. The polymer jet was electrospun using 21 gauge syringe on a grounded aluminum foil, positioned 20 ㎝ from needle tip, as a collector to get the polystyrene/silver nanoparticles composites.

2.3. Characterization

The morphology, such as crosss-section and longitudinal surface, of gold coated polystyrene/silver nanoparticles composites was observed by scanning electron microscope (SEM). The antibacterial efficacy of the polystyrene/silver nanoparticles composites was quantitatively evaluated according to the test method AATCC 100-2004.

3. Results and discussions

The morphology of the polystyrene/silver nanoparticles composites was shown by SEM images, and they had very fine and smooth surfaces and circular cross section with the nano-meter range diameter. The result of antibacerial efficacy of polystyrene/silver nanoparticles composites showed good bacterial reductions against *S. aureus* and *K. pneumoniae,* respectively.

4. Conclusions

We prepared polystyrene/silver nanoparticles composites by the electrospinning process. These polystyrene/silver nanoparticles composites had a diameter of nano scale and exhibited good round shape and smooth nanofibers. These polystyrene/silver nanoparticles composites also proved good antibacterial efficacy against *S. aureus* and *K. pneumoniae,* respectively, therefore polystyrene/silver nanoparticles composites possess good potential for future biomaterials and health care applications.

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