Layer-by-Layer 자기조립을 이용하여 키토산과 알긴산이 코팅된 나노섬유 멤브레인의 세포 친화도

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Cell Affinity of Chitosan and Alginic Acid Sodium Salt Coated Nanofibrous Membrane via Layer-by-Layer Self-assembly

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1. Introduction

Recently, there has been increasing interest in electrospinning to prepare much smaller fiber diameters for many industrials. Due to the small size of the electrospun polymer nanofibers, the membranes collected from electrospun nanofibers possess a large surface area per unit mass and a very small pore size [1-2]. Chitosan and alginic acid sodium salt as a polyelectrolyte were repeatedly coated on a nylon 6 nanofiber surface via Layer-by-Layer (LbL) self-assembly. Both alginic acid sodium salt and chitosan were biodegradable, biocompatible polymers and have been studied extensively owing to its unique properties in various tissue engineering applications. In this study, we report cell affinity of the polyelectrolyte multilayer nano-coated electrospun fiber mats with different number of layers.

2. Experimental

2.1. Materials

A high voltage power supply (CPS-60, K02v1, Chungpa EMT Co., Korea) is used as a source of electric field. Nylon 6 (Kolon Industries Inc., Korea) solution of 22 wt% dissolved in mixture (8:2, v/v) of formic acid (Showa Ltd., Japan) and acetic acid (Showa Ltd., Japan) and was supplied through a plastic syringe. The polyelectrolytes were composed of polyethyleneimine (PEI, Mw ~ 25 kDa, Aldrich), chitosan (medium molecular weight 75-85% deacetylated, Aldrich) and alginic acid sodium salt (viscosity of 2% solution at 25 ℃ : ~250 cPs, Aldrich)

2.2. Methods

The polyelectrolyte multilayer nanocoating was carried out by LbL assembly of layers of chitosan and alginic acid sodium salt onto nylon 6 membrane as a template. For effective dipping procedures in water, PET films as a supporter were used and sandwiched. And the adsorption steps from PEI, chitosan and alginic acid sodium salt were repeated until the desired number of bilayer is reached.

3. Results and Discussion

The morphology of pure nylon 6 fibers is regular and a narrow distribution with an average diameter of 90 nm. After nanocoating polyelectrolyte multilayer, a regular and smooth fiber surface was observed and it was indicated that a uniform polyelectrolyte multilayer was deposited onto electrospun nylon 6 fibers.

Chondrocyte proliferation on the various films was investigated after 1 to 3 days, with the results shown in Figure 1. 1 bilayer and 3 bilayer membranes produced the significant rate of the highest cell proliferation among the various membranes. The proliferation of control, 1 bilayer and 3 bilayer was higher than 5L and 10L is the lowest among the groups in 3 days.

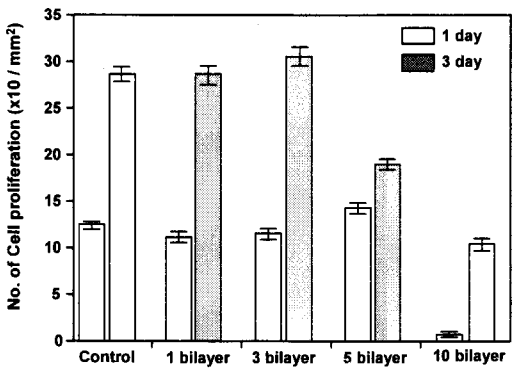

Figure 1. The number of proliferation chondrocyte in the cell-free area (mm^2) with different bilayers.

4. Conclusion

Utilizing the developed concept of LbL self-assembly, electrospun nylon 6 fibers were modified to use as tissue engineering scaffolds. Results demonstrated shows with 5 bilayers modification significant increase in cell attachment were found. The interesting results of proliferation in 1 and 3 bilayer but with low cell attachment need were optimization to make mats of more cell friendly.

This appearance may result in biological activity and cell matrix condition by different hydrophilicity. And the results could be considered as tentative alternatives to improve the bio-mimetic tissue engineering scaffolds with three-dimensional structure.

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6. References

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