

# ELECTROSPINNING OF HIGH MOLECULAR WEIGHT POLY(ACRYL AMIDE)/POLY(VINYL ALCOHOL) BLEND SOLUTION

Won Seok Lyoo<sup>1</sup>, Hyun Kyu Lee<sup>1</sup>, Young Jae Lee<sup>1</sup>, Kun Young Kwak<sup>1</sup>, Eun Joo Shin<sup>2</sup>, Yong Sik Chung<sup>3</sup>, Yeong Soon Gal<sup>4</sup>, and Seok Kyun Noh<sup>5</sup>

<sup>1</sup> *Division of Advanced Organic Materials, School of Textiles, Yeungnam University, Gyeongsan 712-749, Korea*

<sup>2</sup> *Polymer Gel Research Cluster Center, Yeungnam University, Gyeongsan 712-749, Korea*

<sup>3</sup> *Department of Textile Engineering, Chunbuk National University, Jeonju 561-756, Korea*

<sup>4</sup> *College of General Education, Kyungil University, Hayang 712-701, Korea*

<sup>5</sup> *School of Chemical Engineering and Technology, Yeungnam University, Gyeongsan 712-749, Korea*

**KEYWORDS:** PVA, PAAm, Blend, Electrospinning, Nanofiber

## INTRODUCTION

Electrospinning is a fiber spinning technique that produces polymer fibers of nanometer to micrometer size in diameters. It has rapidly developed because of the interesting physical, chemical, and biological properties. In recent years, scientists and engineers working on environmental and industrial problems have renewed their interest in water-soluble polymers and tried to develop aqueous or solvent-free techniques to exclude environmentally hazardous organic solvents. Polyacrylamide (PAAm) is one of the most widely used and technically important water-soluble and synthetic polymers. PAAm has been used as flocculent for portable water and wastewater treatment in industries like mining, papermaking, tanning, and so on.

Poly(vinyl alcohol) (PVA) is typically a water-soluble polymer, a good nontoxic material for human use, and a biodegradable polymer. It is a coating in textiles, a stabilizer in industrial fields, polarizing films, sizers, and adhesives for biomaterials, drug delivery systems, contact lenses, and nanomaterials, and its uses continue to expand.

## EXPERIMENTAL

### Materials

PAAm was polymerized redox-initiated radical polymerization in moderately frozen water solution. Initiator was used *N,N,N',N'*-tetramethylethylenediamine (TMEDA) and ammonium persulfate (APS). The molecular weight of PAAm was  $3.5 \times 10^6$  g/mol. PVA was purchased from DC Chemical Co., Ltd., Seoul, Korea. The number-average degree of polymerization ( $P_n$ ) was 1700 and its degree of saponification was 99 %.

### Electrospinning of PAAm/PVA blend solution

Different blend solutions of PAAm and PVA were prepared by mixing PAAm solution and PVA solution in the volume ratios of 10/0, 3/7, 5/5, 7/3 and 0/10. A copper wire anode immersed in the PAAm/PVA blend solution was connected to the high-voltage power supply. Tip to the collector distance (TCD) were 20, 30, and 40 cm and applied voltages were 10, 15, and 20 kV.

## Characterization

The structure and morphology of PAAM/PVA blend nanowebs were observed with scanning electron microscopy (SEM, S-4100, Hitachi. Co., Tokyo, Japan). A small section of the fiber mat was placed on the SEM sample holder and sputter coated with gold (E-1030, Hitachi. Co., Tokyo, Japan). The thermal behavior of PAAM/PVA blend nanowebs were investigated with differential scanning calorimetry (DSC, TA 2010, TA Instrumental Inc., New Castle, Delaware).

## RESULTS AND DISCUSSION

In this study, PAAM and PVA blend solution was electrospun. Electrospun webs of PAAM/PVA blend solution were compared with homo-PAAM web under same condition.

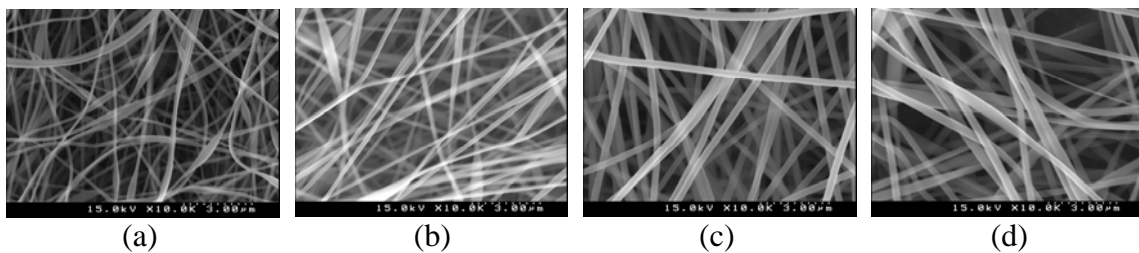


Fig. 1: SEM photos of electrospun webs under 15kV and 30 cm at 2.5 wt%. (a) Homo-PAAM, (b) PAAM(7)/PVA(3), (c) PAAM(5)/PVA(5), (d) PAAM(3)/PVA(7).

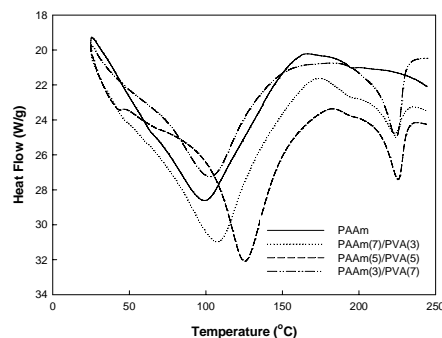


Fig. 2: DSC thermograms of PAAM and PAAM/PVA blend webs under same electrospinning condition.

## ACKNOWLEDGEMENTS

This work was supported by grant No. RTI04-01-04 from the Regional Technology Innovation Program of the Ministry of Commerce, Industry, and Energy (MOCIE).

## REFERENCES

1. Zhao, Y. Y, Yang, Q. B., Lu, X. F., Wang, C. and Wei, Y., "Study on Correlation of Morphology of Electrospun Products of Polyacrylamide with Ultrahigh Molecular Weight". *Journal of Polymer Science Part B Polymer Physics*, Vol. 43, No. 16, pp 2190-2195, 2005.