Preparation and applications of antimicrobial *m*-aramid nanofibrous membrane

Daun Jung, Jaewoong Lee[1], Samsoo Kim

School of Textiles, Yeungnam University,
Gyeonsai, Gyeongbuk, 712-749, South Korea
[1]Kolon Industries, Inc., Gumi, 730-030, South Korea
E-mail: clary8318@yu.ac.kr

1. INTRODUCTION

Nanofibrous membrane produced by electro-spinning has fine and porous structure. In addition it could possess high-efficient filtration rate.

N-Halamines contain nitrogen and one or more covalent bonds between nitrogen and halogen especially chlorine. *m*-Aramid as a precursor of *N*-halamines has antimicrobial properties after chlorination and has stable retention of antimicrobial activity.

In this study, m-aramid nanofibrous membrane was prepared by electrospinning and the antimicrobial membrane was employed to purify contaminated water. The morphology of nanofiborous membrane was determined by Scanning electron microscopy (SEM). Pore size and liquid permeability was measured. Furthermore, the antimicrobial efficacy of the membrane was performed against Gram-negative and Gram-positive bacteria.

2. EXPERIMENTAL

Preparation of m-aramid membrane

m-Aramid fiber (15g) was added in 100mL of DMAC followed by adding $CaCl_2$ (10g). The solution was stirred 4 h at 120°C until a uniform solution.

The *m*-aramid membrane was prepared by electro-spinning. (voltage 20kV, tip to collector distance 20cm, 1.5mL/h). Sodium hypochlorite (NaOCl) which was diluted with distilled water (15%), was applied for chlorination. The *m*-aramid membrane was soaked in the solution (pH 7.5) for 60 minutes at room temperature. After washing with distilled water, the chlorinated samples were dried at 45°C in 2 h.

3. MEASUREMENT

3.1 The surfaces of membrane were shown in the SEM images

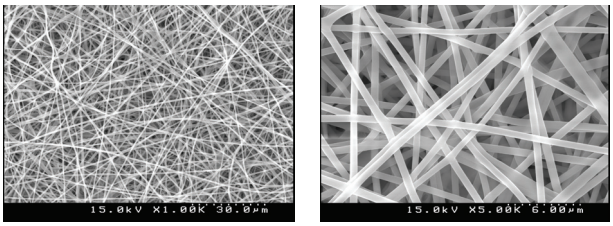

Fig. 1. SEM images of m-aramid membrane.

3.2 PMI capillary flow porometer shows pore distribution and pore size exists and liquid permeability.

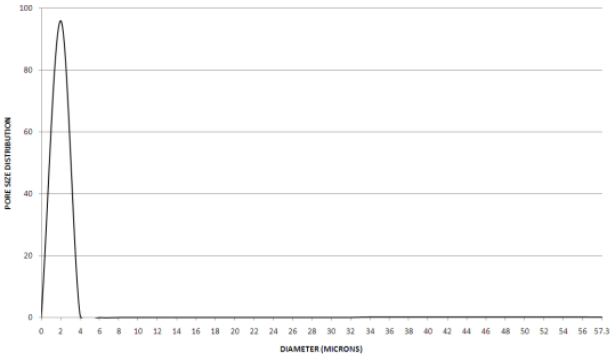

Fig. 2. Pore size distribution of *m*-aramid membrane

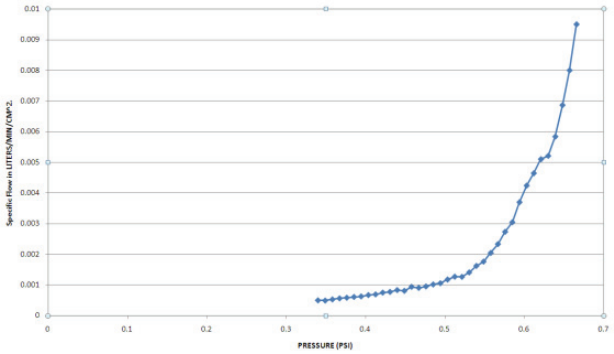

Fig. 3. Liquid permeability of *m*-aramid membrane

3.3 After chlorination, FT-IR spectra of unchlorinated and chlorinated *m*-aramid membrane were compared.

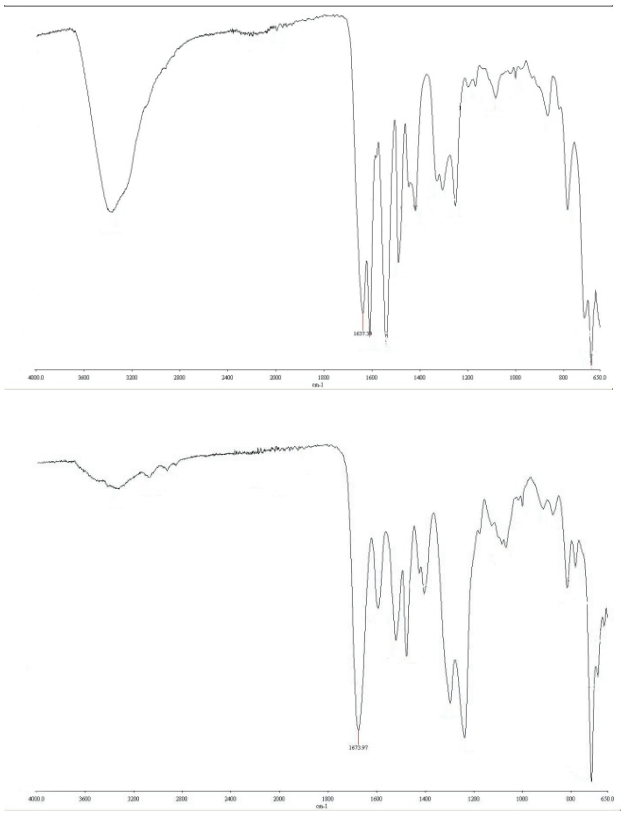

Fig 4. FT-IR spectrum of (a) unchlorinated *m*-aramid membrane (b) chlorinated m-aramid membrane

3.4 Oxidative chlorine contents (Titration)
Oxidative chlorine contents of *m*-aramid membrane were measured.

Table 1. $[Cl^+]$% of chlorinated m-aramid membrane

Chlorinated *m*-aramid membrane	$[Cl^+]$%
Before filteration	5.1
After filtration	1.2

4. REFERENCES

[1] Lirong Yao, Jooyong Kim; Electrospinning of m-aramid polymer by dissolving in LiCL/DMAc solution. Formerly Journal of The Korean Fiber Society, 42-1, 305(2009)

[2] Jiyoon Baek, Eunyoung Song, Jaewoong Lee, SamsooKim; Properties of Antimicrobial Membrane Using an *N*-Halamine Material. The Korean Society of Dyers and Finishers, 21-4, 57-62 (2009)