

# Nanoparticle filtration by electrospun multifunctional TiO<sub>2</sub>-fly ash/polyurethane fiber

Han Joo Kim<sup>1</sup>, Hem Raj Pant<sup>2,3\*</sup>, **Jun Hee Kim<sup>2</sup>**, In Gi Kim<sup>2</sup>, Bo Sang Hwang<sup>2</sup>, Sung Won Ko<sup>2</sup>, Eun Kyo Kim<sup>2</sup>, Cheol Sang Kim<sup>1,2\*</sup>

<sup>1</sup>Division of Mechanical Design Engineering, Chonbuk National University, Jeonju 561-756, Republic of Korea

<sup>2</sup>Department of Bio-nano System Engineering, Chonbuk National University, Jeonju 561-756, Republic of Korea

<sup>3</sup>Department of Engineering Science and Humanities, Institute of Engineering, Pulchowk Campus, Tribhuvan University, Kathmandu, Nepal

[jun8741@naver.com](mailto:jun8741@naver.com)

## Abstract

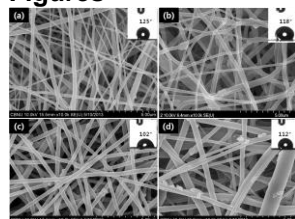
In this study, we demonstrate the fabrication of multifunctional composite polyurethane (PU) membrane from a sol gel system containing TiO<sub>2</sub> and fly ash (FA) nanoparticles (NPs). The adsorptive property of FA and photocatalytic property of TiO<sub>2</sub> can introduce different functionalities on PU mat for water purification. Different types of PU nanofiber mats were prepared by varying the composition of NPs in blend solution. FE-SEM, TEM, TGA, XRD, UV-visible spectra, and water contact angle measurement confirmed the incorporation of FA and TiO<sub>2</sub> NPs on/into PU nanofibrous mat. The influence of NPs on PU membrane was evaluated from the adsorption of heavy metals (Hg, Pb), removal of dyes (methylene blue), antibacterial activity, and water flux. The improvement of all these activities is attributed to the adsorptive property of FA and photocatalytic/hydrophilic property of TiO<sub>2</sub> NPs. Therefore, as-synthesized composite membrane can be utilized as an economically friendly filter media for water purification.

## References

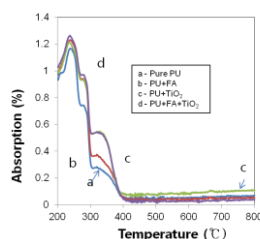
[1] N.A.M. Barakat, M.F. Abadir, F.A. Sheikh, M.A. Kanjwal, S.J. Park, H.Y. Kim, Polymeric nanofibers containing solid nanoparticles prepared by electrospinning and their applications, *Chem Eng J* 156 (2) (2010) 487-495.

[2] N. Bhardwaj, S.C. Kundu, Electrospinning: A fascinating fiber fabrication technique, *Biotechnology Advances* 28 (3) (2010) 325-347.

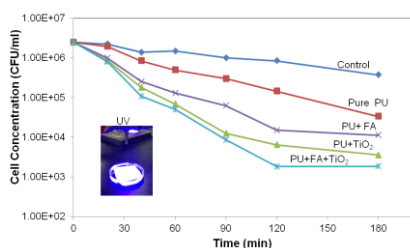
## Figures



**Figure 1.** FE-SEM images of pure PU (a), FA/PU (b), TiO<sub>2</sub>/PU (c), and TiO<sub>2</sub>-FA/PU (d) mats. Insets are their corresponding contact angles after 9s on the surface of mats.



**Figure 2.** UV-visible absorption spectra of pure PU (a), FA/PU (b), TiO<sub>2</sub>/PU (c), and TiO<sub>2</sub>-FA/PU (d) mats.



**Figure 3.** Antibacterial efficiency of different mats on *E. coli* bacteria under UV radiation.