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Electrospun mat swelling: An ally to improve membrane rejection ratio

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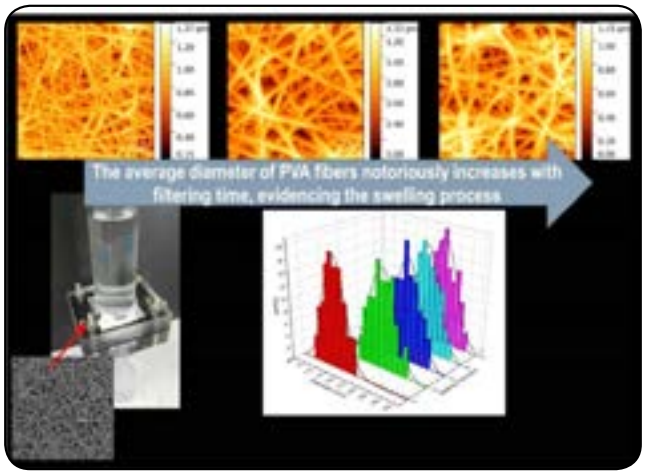
Electrospun polymer fibers have been widely applied as filtration media. The meshes pore size, is usually estimated in literature from microscopy images. However, if the polymer undergoes a swelling process in the filtrated liquid this will change, causing differences in both the particle size it is able to retain and the permeation rate. In this work the effect of polymer swelling on electrospun PVA mats morphology when used as water filters is studied. Electrospun mats were employed to filter pure water during different times (0, 5, 10, 30 and 60 minutes), and observed immediately after that using an AFM. The average diameter of PVA fibers notoriously increases (about a 68%) with filtering time after a short transitory stage, evidencing the swelling process. This effect causes a decrease in the effective spaces between fibers, through which water can permeate. On the other hand, the RMS roughness of the meshes was calculated by the program NanoSurf C3000 over an area of 10 x 10 microns for each image taken. Again a strong change in this parameter is observed, showing a significant decrease in the roughness probably caused by the pressure produced by the water column and the swelling. It is interesting to study how the water permeated volume changes as a function of time during the first transitory stage. To evaluate this, the volume of water passing through the membrane was measured for 90 minutes. During a first stage the system goes through a transitory stage in which the flow at which the water permeates is diminishing. This result is consistent with both the increase in diameter and the change in mesh density.



Recent Publications:

1. Zeytuncu, B., Ürper, M., Koyuncu, İ., & Tarabara, V. V. (2018). Photo-crosslinked PVA/PEI electrospun nanofiber membranes: Preparation and preliminary evaluation in virus clearance tests. Separation and Purification Technology 197:432-438
2. Lee, K. S., Eom, K. H., Lim, J. H., Ryu, H., Kim, S., Lee, D. K., & Won, Y. S. (2017). Aqueous Boron Removal by Using Electrospun Poly (vinyl alcohol) (PVA) Mats: A Combined Study of IR/Raman Spectroscopy and Computational Chemistry. The Journal of Physical Chemistry A, 121:2253-2258.
3. Xia, T., Bian, Y., Zhang, L., & Chen, C. (2018). Relationship between pressure drop and face velocity for electrospun nanofiber filters. Energy and Buildings 158:987-999.
4. Zhou, M., Tang, W., Luo, P., Lyu, J., Chen, A., Qiao, L., & Nover, D. (2017). Preparation of ureido-functionalized

PVA/silica mesoporous fibre membranes via electrospinning for adsorption of Pb2+ and Cu2+ in wastewater. Water Science and Technology 76:2526-2534.

5. Ridzuan, M. B., Daud, Z., Ahmad, Z., Nordin, M., Amira, N., & Zakariah, Z. (2018). Development of Natural Fiber as a Filter Media in Removing Organic Pollutants from Greywater. In Defect and Diffusion Forum (Trans Tech Publications) 382:302-306.

Biography

Dr. García currently belongs to the CIHIDECAR-CONICET Carbon Hydrates Research Center, where she has worked extensively in the development of new composite materials, Initially starch films and starch nanocrystals for packaging were developed, then making interesting modifications that can be used as reinforcements in different polymer matrices. At this moment, she is developing new materials incorporating nanocapsules that allow the controlled release of different active compounds that make it attractive for its application in different matrices.

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