On-Off switching in the grafted nanopores in polymeric track-etched membranes for selective filtration

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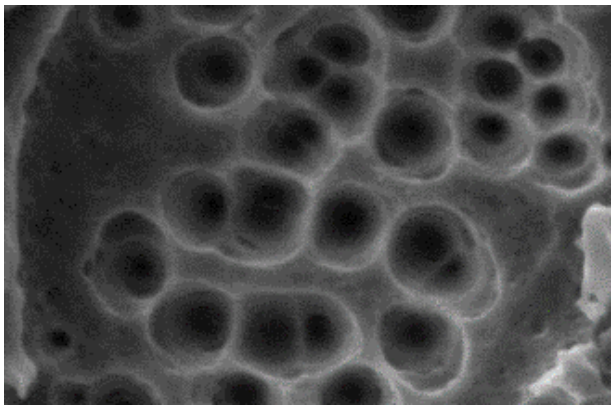
Abstract: Stimuli-responsive hydrogels and membranes have emerged in recent years as a unique class of materials that can offer many advantages over the conventional ones in a number of applications in selective filtration techniques. Synthetic nanopores have also significant potential applications in biosensing and genomics. The main advantages of this technique over current technologies are its high speed, very low detection limit, together with the capability to analyze biomolecules without prior marking, quantitative amplification, or chemical modification. Separation of ions and proteins is also of interest in other applications such as kidney dialysis. In this case, heavy ion beam irradiation followed by chemical etching provides a solution for the fabrication of hollow membranes. Polymeric templates with parallel pores of controlled diameter are produced, on which a suitable monomer is polymerized. After decomposition of the template a hollow membrane is formed. These artificial membranes are presently the ones offering the characteristics the closest to the natural systems. In the present work the Nylon-66 Track Etched Membranes were used and were grafted with Acrylic Acid using chemical grafting method with AIBN (azobisisobutyronitrile) as an initiator.

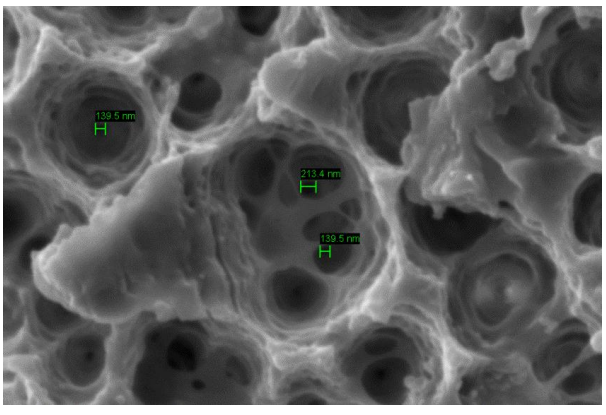
The membranes were characterized using SEM. The change in the pore size was studied as a function of pH. The membranes exhibited excellent on-off switching mechanisms.

Pore size = 1.6 micron Pore size = 139 – 215nm after grafting

(a) Irradiated Film (b) Acrylic Acid grafted film

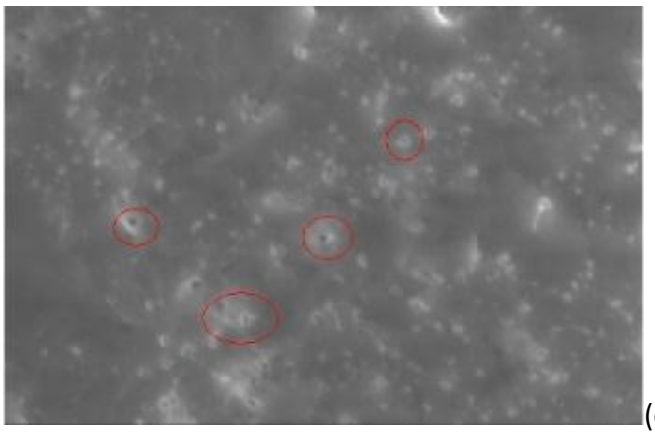
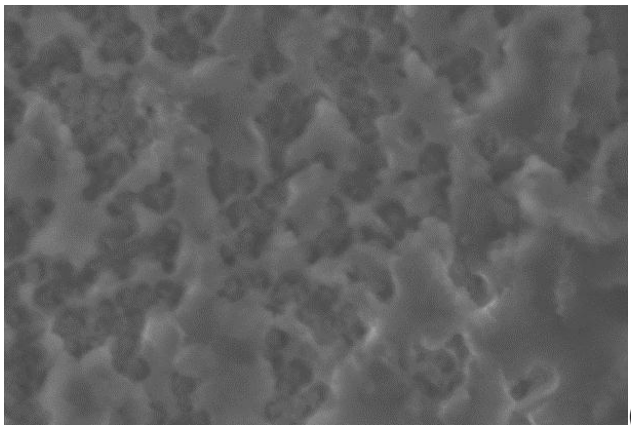


(a)



(b)

5th International Conference on Nanotechnology for Better Living (NBL-2019), Jointly organized by National Institute of Technology (NIT) Srinagar and Indian Institute of Technology (IIT) Kharagpur; April 7 – 11, 2019 at SKUAST, Shalimar Srinagar, Jammu and Kashmir, India; Editor: Dr. M. A. Shah and Prof. P. Banerji, ISBN:978-81-939516-0-6; Published by Applied Science Innovations Pvt. Ltd., Pune, Maharashtra, India.

 (c)  (d)

c) Partially Closed pores at pH 4.5 d) completely closed pores at pH 7.5

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