Nanostructured surfaces

Polyelectrolyte modification of nanofiltration membranes for biofouling reduction

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Membrane fouling is the main problem at application of nanofiltration (NF) membranes for water treatment [1]. In this study we have used layer-by-layer deposition of polyelectrolyte multilayers for preparation of low-fouling composite NF membranes [2]

Four anionic polyelectrolytes such as: poly(sodium 4-styrene sulfonate), poly(vinylsulfonic acid, sodium salt), poly(4-styrene sulfonic acid-co-maleic acid) sodium salt, poly(acrylic acid) and three cationic polyelectrolytes such as poly(diallyldimethylammonium chloride), poly(ethylenimine) and poly-(hexamethylene biguanide were used for modification NF-90 membrane. The Fourier transform infrared technique was used to confirm deposition of modified layers on the surface of initial membranes. It was found that a degree of membrane modification depend on modification time, a number of modified layers and on chemical type and molecular weight of used polyelectrolytes.

With atomic force microscopy it was shown that the surface membrane roughness decreases significantly as the number of modified layers increases. The polymer deposition also leads to hydrophilization of the membrane surface due to hydrophilic nature of modified polymers. The smoothening and hydrophilization of surface morphology is expected to improve the antifouling capability of the polyelectrolyte multilayered NF membrane.

Using a confocal imaging of the growth of *P.aeruginosa* bacteria on the membrane surface, a much larger number of dead cells was found on the surface of initial NF membranes compared with modified samples due to the bactericidal properties of deposited polyelectrolyte layer on the membrane surface.

1. *Baker R.W.* Membrane Technology and Applications. NY: Jonh Wiley&Sons; 2004
2. *Rana D., Matsuura T*. Surface modification for antifouling membranes. Chem. Rev. 2010. – **110.** – P. 2448-71