Polyvinylidene fluoride membranes modification with TiO_2 nanoparticles

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Polyvinylidene fluoride membranes are widely used for water purification due to their properties, such as high mechanical strength, good thermal stability, and excellent chemical resistance. The main disadvantages of PVDF membranes is their low reactivity and high hydrophobicity, which leads to membrane fouling during filtration of proteins and polysaccharides solutions.

PVDF membranes were modified with TiO_2 nanoparticles to improve their properties. For this purpose, membranes were treated with polyethyleneimine in carbonate buffer at 55 ºC overnight. After that TiO_2 nanoparticles, stabilized by citric acid, were grafted to amino groups via peptide bond formation. Modification was confirmed by IR spectroscopy and electrokinetic analysis (Fig.).

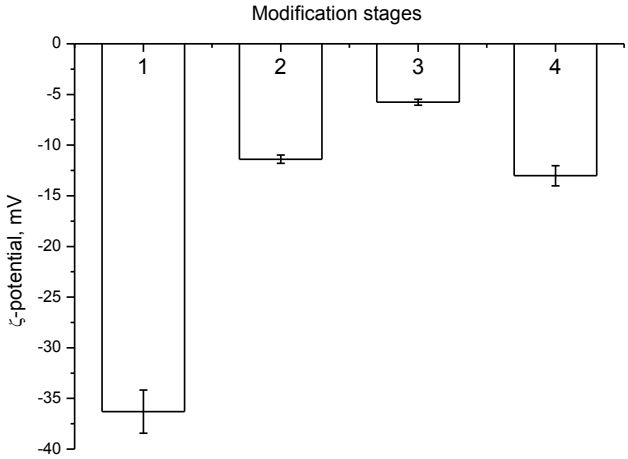

Fig. Changing of zeta-potential of PVDF membrane surface during modification: *1* – unmodified PVDF membrane; *2* – PVDF membrane treated with carbonate buffer; *3* – PVDF membrane treated with carbonate buffer with polyethyleneimine; *4* – PVDF membrane treated by carbonate buffer with polyethyleneimine with further grafting of TiO_2 nanoparticles

Zeta-potential of unmodified membrane was strong negative (-36.3 mV). After modification with polyethyleneimine it changed to slightly negative because of positive charge of amino groups (-5.8 mV). After grafting nanoparticles covered with citric acid zeta-potential was -13.0 mV.

So, proposed method of membrane modification allowed introducing functional groups and hydrophilizing the surface of PVDF membranes.