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Alexandr V. Bildyukevich[1], Tatiana V. Plisko[1*], Alena S. Liubimova[1], Vladimir V. Volkov[2], and Vadim V. Usosky[1]

[1]Institute of Physical Organic Chemistry, National Academy of Sciences of Belarus, Surganov str., 13, Minsk 220072, Belarus

[2]Topchiev Institute of Petrochemical Synthesis, Russian Academy of Sciences, Leninskii pr. 29, Moscow 119991, Russia

[3]National Research Nuclear University MEPhI, Kashirskoye shosse 31, Moscow 115409, Russia

uf@ifoch.bas-net.by

plisko.v.tatiana@gmail.com

liubimova_elena@mail.ru

vvvolkov@ips.ac.ru)

usosky@gmail.com

[*]Corresponding author. Tatiana V. Plisko, Tel./Fax +375172922822; Tel. +375333025744.

ABSTRACT

The novel method of modification of hollow fiber membranes from polysulfone is proposed. The method involves the use of aqueous solutions of polyvinylpyrrolidone (PVP) as a bore fluid in the dry-jet wet spinning process. Increasing PVP concentration (1-5 wt.%) in the bore fluid was found to yield in the efficient hydrophilization of the inner skin layer of the hollow fiber membrane. The contact angle of the skin layer was found to decrease from 76° down to 54° when the PVP concentration in the bore fluid is 1 wt.% and down to 45° - at 5 wt.%. The FTIR-spectra studies reveal the presence of PVP only on the inner surface of the modified hollow fiber membrane while outer surface was found to represent unmodified polysulfone. Scanning electron microscopy and atomic force microscopy studies reveal a difference in the structure of the initial and modified membranes. Introduction of PVP into the bore fluid leads to the marked changes in membrane pure water permeability and rejection. When the bore fluid contains 5 wt.% of PVP, the rejection coefficient for PVP (M_n=40 000 g·mole^{-1}) was found to increase from 29% to 85%, and the pure water flux - to decrease from 370 to 130 L·m^{-2}· h^{-1}·bar^{-1} compared with the initial membrane. Antifouling characteristics against human serum albumin are shown to be significantly improved for the modified hollow fiber membranes compared with the initial membranes.

Graphical abstract

Hydrophilization of hollow fiber membranes using PVP aqueous solution as a bore fluid