

DESCRIPTION FOR THE GENERAL PUBLIC (IN ENGLISH)

Membrane processes are regarded as one of the most promising technologies for the 21st century. They are applied in numerous branches of industry: chemical and petrochemical, power, electronic, food, pharmaceutical or in biotechnology. Membrane processes are attractive alternatives to the conventional water/wastewater treatment processes. Amongst numerous membrane techniques the pressure driven processes, namely microfiltration (MF), ultrafiltration (UF), nanofiltration (NF) and reverse osmosis (RO) are especially widely applied.

Amongst advantages of membrane processes the following ones should be enumerated: low energy and chemicals consumption, easy scale-up, automation and compactness of installation. Further, production of water of stable quality, practically independent on the quality of the treated water is of special importance. Moreover, due to the fact that membrane separation is realized in a physical manner, which means that the separated species do not undergo any physical, chemical or biological transformations, the waste flux contains only natural contaminants removed from water.

One of key problems which are associated with membrane processes is a decline of permeate flux over time due to fouling and biofouling. These undesirable phenomena result in an increase of operating costs, mainly these associated with energy consumption, chemical cleaning of the membranes or their replacement. Therefore, development of membranes which are resistant to fouling and biofouling is one of the most important and challenging problems that need urgent solving. Although many attempts have been made to modify the membrane surfaces, a satisfactory reduction of membrane fouling was not achieved. Recently, the expanding growth of nanotechnology have created a new opportunity to prepare novel membranes with unique properties. One of the latest trends in membrane fabrication is incorporation of nanoparticles (NPs) into polymeric membranes.

The presented project is focused on the investigations on novel synthetic polymeric MF/UF membranes modified with NPs. The influence of NPs properties as well as membrane synthesis parameters on the characteristics of polymeric membranes in terms of their antifouling and antibiofouling properties will be especially evaluated. Titanate nanotubes (TNTs) and nanomaterials obtained by TNTs modification will be applied as NPs. Moreover, the investigations on the possibilities of improvement of membranes' antifouling properties by application of mixtures of TNTs with other NPs are also planned.

The results of the project will contribute to better understanding of the influence of nanoparticles on the properties of polymeric membranes. The research will allow to formulate the guidelines for further works aimed at development of innovative nanocomposite membranes with improved antifouling and antibiofouling properties. Development of new, fouling resistant membranes will help to decrease the operating costs of membrane installations, thus increasing the attractiveness of membrane processes as methods of water and wastewater treatment. This will, eventually, improve the standard of living (pure water) and have a positive impact on the environment (better wastewater treatment efficiency).