

Wrocław, 2.04.2019

Wrocław University of Science and Technology
Faculty of Chemistry
Division of Bioprocess and Biomedical Engineering
M. Sc. Eng. Maciej Wajsprych

The abstract of “Membrane Processes in Coke Oven Wastewater Treatment Including Technological Water Recovery”

In recent years, an increasing global water deficit is observed with a simultaneous increase in demand. For many industries, a technological water is even gaining relevance of a strategic factor, ultimately affecting on quality and economy of the processes. A source of the technological water can be various kinds of by-products of the processes being carried out. The essence of their purification is not only the issue of their reuse for internal processes of industrial plants, but also the reduction of pollution being discharged into the natural environment. In Poland, a large producer of wastewater are coke plants, which to a small extent are using a closed water loop technology. The development of effective methods of water recovery from coke oven wastewater for its reuse is a great challenge for science and technology.

The aim of the research was to recognize the possibility of using a pressure membrane separation techniques for the recovery of technological water from the coke oven wastewater. A lot of emphasis was put on the industrial terms of membrane processes. Due to the complex composition and instability of the wastewater, extensive tests were carried out on the real medium, using equipment that meets industrial requirements. It was confirmed that for this type of systems only modules with tubular membranes make the possibility of effective application. The research was carried out on these types of membranes.

The hydraulic and separation characteristics of the selected membranes were carried out, dividing them into low-pressure (*MF* and *UF*) and high-pressure (*NF* and *RO*) separation. The optimal process parameters for low-pressure filtration were determined and components that can be removed from the wastewater by this separation method were indicated. The treated wastewater allowed to obtain preliminary purified technological water. Then it was shown that high pressure filtration can be used for the production of deeply purified technological water. The possible parameters for this water were determined at a given recovery rate. The range of optimal process parameters was experimentally determined.

One of the most important factors determining the use of membranes in industry is the ability to regenerate their surface. So far, there are dearth of sufficiently developed techniques to restore the primary performance of a membranes after filtration of a coke oven wastewater, what can be an explanation of the lack of their current application in this industry. In the performed studies, two original methods for regeneration of the membranes were determined: hydraulic and chemical. They ensure effective restoration of the membrane properties, lost as a result of fouling.

Based on the obtained results, a number of process variants leading to obtain technological water with different parameters were presented. A design of an exemplary installation is attached to the work. The results obtained through the presented research allowed to confirm the possibility of using pressure membrane separation for the treatment of coke oven wastewater and are the source of important process data.