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**WATER DESALINATION BY BAROMEMBRANE METHODS
ОПІСНЕННЯ ВОДИ ПРИ ВИКОРИСТАННІ БАРОМЕМБРАННИХ МЕТОДІВ****Trus I.M. / Трус І.М.***Cand. Sc./к.т.н.*

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Annotation. For nowadays one of the most important ecological problems is the salinity of the surface and underground sources of water supply. This is due to the formation of huge amount of mineralized wastewater. In this paper scientific provisions for the increasing the efficiency of baromembrane desalination of water were developed. The effect of parameters of the processes of reverse osmosis desalination of water into the permiate yield were determined to achieve the required level of its quality. The studied methods of pre-stabilization water treatment can increase the efficiency of reverse osmosis desalination of water, as well as to increase the service life of the membrane Filmtec TW30-1812-50. The obtained results allow to develop low-waste technologies of mineralized waters desalination.

Key words: desalination, mineralized waters, reverse osmosis, low-waste technologies, productivity.

Introduction.

Today, the problem of water salinity is very common in Ukraine due to natural and anthropogenic factors. This problem is most acute for industrial regions due to the presence of coal, iron ore and uranium mines. Great contribution to the salinization of water bodies is made by the discharge of mine waters, saline effluents, water from cooling systems and infiltration of solutions from many sludge storages. Unfortunately, modern methods of saline water treatment do not solve the problem, but only worsen the situation in densely populated areas, where industry is well developed [1].

The solution to this problem can be the implementation of the latest integrated technologies for water desalination in preparing it for use by utilities and industry [2]. Membrane technologies are highly efficient and can be used at various stages of water treatment, as well as in combination with other treatment methods [3, 4].

Main part.

Depending on the quality of the source water and the requirements for treated water, only membrane separation methods can be used for water treatment and wastewater treatment in a technologically reasonable combination.

Desalination of water was studied using a cassette with a low pressure reverse osmosis membrane Filmtec TW30-1812-50. The model solution (hardness = 9,0 mg-



eq/dm³, alkalinity = 5,0 mg-eq/dm³, pH = 8,90, SO₄²⁻ = 13,0 mg-eq/dm³, Cl⁻ = 3,5 mg-eq/dm³, acidity = 0,5 mg-eq/dm³) was used as a medium. Model solution was pre-filtered through weakly acidic cation exchange resin Dowex MAC-3 in acid form. The working pressure was 0.3 MPa.

To prevent sedimentation on the membranes during baromembrane methods application, it is necessary to ensure effective stabilization of water treatment. In this case it is important to provide effective lighting and decolorization of water. Therefore, to reduce the load on the reverse osmosis membranes, increase process productivity, increase the service life of reverse osmosis membranes as a pre-treatment, it is proposed to use ultrafiltration membranes for cleaning water solutions from suspended solids.

In this work the effect of preliminary mechanical water purification on the productivity and selectivity of the low pressure reverse osmosis membrane Filmtec TW30-1812-50 (Fig.1) was determined.

Membrane Filmtec TW-30-1812-50 provides effective desalination of water at high productivity of the process. Despite the fact that only 10 dm³ of the model solution was passed through the cassette with the reverse osmosis membrane, its pre-lighting significantly affected the productivity of the membrane. As an increase in the productivity of the membrane by almost 20 % is observed during filtering.

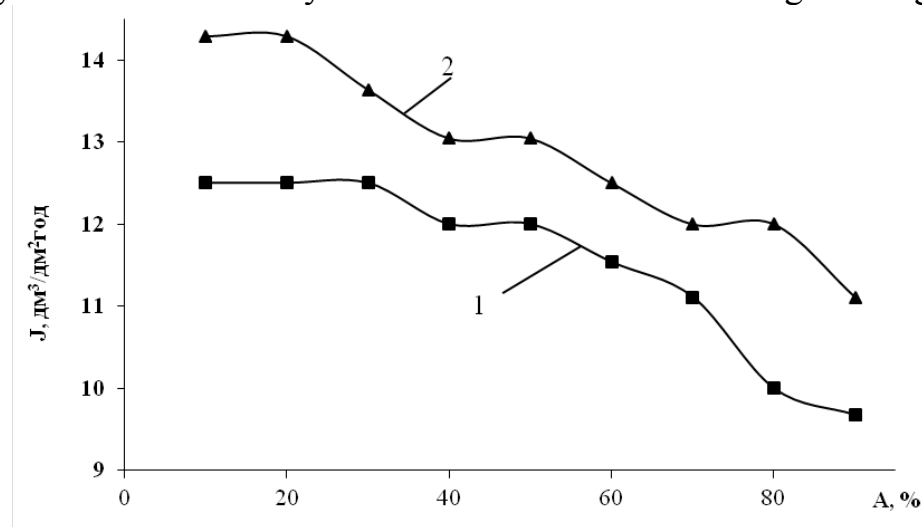


Fig. 1. The dependence of the productivity of the reverse osmosis membrane Filmtec TW-30-1812-50 from the degree of selection of permiate in desalination of unfiltered (1) and filtered model solution (2)

Another difficult problem of reverse osmosis water purification is its high-quality preparation before putting on membrane filters. When purifying water using membrane technologies, there is a problem of formation of deposits and fouling on the membranes, which reduces the flow of filtrate and increases the transmembrane pressure. Therefore, along with effective lighting and discoloration of water solutions, the problem of its stabilization in relation to sediments on the membranes is acute. The applications of weakly acid cation exchange resin Dowex MAC-3 in H⁺ form allow to reduce the alkalinity of water and to soften it. The alkalinity of the water is reduced to zero value, and the pH reaches 3.9, such water can not lead to the formation of carbonate deposits on the membrane. In this paper the effect of



stabilizing water treatment on weakly acid cation exchange resin Dowex MAC-3 in H^+ form on the efficiency of water desalination on the reverse osmosis membrane Filmtec TW 30-1812-50 was determined. Model solution after filtration through weakly acid cation exchange resin Dowex MAC-3 in acid form had the following characteristics: hardness = 3,50 mg-eq/dm³, alkalinity = 0 mg-eq/dm³, pH = 3,9, SO_4^{2-} = 13,0 mg-eq/dm³, Cl^- = 3,5 mg-eq/dm³). The results of the evaluation of the productivity of the reverse osmosis membrane are shown in the Fig. 2.

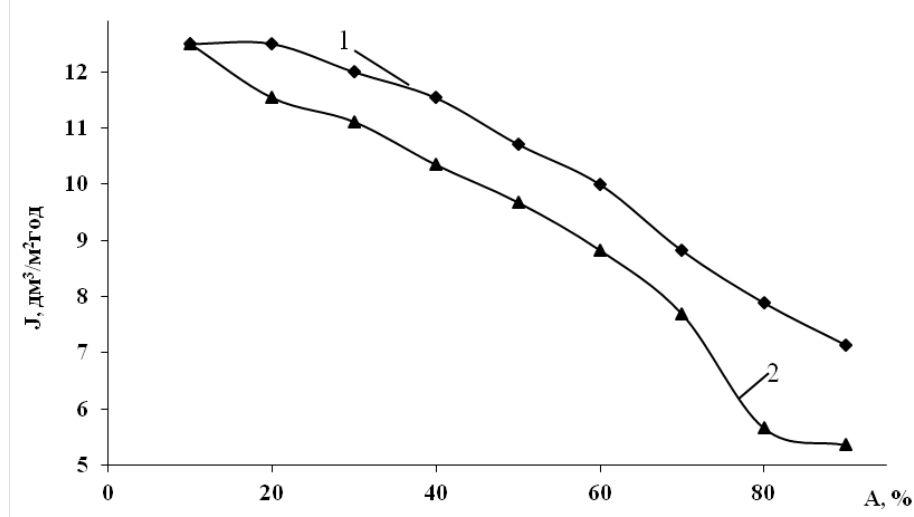


Fig. 2. The dependence of the productivity of the reverse osmosis membrane on the degree of permiate selection during desalination of the filtrate after the cationic filter Dowex MAC-3 in acid form pH = 3,9 (1) and model solution pH = 8,6 (2)

As can be seen from Fig. 2, the performance of the membrane is almost independent of the pH of the solution. Acidification of the solution with partial softening helps to increase the productivity of the reverse osmosis membrane. This is primarily due to the partial demineralization of the solution on the ion exchange filter and the absence of carbonate deposits on the membrane. When filtering 10 dm³ of water there is no significant deposition of sediments on the membrane, so the effect of pH on productivity is negligible. With longer tests and large volumes of water, the productivity of the membrane in stabilizing water treatment would remain quite high during use. Therefore, preliminary mechanical water purification and stabilization treatment on cation exchange resin Dowex MAC-3 in acid form allows to increase the efficiency and service life of membranes in baromembrane desalination processes.

Conclusions.

Methods of stabilization water treatment for baromembrane desalination have been developed to increase the efficiency and service life of membranes.

The optimal parameters of reverse osmosis desalination of solutions that provide high water quality were determined.

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Анотація. Однією з важливих екологічних проблем на сьогоднішній день є засолення поверхневих та підземних джерел водопостачання. Це пов'язане з величезними обсягами мінералізованих стічних вод. В роботі розроблені наукові положення щодо підвищення ефективності процесів баромембранного знесолення води. Було визначено параметри процесів зворотньоосмотичного знесолення води на вихід перміату при досягненні необхідного рівня її якості. Запропоновані в роботі методи попередньої стабілізаційної обробки води дозволяють підвищити ефективність процесів зворотньоосмотичного знесолення води, а також збільшити термін експлуатації мембрани Filmtec TW30-1812-50. Отримані результати дозволяють розробити маловідходні технології знесолення мінералізованих вод.

Ключові слова: знесолення, мінералізовані води, зворотній осмос, маловідходні технології, продуктивність.

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