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TECHNOLOGY OF COLLECTOR-DRAINAGE WATER desalination IN THE CONDITIONS OF THE KYRGYZ REPUBLIC

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Annotation

This article discusses membrane desalination methods that use membrane processes (ion exchange membranes, electrodialysis). A brief summary of the technology of water desalination on the electrodialysis apparatus as part of a combined scheme is given followed by a reduction in the maximum salinity of the resulting solution and timely washing (regeneration) and their improvement.

Keywords: collector-drainage water, irrigation, water management, groundwater reserves, natural and wastewater, regeneration of cationite filters, brine concentration, mineralization.

In the Kyrgyz Republic, there are problems associated with a lack of drinking water for the needs of the population, irrigation water for agriculture and industry. New water management solutions are required, especially for the efficient use of irrigation water on farms. Of particular importance is the ability to find additional water resources. In addition, in recent

years, the hydrochemical state of river waters in the Republic of Kyrgyzstan has deteriorated significantly.

This is due to the fact that throughout the entire basin, the river is a receiver of various wastewater pollution, including mineralized collector-drainage waters flowing from irrigated areas. Based on official data from the Department of Water Resources, it was calculated that only in the irrigated zone of the southwestern irrigation regions of the Republic of Kyrgyzstan, up to 9.0-9.5 km3 of collector-drainage water is formed per year.

Naturally, with a shortage of irrigation water (especially in dry years), specialists are faced with the acute issue of reusing collector-drainage water in the national economy.

At the department "Water supply, sanitation" at KSTU named after. I. Razzakov conducted scientific research in the laboratory on the technology of desalination of low-mineralized and collector-drainage effluents.

The purpose of scientific research was to analyze the dynamics of runoff and the quality of groundwater, surface water in the Kyrgyz Republic, and special attention was also paid to identifying all aspects of the use of collector and drainage water

During the research, the following tasks were solved:

- analyzed the hydrochemical composition of the waters of the rivers of the republic and the groundwater reserves of the Kyrgyz Republic;

- study of the quality of natural and waste waters;

- study of physical and chemical properties of ion-exchange membranes;

- theoretical and experimental study of membranes;

- calculation of geometric and hydrodynamic parameters of the working chamber of an industrial electrodialysis apparatus;

-development of an effective technology for the desalination of natural water;

- implementation of research results in production.

Conducted in the laboratory, research on pilot testing of a series of electrodialysis plants with rolled membrane elements on different types of membranes made it possible to substantiate and develop technological schemes and designs of plants intended for the treatment of groundwater, surface water with a suspended solids content of up to 10-15 mg / l and color up

to 30-40 degrees, collector-drainage water and conditioning tap water. This technology allows the operation of electrodialysis plants without preliminary treatment of the source water.

The effect on the operation of membranes of suspended and colloidal particles during the treatment of surface water was also studied in the laboratory at the Department of "VV". Precipitation of suspended and colloidal particles contained in river water has a rather insignificant effect on membrane performance.

This was confirmed by the results of numerous life tests on untreated river water, during which sediment of suspended solids accumulated in the membrane apparatus. Such precipitates tend to have a loose structure, which has little effect on the performance of the membranes. In order to maintain the performance of the membranes during their operation at a given level, it is required to carry out timely flushing (regeneration measures), which result in the dissolution and removal of sediments.

In accordance with the tasks set at the second stage of the study, the influence of the degree of brine concentration on the indicators of the electrodialysis process was studied (when obtaining a brine concentration suitable for the regeneration of cation exchange filters). Table 1 shows the results of these studies for H - cationic water of the chloride type with a concentration of 12.7 mg-eq / l t \u003d 250), at different degrees of brine concentration, the concentration coefficient "K" of the brine varied from 1 to 31). The maximum concentration of acid in the brine tract during the concentration process reached 1.5% of the concentration suitable for the regeneration of H-cation exchange filters. Analysis of the experimental results (see Table 1) showed that with an increase in the concentration gradient between brines and dialysate chambers, due to the phenomenon of reverse ion transfer, there is a decrease in the efficiency of desalination and current efficiency (at CC b) with a simultaneous increase in specific consumption electric power W. The decrease in the indicators of the electrodialysis process at a high degree of brine concentration in the brine chambers allows us to conclude that, from an economic point of view, when operating the electrodialysis plant as part of a combined circuit, the mineralization of the resulting solution should be minimized, which is feasible only in the case of circulation of the brine tract through the cation exchanger wash water reuse tank (1st brine disposal method)

Table 1 Parameters of the processes of electrodialysis of H - cationized water at different concentrations of brine

Concentrations C, mg-eq/l	Current	Current	α	KC	η	Specific electricity

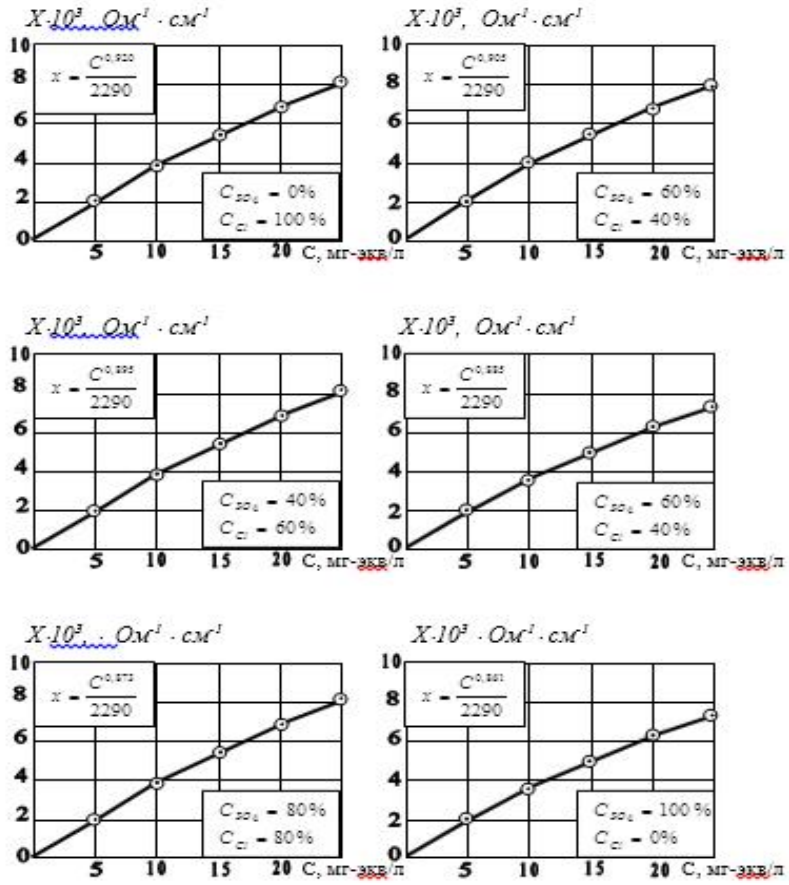
Dialysis		Pickle		A, Voltage B	A, Voltage B				consumption kW/h per 1 kg of transferred acid
entert	exi	enter t	exi						
12,7	6,6	12,7	18,8	1,42	1,35	0,52	1,0	0,9	0,27
12,7	6,7	64,0	70,0	1,43	1,31	0,52	5,1	0,9	0,27
12,7	7,2	13,9	145,0	1,42	1,23	0,57	11,0	0,6	0,28
12,7	8,0	250,3	235,0	1,42	1,6	0,63	19,7	0,7	0,30
12,7	8,7	323,5	327,0	1,42	1,19	0,66	25,4	0,6	0,27
12,7	9,1	389,4	393,0	1,43	1,18	0,72	30,7	0,51	0,41

In this case, the numerical value of the coefficient of concentrated brines of the SC will be in the range from 3 to 5, which, according to the data in Table 1, will practically not affect the parameters of the electrodialysis process.

The second method of disposal of the resulting brine should be considered irrational due to the fact that 1.5% acid is highly corrosive and requires storage in a special lined container. In addition, along with high energy consumption during electrodialysis, the volume of the acid regeneration solution required only for one regeneration of the H-cation exchange filter d = 3.4 m3, according to approximate calculations, can be obtained on average for 5-8 hours of operation of an electrodialysis unit with a capacity of 250 m3/ h. This conclusion is also valid for the cases of desalination of Na - cationic water.

According to the above studies, nomograms have been developed to determine the operating parameters of the process of electrodialysis of H-cationic water, in relation to industrial electrodialysis devices ED-2D-L. These nomograms allow you to easily and quickly, without using calculation formulas, determine the desalination coefficient of H - cationic water, the working current density, for any possible calculation cases: the qualitative composition of water, its salinity, temperature and flow rate in the working chamber of the electrodialyzer, the degree of concentration of brine CS in brine chambers.

Specific electrical conductivity H - cationic water and various types and ion-exchange membranes MA-40 and MK-40. According to the above measurements, the dependence of the specific electrical conductivity of MA-40 and MK-40 membranes on salinity and the qualitative composition of H - cationic water was obtained. linear character.



Rice. 1 Specific electrical conductivity of H-cationic water (t = 180C) at different salinity and concentration ratio C_{SO_4} $и C_{Cl}$ ..

⊙ - measurement result: - calculated value

Using the obtained values of the coefficients, a nomogram was constructed for graphical determination of the specific electrical conductivity of H - cationic water, depending on its mineralization, qualitative composition and temperature.

Obviously, the solution to this problem is for objects with relatively low water consumption. Using surface, underground and even collector-drainage water as a source, it consists in the use of membrane cleaning methods. Of the membrane methods that have been worked out and tested to date, electrodialysis is more versatile and promising, as it allows you to get rid of not only salts and other substances that are in an ionized state, but also suspended and organic substances, colloids, bacteria and viruses. A guarantee of high water quality is the pore size of the membranes that prevent the passage of these substances. If the technological modes of cleaning are violated, the productivity of the installations can only decrease while maintaining the desired cleaning effect.

New irrigation technologies create an opportunity to solve many problems. These technologies save up to 40% of irrigation water on the field, create a water-salt regime that allows you to get crop yields almost twice as much, make it possible to meet the necessary agrotechnical requirements for growing crops, prevent deep and surface water discharge, and ensure high uniformity of water distribution over the field area , thus, at the same time, solving the problems of improving the reclamation and ecological state of lands.

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