

**ION-EXCHANGE CORRECTION OF MINERAL COMPOSITION OF
NATURAL AND WASTE WATER**

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Abstract

Methods of correcting the mineral composition of water when it is used in industrial and drinking water supply systems are usually divided into two groups. Methods from the first group change the aggregate state of water, for example, thermal desalination. Methods from the second group involve adjusting the mineral composition of water without changing the aggregate state of water using chemical processes, such as ion exchange. Methods of correction of mineral composition of water from the second group are more widespread, as they have a simple technological scheme, have the possibility of utilisation of valuable components from water, regeneration solutions can be used to produce useful products, for example, fertilizers. Application of the method of ion-exchange correction of mineral composition of natural and waste waters considered in this work is limited in application mainly by the value of salt content of treated water. In most cases it is economically favourable to treat wastewater with total salt content up to 3 g/l. The main methods of correcting the mineral composition of water by ion exchange technologies are cation-anion exchange to obtain chemically treated water, ion exchange in technological schemes of water desalination and additional treatment of industrial wastewater when it is used in industrial water supply systems. Chemically treated water is mainly used for the needs of thermal power engineering, chemical and pulp and paper industries. Technological schemes of water desalination using ion exchange provide for reduction of salt content to the concentration permissible for its use in industrial and domestic water supply systems. The main technological methods used in ion-exchange adjustment of water composition are Na- and H-cationisation and OH-anionisation. The researches were carried out on the experimental installation consisting of H-cationic and OH-anionic filters, decarboniser, tanks for preparation and collection of fresh and spent regeneration solutions. Ion-exchange filters are made of Plexiglas to facilitate maintenance and observation of the processes of water treatment, regeneration and ionite loosening. The diameter of the ion exchange filters is 100 mm to avoid the effect of constriction, and the height of the loading layer is 2500 mm, which corresponds to commercially available industrial filters. The experiment was carried out as follows: the filtrate sample after the H-filter was titrated with alkali in the presence of phenolphthalein and analysed for the presence of hydrogen ions. On the basis of these data the output curve of dependence of filtrate acidity on the volume of passed liquid was constructed, the efficiency of magnetic activation of KU-2x8 was analysed. Regeneration of cationite was carried out with 5% HNO₃ solution. The regeneration solution was passed through the cationite, the spent solution was collected and its acidity was determined. On the basis of experimental data on regeneration of cationite the dependence of degree of regeneration of cationite KU-2x8 on the passed volume of 5% HNO₃ solution was obtained. In the future it is planned to carry out research on the effect of magnet activation on the intensification of ion exchange processes during the mineral composition of natural waters, which is based on the action of magnetic fields on the colloidal particles, which have a very large magnet perceptibility. It is planned to modernise the plant with an external electromagnetic system consisting of 6 symmetrically arranged electromagnets. Thus, magnetic fields pass through the ion-exchange material and treated water form a closed magnetic circuit and increase the efficiency of the process of correcting the mineral composition of natural and waste water.

Keywords: ion exchange, salt composition, modification of ion exchangers, diffusion coefficient, hydrated ions, magnetic water treatment.