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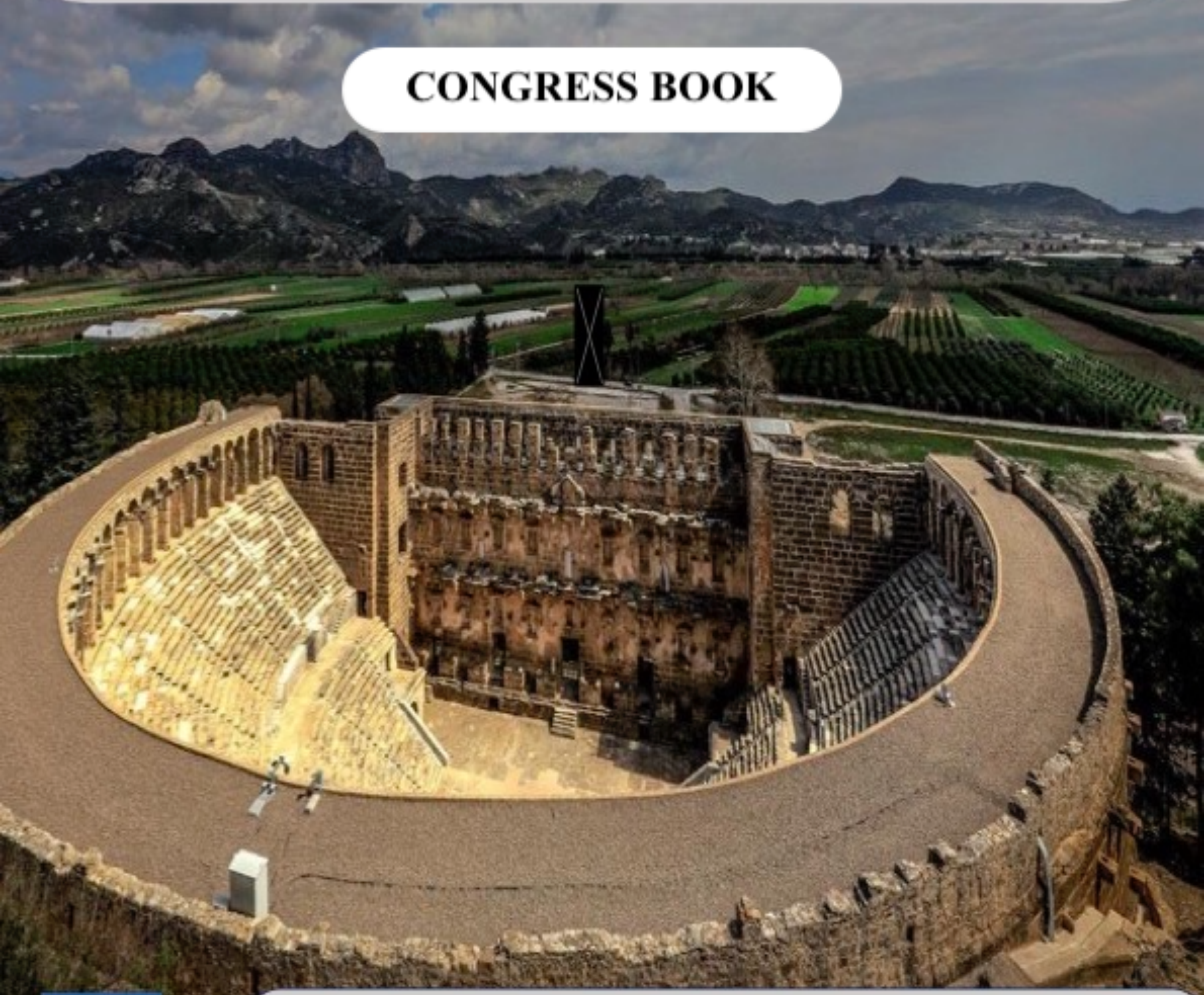

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INCREASE THE EFFICIENCY OF THE PROCESS OF DEMINERALIZATION OF NATURAL WATERS

David KOVTUN
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ABSTRACT

Today's environmental challenges, including the growing pollution of water resources, require the search for new approaches to water treatment. Existing reagent demineralization methods, although widely used in water treatment systems, have a number of disadvantages, such as significant economic and resource costs, as well as causing secondary pollution. This creates a need to improve existing water treatment technologies to reduce their environmental impact.

There is a global trend towards a decrease in clean water reserves, which is particularly acute in Ukraine and other parts of the world. Studies show that the level of groundwater and surface water pollution in Ukraine is high. The main pollutants are nitrogen compounds (nitrate ions, ammonium ions), iron ions, manganese ions, and dissolved salts, including calcium and magnesium ions. This poses a serious threat to public health and ecological balance. In this regard, the development and improvement of methods for demineralization of natural water in water treatment systems is a relevant and important area of solving the problem of

One of the promising areas is the use of the ion exchange method, which, due to its efficiency and potential for combination with other technologies, is attracting the attention of scientists. However, existing ion exchange water treatment systems need to be improved to increase their efficiency and reduce costs. The study of the possibilities of magnetic activation of ion exchange processes seems to be a promising area for increasing the efficiency of water demineralization and improving the environmental performance of water treatment technologies.

To intensify ion exchange processes, a method using modified ion exchangers has been proposed, which includes the simultaneous action of a magnetic field on the ion exchanger and the water to be purified.

Taking into account the analysis of experimental data, values for the construction of a mathematical model for the magnetic field strength in the range from 0 to 3 A/m were chosen. This is justified by the largest values of the change in the working exchange capacity of cationite.

The basis for building the mathematical model was the equation.

$$Y(X1,X2)=F1 \cdot X1 \cdot X2^2+F2 \cdot X1 \cdot X2+F3 \cdot X1^2+F4 \cdot X1+F5 \cdot X2+F6 \quad (1)$$

where:

F1,F2,F3,F4,F5,F6 - coefficients, solutions of the system of equations found using the Gaussian method;

X2 – magnetic field strength;

X1 – water hardness;

Функція Y – working exchange capacity;

To determine the coefficients F1-F6, we used the Gaussian method. It involves reducing the system of equations describing the experimental results to an upper-triangular form and then finding the solution coefficients. This approach makes it possible to accurately determine the dependence of the working exchange capacity on the input parameters, in particular on water hardness and magnetic field strength

The obtained coefficients allowed us to build a model that demonstrates how changes in water hardness and magnetic field strength affect the working exchange capacity. This model is the basis for further optimization of water treatment processes to increase their efficiency.

Experiments and a mathematical model show that the magnetic field strength affects the working exchange capacity of cationite, especially in the range from 0 to 3 A/m. The greatest increase in exchange capacity is observed at magnetic field strengths up to 3 A/m, after which the efficiency decreases. It should be noted that the use of magnetic activation to intensify ion exchange processes in water treatment systems requires additional research. It is necessary to study in more detail the mechanisms of interaction of the magnetic field with the cationite, as well as to establish optimal parameters for different operating conditions to ensure maximum efficiency of this method.

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