Development of technology for obtaining drinking-quality water from Myanmar's underground sources

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Relevance of the research. Pure drinking water is a vital resource for humanity. The need for high-quality drinking water is rapidly increasing due to rapid population growth and industrialization. The Republic of the Union of Myanmar has significant water resources, but their quality often does not meet sanitary standards. This has an adverse effect on the health of the population and the state of the country's ecosystems. Groundwater, which is considered a reliable source of water supply worldwide, is polluted in Republic of the Union of Myanmar, making it unsuitable for drinking without prior treatment. The use of untreated water can pose a threat to the health of citizens.

In recent decades, significant improvements in the quality of drinking water have been achieved in urban areas of the Republic of the Union of Myanmar due to the introduction of centralized water treatment systems and the distribution of purified water through underground pipeline networks. However, access to safe drinking water remains a major challenge in rural region of Republic of the Union of Myanmar. The creation of centralized water treatment systems in these areas is economically impractical due to high capital costs and underdeveloped infrastructure. Therefore, innovative, energy- and resource-saving water purification technologies are needed to improve the quality of drinking water in rural areas.

A promising approach for solving this issue is the application of water treatment technologies based on baromembrane processes. Traditional methods such as mechanical filtration, sedimentation and coagulation do not always provide sufficient removal of pollutants. In some cases, they do not allow to bring the water

quality to contemporary sanitary standards. Baromembrane processes are an effective alternative to traditional purification methods. They have a number of advantages: relatively low capital costs, short payback period, ease of operation and high degree of automation.

This work focuses on the development of scientifically based technological solutions for the intensification of groundwater purification processes by ultrafiltration and reverse osmosis, with regard to the Republic of the Union of Myanmar.

The aim of the work is to develop technology for obtaining drinking-quality water from underground sources, to study the effectiveness of baromembrane processes (ultrafiltration and reverse osmosis) and, based on them, to develop a technological scheme for a water purification system.

Research objectives:

- Improving the efficiency of the membrane system through pre-oxidative treatment and ensuring optimal cleaning efficiency.
- To evaluate the effectiveness of ultrafiltration membranes and to determine how technological parameters affect flux and separation selectivity of these membranes.
- Study of the influence of technological parameters on the flux and selectivity of reverse osmosis membranes in the purification of model groundwater solutions.
- Study of the membrane-solution relationship based on the nature of the initial solution and the technological parameters of the membrane process.
- Techno-economic analysis of the groundwater purification process using membrane methods.

Scientific novelty:

1. The stage of water pretreatment by ultrafiltration has been scientifically substantiated and developed through the use of pretreatment with oxidation and ensuring maximum filtration efficiency.

2. New experimental and computational data have been obtained for the development of groundwater purification processes in Republic of the Union of Myanmar using baromembrane methods such as ultrafiltration and reverse osmosis, which provided important information on the technological aspects of separation processes in water purification.

3. The operational characteristics of UF membranes for two-component systems in the separation of solutions containing iron and manganese ions are investigated. It has been established that when two types of ions are present in the solution, their ionic competition and electrostatic interactions occur, which increases the separation efficiency. In the presence of a certain ion, the removal of another can be improved due to a synergistic effect.

Theoretical and practical significance:

1. A method for calculating baromembrane units using hollow fiber membranes for ultrafiltration and spiral-wound membrane elements for reverse osmosis has been developed.

2. Methods for obtaining drinking water with constructive simplicity and low energy costs have been developed, allowing for a high degree of purification comparable to that of water undergoing deep multi-stage purification.

3. A techno-economic analysis has been conducted to minimize the cost of treating brackish groundwater using a combined UF and RO system to produce clean water.

4. The proposed technology, utilizing combined UF and RO-based systems, enables the production of high-quality clean water while enhancing energy efficiency and resource conservation at water treatment facilities.

Thesis to be defended:

1. Results of a study on ultrafiltration purification with pre-oxidative treatment for the removal of iron and manganese compounds in single- and multicomponent systems of model solutions.
2. Results of a study on the reverse osmosis process for the removal of hardness and salinity ions in single- and multicomponent systems of model solutions.
3. Techno-economic analysis of the groundwater purification process for obtaining drinking-quality water based on a combined UF and RO system.