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Water supply for settlements of the Kyrgyz Republic

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Nature generously endowed the mountainous expanses of the Kyrgyz Republic with huge freshwater resources contained in vast glaciers, deep rivers, large and small lakes, and large groundwater reserves. Natural water resources fully cover the needs of Kyrgyzstan, and are the main source of water supply for significant water consumers of Central Asia, located downstream.

The total volume of available water reserves in Kyrgyzstan, according to experts, is 2,458 km^3, including 650 km^3 of water stored in glaciers, 1,745 km^3 in lakes, as well as 13 km^3 of potential groundwater reserves and from 44.5 to 51.9 km^3 of average annual river flow.

At the same time, more than 60% of the rural population of the country do not have sufficient access to safe, centralized drinking water, or today about 700 thousand residents of the rural areas of the republic are forced to use water from open water sources without proper treatment. By 2013, the total number of those who need to improve the provision of centralized drinking water supply, not counting other settlements, in the villages alone amounted to more than 1.5 million people.

In general, an analysis of the main factors shaping the level of rural water use in various regions of the Kyrgyz Republic showed that:

- regional features of the formation of rural water supply and the quality of drinking water supplied are determined by many factors: the nature of the water source, the characteristics of groundwater and minerals, the effectiveness of disinfection, the degree of anthropogenic load;
- in surface water bodies, actual concentrations of pollutants have wide variability with respect to average values during one season, which is associated with the hydrochemical characteristics of the territories and their climatic conditions;
- the main distinctive features of the formation of a rural water use system in modern conditions are the steady increase in water consumption; qualitative changes in water sources; anthropogenic impact on both surface water bodies and groundwater, resulting in microbial and chemical pollution of water;
- The priority chemical pollutants of surface water sources in rural areas are mineral and organic substances, washed away by melt, rainwater from the territories of settlements and industrial enterprises located on the catchment area, as well as rainwater runoff from arable land, as a result of which organic substances, mineral fertilizers fall into the water and pesticides;
- deterioration of water and sewer networks and structures does not provide adequate water treatment, purification and transportation of drinking water and is often the cause of accidents and water leakage;

- the destruction of the anticorrosion coating on the surface of the water pipes of the distribution network leads to an increase in the iron content in tap water and is the cause of secondary bacterial contamination of drinking water;
- the current monitoring system for the status of water bodies is not effective enough and does not allow to take promptly measures to improve water quality;
- the low quality of the water sources used for drinking water, the existing level of water treatment does not allow providing rural settlements with high-quality drinking water, which is a risk factor for the health of rural residents;
- residents, as well as deficiencies in the agricultural water supply management system
- An effective solution to the problem of improving drinking water supply and the quality of drinking water can only be achieved on the basis of an integrated approach using legislative and regulatory frameworks covering all aspects of activities in the field of regulation and control of water quality, its treatment and disinfection, economic incentives and material support.

The conditions for the development of centralized drinking water supply in the settlements of Kyrgyzstan require the following measures:

Legislative initiatives:

- amendments and additions to the Laws of the Kyrgyz Republic "On Water", "On Drinking Water" and "Tax Code", in terms of improving tariffs and payments for water use, wastewater and wastewater treatment, taxes on economic entities when using water resources in technological and other commercial purposes (saunas, pools, car washes), based on the adopted *National Strategy for the Sustainable Development of the Kyrgyz Republic for the period 2013-2024* based on the developed *State Program for the Development of Drinking Water Supply and Sanitation in the 2014-2024 years* to develop new rules of use of water systems and sanitation of human settlements of the Kyrgyz Republic;
- to develop recommendations on making amendments and additions to existing design standards (Building Code, Sanitary Code, water consumption and sanitation standards, etc.) taking into account the seismic, climatological, mountain and foothill features of Kyrgyzstan.

Organizational and technical measures:

- safe and high-quality water supply and sanitation, as a priority for maintaining health;
- management of the water supply and sanitation sector;
- financial and economic sustainability of water supply and sanitation services;
- enhancing transparency, trust and accountability in the water supply and sanitation sector;
- optimization of technical standards.
- construction of water supply networks in 425 villages;
- construction of water disposal networks in 27 district centers with village status;
- creation of the Republican training center on water supply and sanitation;
- Creation of technical service centers for water supply and sanitation in 40 district centers.

Technological and technical measures:

- development and implementation of new water supply practices and improvement of existing industrial technologies for water treatment and wastewater treatment and related technological equipment;
- development and implementation of a continuous improved system for supervision and monitoring of the quality of water sources of water supply systems and the quality of drinking water;
- development and introduction into practice of water supply of new effective reagents, filter materials, sorbents, etc.

Scientific and research activities:

- development of the state program of scientific research and research development in priority areas of water treatment technologies and improving the quality of drinking water.

Carrying out the above measures will improve the condition in the field of water supply to the population of the Kyrgyz Republic with clean drinking water and solve the issues of disposal and treatment of used wastewater and their further disposal. All this will improve the sanitary-epidemiological state in terms of providing the population of the Kyrgyz Republic with clean drinking water and significantly improve the ecological state of the country's water resources.

PHOTOCATALYTIC ACTIVITY OF TiO_2 NANOCOMPOSITES DOPED WITH Sn

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Titanium dioxide (TiO_2) has been used as a photocatalyst in water purification and environmental applications because of its efficient photoactivity, non-toxicity and high stability. However, due to large band gap energy, the photocatalytic activity of TiO_2 is restrained by the fast recombination of the photogenerated electron-hole pairs and photocatalysis can be activated only with UV-light irradiation, that limits the usage of TiO_2 [1]. Our research aims to increase the photocatalytic activity of TiO_2 by doping with Sn.

TiO_2-SnO_2 nanocomposites were received by the hydrothermal method using titanium isopropoxide and tin (II) chloride, as previously described in [2]. All samples: HT90P2510Sn(II)s, 1HT90Ti10Sn(II)s, 2HT90Ti10Sn(II)s. HT90P2510Sn(II)s contain 90% and 10% of TiO_2 and SnO_2 respectively. HT90P2510Sn(II)s was synthesized on base of AEROXIDE® TiO_2 P25.

The synthesized samples show high photocatalytic activity towards cationic (methylene blue) and cationic (Congo red) organic dyes, which is shown in Fig.1. Photocatalytic activity of AEROXIDE® TiO_2 P25 and TiO_2 synthesized by ourselves are also measured for comparison.

To sum up, some of the synthesized samples have higher photocatalytic activity then commercially available AEROXIDE® TiO_2 P25 and TiO_2 synthesized by ourselves.