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"FACTORS AFFECTING THE COMPOSITION OF DRINKING WATER AND METHODS OF ITS PURIFICATION"

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Annotation:
This article discusses the issue of the body's need for drinking water, the concept of improving the quality of drinking water, factors that led to a decrease in the quality of water from natural sources, and the results of research on this issue. An overview of drinking water purification methods is provided.

Keywords: quality, water quality improvement, purification methods, research, heterogeneous photocatalysis, solar sterilization, bamboo charcoal, ceramic filters, bone charcoal filtration, chlorination, slow sand filtration, solar distillation.

Introduction:
Today, for the comfortable functioning of mankind, a supply of fresh water is necessary. We know that the lack of drinking water in many countries is one of the pressing problems. We also face this problem. In many villages and villages of the Republic of Karakalpakstan, we encounter a lack of drinking water that meets the requirements of the state standard. Therefore, it is relevant to study issues related to this problem. Water loss by the body increases with increasing ambient temperature, as well as when performing physical work. For example, in a hot climate during physical work, the amount of water required for a person reaches 5 liters or more per day. Water regulates the climate of the planet, ensures the economic and industrial activities of people, being its condition and object, it is part of all living organisms inhabiting the Earth, including the composition of the human body, playing the role of a structural component, solvent and carrier of nutrients in it, water participates in biochemical processes and regulates heat exchange with the environment. [2,3]
Due to the fact that in recent years there has been a sharp decline in the quality and quantity of drinking water, measures have been taken to improve it. Thus, a brief concept for improving water supply and sanitation was adopted. In developed countries, the quality of drinking water is at a high level and to improve it, more and more new developments are being introduced, the effectiveness of which has been proven by many studies. Our task is to adopt the best of the proposed options and adjust them so that they are adapted to the conditions existing on the territory of the Republic of Karakalpakstan. The concept of improving drinking water quality and sanitation as a critical component of health is not a new idea. Traditional environmental health already focuses on sanitation issues, including clean water, wastewater, and waste management. The global definition of improved water supply and sanitation has been clearly articulated and described by the Joint Monitoring Program (JMP) for Water Supply and Sanitation. The JMP has defined sources of "improved water" as those that are protected from environmental pollution, especially faecal pollution such as tap water.

water to a home, plot or yard, protected well or collection of spring and rain water. An "improved sanitation facility" was defined by the JMP as a facility that separates and removes human excreta from potential human contact. It has been specifically determined that shared spaces of any type are classified as non-improved sanitary conditions. To all of the above, I can add that the state of water resources forces people to look for new ways to combat pollution. Thus, on the territory of the Republic of Karakalpakstan, measures were taken to improve the quality of life of the population and water supply in populated areas (Resolution of the Cabinet of Ministers of the Republic of Uzbekistan "On additional measures for social protection of the population and mitigation of the consequences of low water in the Republic of Karakalpakstan and Khorezm region" No. 249 06/08/2001). [8,4]

The water resources of the Republic of Karakalpakstan are the most important factor determining the sustainability of ecosystems in this region. Most environmental indicators characterizing the state of water resources indicate a decrease in its regulatory potential. The development of irrigated agriculture in the Amu Darya basin has led to a decrease in water flow to the delta by 4 times compared to the natural regime. Mineralization has increased greatly, and the quality of drinking water has deteriorated. An analysis of the state of the environment in the Aral Sea region shows that the main trends of environmental destabilization continue and increase, and the threat to human health is growing. Currently, the population of the Aral Sea region uses drinking water from the following sources: tap water supplied through the Tuyamuyun-Nukus-Kungrad-Takhtakupir water pipeline, as well as taken from the irrigation network, from open reservoirs, from wells, from desalination plants and taken from underground wells. In various regions of the Republic of Karakalpakstan (Muynak, Kungrad, Takhtakupir, Kanlykul, Nukus, Khojeili), a comprehensive assessment of various categories of drinking water (tap, well, open reservoirs) was carried out according to the most important physicochemical components: water mineralization (based on dry residue), hardness (Ca+Mg), content of chlorides and sulfates, pH, presence of organic matter (based on BOD 5 and permanganate oxidation), nutrients, macro- and microelements. According to numerous literature data, the mineralization of drinking water in the studied areas is sharply increased.

The quality of natural waters, i.e. the degree of their suitability for practical use is determined by the composition and quantity of dissolved and suspended substances, microorganisms and hydrobionts. In water supply systems supplying water from surface sources, the percentage of cases of water quality deviations in some years reached 38% for chemical indicators and 43% for bacteriological indicators. Analyzes have shown that recent years have been characterized by a sharp increase in the mineralization of underground drinking water. Mineralization in underground drinking water of the Republic of Karakalpakstan ranged from 0.8 to 14.7 g/l. The presence of Ca^{2+} salts and excess Mg are especially dangerous. In underground drinking water, the presence of fertilizer residues was noted: nitrates up to 4.25, ammonium ion up to 1.20, phosphate ion up to 0.7 mg/l. Rural water pipelines, as a rule, have low capacity, are often in disrepair, operate irregularly and supply low-quality water. The share of water samples that do not meet hygienic standards for microbiological indicators for water pipes with underground sources is 7.0%, with water intake from open reservoirs - 4.6%, for sanitary and chemical indicators - 15% and 27.7%, respectively. Sulfates were also detected in the drinking water samples studied. Their presence is explained by the processes of chemical weathering and dissolution of sulfur-containing minerals, mainly gypsum, as well as the oxidation of sulfides and sulfur. It is common knowledge that the presence of sulfides in drinking water is unacceptable. Their presence in drinking water is associated with processes occurring during bacterial decomposition and biochemical oxidation of organic substances, and indicates bacterial contamination of drinking water consumed by the population. [1,10,17]

Methods:

Based on the above, in order to provide the population with high-quality drinking water, there is a need to use various water purification methods consisting of several stages, which can be used due to economic profitability, speed and efficiency. One such purification method is Heterogeneous photocatalysis. It can be defined as the acceleration of a photoreaction in the presence of a catalyst. The two most significant applications of photocatalysis are solar water splitting and the purification of air and water containing low concentrations of pollutants. The interdisciplinary nature of the field has also grown significantly to include semiconductor physics, surface science, photo- and physical chemistry, materials science, and chemical engineering [10].

Heterogeneous photocatalysis can be described as the acceleration of a photoreaction in the presence of a catalyst. In the context of history and research, interest in heterogeneous photocatalysis can be traced back many decades to the discovery by Fujishima and Honda in 1972 of the photochemical splitting of water into hydrogen and oxygen in the presence of TiO_2. Since that time, extensive research, many of which have been published, has been carried out to produce hydrogen from water in oxidation-reduction reactions using various semiconductor catalysts. In recent years, interest in photocatalysis has focused on the use of semiconductor materials as photocatalysts to remove ambient concentrations of organic and inorganic species from aqueous or gaseous media in environmental, drinking water, industrial, and healthcare systems. This is explained by the ability of TiO_2 to oxidize organic and inorganic substrates in air and water through redox processes. In this context, TiO_2 has become not only one of the most interesting materials, but also one of the most used in both homology and medical systems. Not only the material used in both homogeneous and heterogeneous catalysis, but also managed to attract the attention of physical chemists, physicists, materials scientists and engineers to the study of the distinctive features of semiconductor and catalytic properties. Inertness to chemical environments and long-term photostability have made TiO_2 an important material in many practical applications, as well as commercial products ranging from drugs to food, cosmetics to catalysts, paints to pharmaceuticals, and sunscreens to solar cells in which TiO_2 is used as a desiccant, bleaching agent or reaction mediator [7].

Although there are no known health effects associated with TiO_2 use, a recent study found that children aged 3-6 years are the most exposed group of people who consume TiO_2 particles from food sources. Many new properties of TiO_2 have been introduced in the last few years [11]. It should be noted that the regulatory framework for the use of TiO_2 in food products has not yet been established in many countries, especially in developing countries. The catalyst itself remains unchanged during the process and no consumable chemicals are required. This provides significant savings and simplifies the operation of the equipment. High-bandwidth semiconductors such as TiO_2 are commonly studied in rutile (3.0 eV bandpass) and anatase (3.2 eV bandpass), and the response of TiO_2 to ultraviolet radiation has led to more than just research into photocatalysis. [5,6,9]

But also to extensive research into the superhydrophilicity of TiO_2, its use in environmental remediation and solar fuel production. Excitation of TiO_2 passbands leads to charge separation followed by absorption of electrons and holes adsorbed on the surface.
Community-wide water infrastructure is as good as it gets. But until everyone has it, there are other, cheaper solutions to this problem. In addition to the heterogeneous photocatalysis method, there are purification methods:
1. Ceramic filters. Ceramics, clay, sawdust and a plastic bucket can act as a water filter that traps dirt and pathogens. The classic design involves mixing clay with a combustible material such as sawdust or rice husks, shaping it into a flower pot and firing it in a kiln. The sawdust or rice husks burn off, leaving tiny pores in the ceramic through which water is filtered. Organizations around the world have been using this ceramic filter for many years to reduce disease in poor areas.
2. Filtration of bone charcoal. Not all filters remove heavy metals or other toxins from water, but crushed and charred animal bones can. In areas where toxins enter the water, it is recommended to remove them. For example, chronic exposure to arsenic can cause skin, bladder, kidney and lung cancers, gangrene and possibly diabetes, high blood pressure and reproductive problems. Uranium in drinking water is associated with nephritis, an inflammation of the kidneys. When they become inflamed, the kidneys dump proteins the body needs into the urine stream, a condition that can be fatal. Ground and charred cattle bones are cheap and locally available. When designed correctly, filters like the carbon prototype pictured can purify contaminated water right in the home. However, clean water solutions for developing countries are not universal.
3. Slow sand filtration. Slow sand filtration has the advantage that it works with the water source of the entire community, not just individual households. A slow sand filtration system is a combination of several parts: water storage tanks, aerator, pre-filters, slow sand filters, disinfection stages and filtered water storage tanks. The number of filters and types of filters used in a given slow sand filtration system will depend on the quality of the source water and will vary.
4. Solar distillation. Not to be confused with solar sterilization or disinfection, solar distillation purifies even cloudy, salty or undrinkable water through evaporation and condensation. In reality, solar panels can be a cheap and simple piece of plastic or glass in a specific shape, or they can be more advanced devices. To operate, the still lets sunlight through a transparent panel onto the impure water. The water heats up and evaporates, then condenses on the underside of the panel and flows into some container. This simple process requires a huge amount of energy, which is why solar installations may make more sense than those running on other fuels.
5. Chlorine. We left chlorinated water for last, the most reliable method of treatment. Chlorine can act in public water supplies, killing germs before it gets into people's jerry cans or home water supplies. And it protects the water from new contaminants long after it is added. We've seen some interesting chlorination methods operating in resource-limited areas. The chlorinator, fully assembled and disassembled, is attached to a loop on the water pipe that feeds into the public reservoir. Chlorine is one of the most versatile and effective clean water solutions for developing countries and beyond. [12]

Discussion

All these methods show us the ability to purify water in places where it is difficult or the purification is not complete, and due to the fact that these methods are more accessible and cost-effective. Conclusion: based on all of the above, it follows that for the water used in the territory of the Republic of Karakalpakstan, a purification method is needed - the most acceptable to climatic conditions and its changes - to pollution conditions - capable of purifying a large volume of water in a short period of time, that is, completeness and speed of action. - environmentally safe, not causing disease in the population or exacerbating existing chronic diseases, and also, if possible, not affecting the ecosystem. The latter is especially important due to the fact that on the territory of Karakalpakstan the state of the ecology and environment is much lower than the standards and indicators that are necessary for the growth, development and living of a healthy person. Therefore, there is a need to create a method of water purification that will be most optimal under these conditions.

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