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POLLUTIONED WASTEWATER AND ITS BIOLOGICAL PURIFICATION.

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Normatov Abdurahim Eminovich
Fergana State University, basic doctoral student
abdurahim85normatov@gmail.com
Tel: (+998-99) 010-91-51
ORCID ID: 0009-0004-5617-3258
Yuldoshov Laziz Tolibovich
Bukhara State University, Associate Professor

Annotation

This article provides information on the effective use of water resources, conservation and prevention of pollution, the negative consequences following pollution, and the utilization of biological methods for water purification.

Key words

Water, clean water, oil, petroleum products, polluted wastewater, contaminated wastewater, maximum permissible concentration of pollutants, industrial water, treatment facility, biological treatment.

IFLOSLANGAN OQAVA SUVLAR VA ULARNI BIOLOGIK TOZALASH.

ЗАГРЯЗНЕННЫЕ СТОЧНЫЕ ВОДЫ И ИХ БИОЛОГИЧЕСКАЯ ОЧИСТКА.

Annotatsiya

Ushbu maqolada suv resurslaridan samarali foydalanish, tejash va ifloslanishini oldini olish, ifloslanishidan keyingi salbiy oqibatlari hamda ularni tozalashda biologik usullardan foydalanish to‘g‘risida ma’lumot berilgan.

Tayanch so‘zlar

Suv, toza suv, neft, neft mahsuloti, ifloslangan oqava suv, zararlangan oqava suv, ifloslantiruvchi moddalarning cheklangan miqdori, texnik suv, tozalash inshooti, biologik tozalash.

Аннотация

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В данной статье представлена информация об эффективном использовании водных ресурсов, их экономии и предотвращении загрязнения, а также о негативных последствиях загрязнения и использовании биологических методов для очистки воды.

Ключевые слова

Вода, чистая вода, нефть, нефтепродукт, загрязненные сточные воды, зараженные сточные воды, предельно допустимое количество загрязняющих веществ, техническая вода, очистное сооружение, биологическая очистка.

Proper management and protection of natural water resources is a pressing task for all countries and societies.

With the development of industrial enterprises, the increase in wastewater rich in harmful substances and their discharge into natural water sources without treatment is causing the destruction of the soil ecosystem, the spread of various diseases among the population in the region, the loss of agricultural crop yields, the extinction of cultivated, medicinal and wild plant species, the reclamation of soil and water systems, and the extinction of representatives of the animal world in them.

Most importantly, this contaminated wastewater is reaching the groundwater we consume, mixing with the natural water of streams and ditches, and using these waters, which contain various harmful substances, for various purposes is causing new types of diseases that pose a great threat to human health.

Clean water is necessary for all life. The negative impact of the human factor on nature is harming itself at the expense of natural cycles. All living organisms, including humanity, cannot live without water. Water is not only for drinking, but also a part of all types of products we consume. For example, fresh vegetables and fruits contain 90% water, potatoes and meat 75%, and bread up to 7%.

A person consumes from 100 ml to 3000 ml of water per day, depending on age. In particular, an average of 1200-1300 ml (48%) of water is consumed in liquid form, and 1000-1200 ml of water is consumed in food. As a result of endogenous oxidation of nutrients and breakdown of fats in the body, an average of 300 ml of water is produced per day. All water molecules in the body are renewed within 15 days in an adult, and within 35 days in children.

In terms of sanitation and hygiene, in addition to meeting a person's physiological need for water, a significant amount of water is spent on personal hygiene, household and production needs.

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An average person uses 370 liters of clean water per day for personal needs, 180-150 liters for hygienic showering, and 580 liters for laundry, cooking, and dishwashing. However, in addition to the above, natural water is also needed to keep residential and public buildings clean, flush waste, wash streets, and water green plants when sewage is used.

The number of people living on Earth has exceeded 8.2 billion (as of January 14, 2025). However, the amount of water has not changed, but the amount of consumption has increased. Currently, more than 3 million people in the world die from lack of clean drinking water, and 12 million people suffer from various diseases every year due to the lack of clean drinking water.

According to the analysis, in London, 170 liters of water are consumed per person per day for daily activities, in Paris - 160 liters, in Brussels - 85 liters, and in Tashkent - 370 liters.

According to calculations by scientists from the global community, the norm is set at 50 liters of water per person per day for drinking, washing, and cooking.

It is known that water is the most important mineral necessary for the survival of various organisms on Earth, and all the processes that occur in them take place only in the aquatic environment. This indicates that water is a very important and invaluable natural component. For example, during the process of photosynthesis in plant cells, an average of $4.6x10^{11}$ tons of oxygen are released into the atmosphere per year, and $2.25x10^{11}$ tons of water are consumed in this process.

Today, in the world, 2,800 km^3 of water is taken from rivers and groundwater annually to irrigate 200 million hectares of land. This is equivalent to 7% of the world's river water. Of the 2,800 km^3 of water consumed, 17% or 470 km^3 is added to rivers and groundwater in the form of return water, while the remaining 83% or 2,330 km^3 is completely consumed. On average, 92-94% of the fresh water obtained in our republic is used in agriculture, 6% in industrial enterprises, and 0.5% in municipal services as household water.

The problem of providing humanity with water is gradually becoming more complicated due to the expansion of cities, the rapid development of industry and agriculture, the increase in irrigated land, the growth of the population and the improvement of their living conditions, and other factors.

Therefore, the protection and rational use of water resources in the world still remains one of the priority issues. In our republic, extensive scientific research is being carried out in this area and necessary measures are being taken. The development of new, economical technologies, the introduction of a closed cycle of water use, biological treatment of wastewater, and environmentally safe, economically affordable and effective methods for protecting water resources is an

important requirement of the present era.

Among the sources of water pollution, the most important place is occupied by wastewater from industrial enterprises and household and communal services. These wastewaters contain various acids, phenols, alkali metals and other toxic substances, oils and petroleum products that are dangerous to living organisms. Together with wastewater used in industrial enterprises, they are the main source of pollution of natural water sources, rivers, lakes and reservoirs.

As is known, another of the main tasks of the optimal use and protection of water resources is to treat wastewater from industrial enterprises, agricultural production, and household and communal sectors and use it for various purposes, with the treatment of urban wastewater being particularly important.

Some enterprises do not have facilities for treating wastewater contaminated with iodine substances. Even enterprises that have treatment facilities use chemical additives economically, which leads to pollution of wastewater by discharging it into open water bodies without or with insufficient treatment in accordance with the established municipal and environmental standards. In addition, preventing soil pollution in our region and cleaning contaminated soil due to its direct connection with the pollution of water sources is one of the urgent issues.

In particular, the study of the properties of soils contaminated with oil and oil products, as well as the individual factors of biological remediation of soils contaminated with oil and oil products, and the development of general remediation technologies for them, are hampered by the diversity of the chemical composition of oil, soil, and climatic conditions and properties.

In our republic, the Bukhara Oil Refinery, the Chinaz Oil Refinery, and the Fergana Oil Refinery are operating as oil and oil product processing plants. These plants have a very high need for clean water during the oil product processing processes.

According to the studied analyses, an average of 2.4 tons of clean or technical water is required to process 1 ton of petroleum products into a finished product. Among the harmful substances, oil and petroleum products occupy a special place, and insoluble derivatives of petroleum products are considered very dangerous pollutants.

The maximum permissible concentration of pollutants in industrial wastewater into municipal sewage networks, as set out in Appendix 2 of the Resolution No.820 of the Cabinet of Ministers of the Republic of Uzbekistan dated October 11, 2018, establishes that the amount of petroleum products in wastewater is 1 mg/liter, exceeding which leads to a fundamental deterioration of the natural ecological environment.

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According to the calculations obtained, if the average density of oil is 0.89 g/cm^3, we can calculate how many kilograms 1 liter (1000 cm^3) of oil weighs as follows:

Mass=Density×Volume, Density is 0.89 g/cm^3, and volume is 1 liter = 1000 cm3:

Mass = 0.89 g/sm^3 × 1000 sm^3 = 890 g = 0.89 kg. Therefore, 1 liter of oil is approximately equal to 0.89 kg.

If 1.1 mg/l of oil contaminates 1 liter of water, then the density of 1 liter of oil is 0.89 g/cm^3 or 0.89 kg/l. 1 liter of oil = 0.89 kg = 890 g = 890,000 mg.

If 1.1 mg of oil contaminates 1 liter of water, then 890,000 mg of oil can contaminate 809,090.91 liters of water.

1 gram of oil typically forms a film on the water surface 0.1-0.01 micrometers (µm) thick. This film thickness serves to disrupt the exchange of essential substances and gases in the water.

We use the following formula for the calculation:

$$A = \frac{m}{p \times d}$$

Here:

· A- distribution area.

· m- mass of oil (1 gram = 0.001 kg).

· p- oil density (approximately 0.89 g/cm^3 or 890 kg/m^3).

· d- film thickness (e.g. 0.1 micrometer = 1×10^{-7} meters).

$$A = \frac{0.001\ \text{кг}}{890\ \text{кг/м}^3 \times 1 \times 10^{-7}\ \text{м}} = 11.24\ \text{м}^2$$

According to calculations, 1 gram of oil or oil product can form a film on 11.24 m^2 of water. Since petroleum products have a low density compared to water and are insoluble and immiscible in water, they become a source of pollution for any water body.

To calculate the rate of spread of oil on the surface of water, with a density of 0.89 g/cm^3 per liter, a number of physical parameters affecting it can be calculated with average values. Based on the model, we calculate the rate of spread using the following data:

Information provided:

- **Density of oil (ρ_{oil})**: 0.89 g/sm^3=890 kg/m^3.
- **Density of water (ρ_{water})**: 1000 kg/m^3.
- **Gravitational acceleration (g)**: 9.81 m/s^2.

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• **Oil viscosity (μ_{neft}):** Typically, the viscosity of oil averages around 0.5 Pa.

• **Spread thickness (h):** Oil typically spreads on water at a thickness of 0.1 µm (micrometer) or 1×10^{-7}m.

We calculate the diffusion rate with the following equation:

$$v = \frac{\Delta\rho \cdot g \cdot h}{\mu}$$

Бу ерда:

- $\Delta\rho = \rho_{\text{сув}} - \rho_{\text{нефть}} = 1000\,\text{кг/м}^3 - 890\,\text{кг/м}^3 = 110\,\text{кг/м}^3$,
- $g = 9.81\,\text{м/с}^2$,
- $h = 1 \times 10^{-7}\,\text{м}$,
- $\mu = 0.5\,\text{Па\cdotpс}$.

$$v = \frac{110\,\text{кг/м}^3 \times 9.81\,\text{м/с}^2 \times 1 \times 10^{-7}\,\text{м}}{0.5\,\text{Па\cdotpс}}$$

Calculation

$$v = \frac{110 \times 9.81 \times 10^{-7}}{0.5} = \frac{1.0791 \times 10^{-4}}{0.5} = 2.1582 \times 10^{-4}\,\text{м/с}$$

The average spreading velocity is 2.16×10^{-4} m/s, meaning that oil spreads across the water surface at a speed of approximately 0.216 mm/s.

These indicators show how negative consequences pollution of wastewater with oil and oil products can lead to.

Large manufacturing plants in our republic are large water consumers, and they have new modern wastewater treatment facilities.

Wastewater treatment in treatment facilities always requires large overall costs. The biological treatment method using modern, effective, natural and economical macrophyte plants in treatment facilities always justifies itself.

LIST OF USED REFERENCES:

1. Abdukodirova M.N., Biological treatment of wastewater. – Monograph. – Tashkent, 2023. – P. 3-24.

2. Buriyev S.B., Qobilov A.M., Distribution of higher aquatic plants in Lake Kara-Kir // Reproduction of microscopic algae and higher aquatic plants, their application in the national economy: Materials of the Republican scientific and practical seminar. – Bukhara, 2018. – P. 92-94.

3. Iskandarova G.T., Text of lectures on communal hygiene. –Tashkent, 2006. – P. 10-22.

4. Makhmudova D.E, Rakhmonova M.A., Improving the technology of domestic wastewater treatment, Innovative technologies in construction., Collection of materials of the Republican scientific and technical conference. – Tashkent TAQI, 2017. – P. 160-161.

5. Tulaganov. K., The ecological significance of water in human life. – Tashkent, 2011. – P. 51-59.

Websites

www.colector.uz https://www.twirpx.com/ http://diss.natlib.uz/ https://www.dissercat.com/ https://www.calacademy.org/

http://wash.earthforever.org/lib/uz/water_critical%20resource_Uzbekistan_enru_uz/Uzbek/Water_uz_part_02[1].pdf