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Evaluation of the effectiveness of the technology of biological treatment of wastewater at the Salar aeration station.

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Abstract: The article , 2 strains of chlorella algae and 5 species of aquatic plants were grown in domestic-communal wastewater, and the resistant species were selected from among them. , development and productivity, as well as information on the physical and chemical properties of wastewater before and after the growth of algae and aquatic plants. The obtained results showed that Pistia and Eichhornia algae and aquatic plants developed rapidly in 100% wastewater, with high productivity and improved physico-chemical properties.

Key words: Waste water, aeration station, biological treatment, aquatic plants, physicochemical properties, pistia, eichhornia.

Introduction It is known that the water reserves on our planet are decreasing year by year, because the demand for water is increasing due to the growth of the irrigated area, the rapid development of industry and the increase of the population, which requires the efficient use of water resources and the treatment and reuse of used water. Therefore, all over the world, they are paying special attention to research on effective use of water resources, their protection, and the treatment of various wastewaters. In our republic, many researchers on the biological treatment of wastewater (Muzafarov A.M., Shoyakubov R.Sh., Ismoilkhodjaev B.Sh., Abdukadirova M.N., Muminova R.N., Haydarova H.G., Djumaniyozova G. I, Hasanov O.) extensive scientific research works were carried out. By them, the distribution of algae and aquatic plants in water bodies, their systematics, their morphology, anatomy, physiology, biochemistry, the development of methods of growing them indoors, in various fields of the national economy - animal husbandry, poultry farming, cotton farming, cocoon farming, food industry, textile industry and scientific research works were carried out on the use of other wastewater treatment. However, various wastewater treatment issues have not lost their relevance until now. [1;2;4]

Due to the expansion of cities, the rapid development of industry and agriculture , the increase of irrigated land, the increase in the number of people and the improvement of their living conditions, and other factors, the problem of providing water to humanity is becoming more complicated.

Therefore, the issues of protection of water resources and their rational use have become one of the priority directions in the whole world. In our republic, comprehensive scientific and research works are being carried out in this direction and necessary measures are being implemented. Development of new, cost-effective technologies, implementation of a closed cycle of water use, biological treatment of wastewater, ecologically safe, economically cheap and effective methods for protecting water resources is an important requirement of the current era.

In this regard, research works on the biological treatment of domestic and communal wastewater formed in residential areas, i.e., on reducing the duration and increasing the level of wastewater treatment at aeration stations in Tashkent, especially with algae and aquatic plants, have not been carried out sufficiently. Taking this into account, we planned to conduct scientific research work on improving the technology of biological treatment of wastewater from the Salar aeration station located in Tashkent.

The purpose of the research is to improve the technology of biological treatment of wastewater formed at the Salar aeration station located in the city of Tashkent using algae and aquatic plants.

The purpose of the research is to select wastewater-resistant species from among aquatic plants, to determine the level of purification by growing the selected algae in wastewater with different concentrations in laboratory conditions, and to use active purification plants in a treatment plant.

Research object and methods - the research was conducted at the Salar aeration station located in Tashkent. The Salar feeding facility is located in the southern part of our capital, on the banks of the Salar creek, on an area of 82 hectares. It was launched on April 12, 1961 with a capacity of 25,000 m3 · By the 1970s, the structure expanded as a result of the increase in the population of Tashkent. 8 primary clarifiers,

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pump units are installed in each section. Currently, the facility receives 750-850 thousand m 3 of wastewater from Yakkasaroy, Mirabad, Mirzo Ulug'bek, Chilonzor, Yashnabad, Sergeli districts of our capital, neutralizes it and discharges it into the Salar stream. Currently, the Salar saturation plant includes mechanical treatment and sludge processing, biological treatment and wastewater treatment, and chemical and bacteriological departments. The main task of the mechanical department of the aeration saturation facility is to catch large objects in 11 mechanical grates and 16 of them, 8 d-20m and 8 d-40m primary clarifiers, for 1.5 hours, to separate 50-55% of suspended substances from wastewater. The collected sludge is sent to the clarifiers for recycling according to the schedule, and the settled wastewater goes to biological treatment. The second, biological section of the facility is designed to extract dissolved and suspended organic matter from wastewater after mechanical treatment. This work is performed by 2 groups of aerotanks and 2 groups of secondary radial clarifiers with a total capacity of 970,000 m ^{3} per day, designed to break up the turbid mixture . There is a chemical-bacteriological laboratory at the aeration station, where samples are taken several times a day and water purity is analyzed until the water leaves the station and is thrown into the Salor stream. In this process, wastewater is purified up to 60 percent.

The wastewater sample was taken from the inlet to the treatment plant of the aeration station. We selected 2 strains of Chlorella vulgarius algae from the collection of aquatic plants (pistia, eichhornia, azolla, ryaska, wolfia) (Fig. 1) in order to select a type resistant to wastewater as an object of biological treatment.

eichhornia pistia Azola ryaska Wolfia

1- picture . In laboratory conditions grown water plant common appearance

Algae Chlorella Vulgarius YA-1-1 belonging to the section of green algae; YA-1-6; YA-1-8; Strains YA-1-12 (Fig. 2) were obtained from the collection of the Institute of Botany of the Academy of Sciences of Uzbekistan). Cultivation was carried out under laboratory conditions in special algae growth flasks under appropriate temperature, light and nutrient conditions. Algae were grown in laboratory conditions in glass containers of different sizes (250, 500) ml in mineral nutrient mediums at the temperature (25-30; 35ºC) and light intensity (100-120 thousand lux) suitable for the algae in the stationary devices of rapid multiplication that automatically hold them. .

We grew these plants for 5 days in 100% wastewater from the Binokor aeration station.

a) b)

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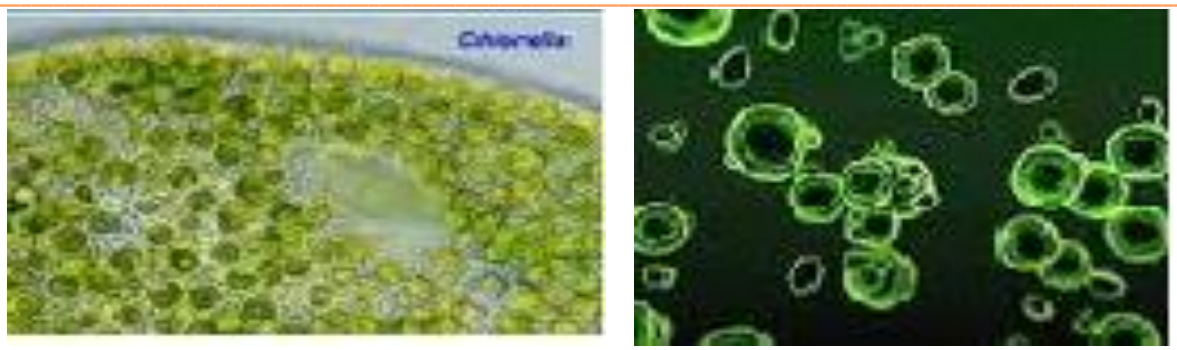

c) g)

Figure 2. Microscopic appearance of Chlorella algae Ch. vulgarius YA-1-12(a), Ch. vulgarius YA-1-8(b), Ch. vulgarius YA-1-6(v), Ch. vulgarius YA-1-1(g).

During this time, we determined the daily growth, morphological condition and productivity of the plants. Productivity was determined by weighing dry biomass. Physical and chemical properties of wastewater before and after the experiment were conducted according to Yu.Yu.Lure method. In order to determine the wastewater treatment levels of the selected wastewater-tolerant plant species, we cultivated aquatic plants for 1 week in a 25 L spherical aquarium with wastewater at different concentrations (100, 50, 25%) and as a control option in Tamiya mineral nutrient medium for 1 week, and daily growth and we monitored its morphological condition. Based on the results of the laboratory, we tested the species of algae and aquatic plants that can maximally purify wastewater in the biological pond of the Salar aeration station treatment facility, and their phenological indicators of productivity and physical and chemical indicators of wastewater before and after the experiment were studied and the efficiency of purification was evaluated. [3;5]

The results of the experiment show that among the 4 tested strains Ch.vulgarius YA-1-6 showed minimal changes in the cell shape and organoids (60% with effluent). In the rest of the strains, significant changes were observed in the morphological characteristics, as well as in the cell nuclei and pyrenoids (in 2-3 days of cultivation). So, Chlorella vulgaris UA, which is widely distributed in water bodies in the Okhangaron region, among several strains of Chlorella vulgarius (Chlorella vulgaris YA-1-1, YA-1-6, YA-1-8, YA-1-12) kept in pure algal state - We selected strains 1-6. This algal strain was found to be resistant to various environmental conditions in preliminary phenological experiments. Experiments showed that the highest productivity (2.5 g/l of dry matter) is recorded in Ch. vulgarius YA-1-6 strain and the lowest 1.7 g/l in Ch. vulgarius YA-1-12. We conducted the next experiments in laboratory conditions in Ch. vulgarius strain YA-1-6.

We conducted an experiment with the following species from the collection of aquatic plants: pistia, eichhornia, azolla, ryaska, and wolfia, in order to select a type resistant to wastewater as a biological treatment object. We grew these plants for 5 days in 100% wastewater from the Salar aeration station. During this time, we determined the daily growth, morphological condition and productivity of the plants.

To select plant species resistant to wastewater, we grew them in a 25 l spherical aquarium for 1 week in laboratory conditions and monitored their daily growth and morphological condition.

The results of the experiment show that the condition, growth and productivity of the 5 tested species of aquatic plants are different when growing in wastewater, among which the most resistant species to this wastewater are Pistia and Eichhornia plants. It is observed that pistachio productivity reaches 400 g (wet biomass) per 1 m^2. The productivity of the Eichhornia plant reached 350 g, and yellowing of its leaves occurred after the experiment. The yield of the remaining plants was 37-70 g. It was observed that there was little change in the morphological state of Pistia and Eichhornia when grown for 5 days, in the other 3 species of aquatic plants, especially in the body of Wolfia aquatic plant, a change began to occur during the growth period, and on the 5th day, the biomass growth slowed down and the productivity began to decrease. This condition started to occur in the Azolla plant after 3 days. In the results of other researchers' work, it was shown that pistia and eichhornia plants grow well in various wastewaters [6; 7; 8; 9].

In order to determine the effectiveness of cleaning algae and aquatic plants in the treatment plant at the Salar aeration station, we determined the levels of their separate overgrowth cleaning.

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A significant reduction in pollutants was observed in the wastewater from the Salar aeration station after the cultivation of aquatic plants and algae. However, it was found that the level of purification did not increase to 75-80%. The reason for this is that Salar station is known to generate 70% of wastewater generated in Tashkent city, and the amount of pollutants in wastewater is higher than that of other stations in the city. For example, it was found that the amount of pollutants in the waste water from Binokor aeration was five times higher. Therefore, in order to improve the efficiency of further treatment of this wastewater, we conducted an experiment using aquatic plants and algae together. [13;14;]

The experiment was carried out in 2 consecutive corridors of the Salar aeration station treatment plant section (1-pistia, 2-chlorella was grown for 10 days and their hydrochemical composition was analyzed).

The conducted chemical analyzes showed that the indicators of sulfate, nitrogen, phosphorus and other substances before growing algae can be seen to be significantly reduced after 5 days after growing algae. Nutrient elements nitrogen and phosphorus did not remain in the waste water at all (nitrogen-10%, phosphorus-20%). Until this period, it can be observed that other substances, copper, iron, chromium have significantly decreased (70%, 50%, 75% respectively). It can be observed that the smell of water has decreased from 5 points to 1, and rN has decreased to 7.0. Therefore, it is possible to achieve a further improvement of their hydrochemical composition and quality by growing algae in wastewater at the second stage. [10;11;12]

Physico-chemical composition of wastewater before and after algae cultivation under semi-production conditions

No	Options	The smell score	pH	Copper , mg/l	Iron mg/l	Chromium mg/l	Chlorine (cl) mg/l	Sulfate (SO_4) mg/l	Total nitrogen (N) mg/l	Phosphate (R_2O_5) mg/l	BOD$_5$ mg/o$_2$/l
Water plant - the composition of wastewater before growing pistachios											
1	Before growing pistachios	5.0	9.0	3.6	2.5	1.8	90	145	20.4	73.1	250.0
Composition of wastewater after pistachio cultivation											
2	After growing pistachios in 100% wastewater nutrient medium	2.0	7.8	1.9	1.5	0.8	45	70	6.8	35	50.0
Seaweed - Chlorella vulgarius post-cultivation effluent composition											
1	100% wastewater nutrient medium pistachios are grown	0	7.0	0.9	1.2	0.5	22	39.0	2.0	15	14.0
Reduction Rate %		160	8	70	50	75	75	70	90	80	92

Later, researchers [Khidirboeva, 2016] are conducting scientific work on the biological treatment of wastewater using several similar plants. Experiments have shown that, as a result of co-cultivation of wastewater from a poultry factory in Qibray District, Tashkent region, together with aquatic plants Pistia

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telerhizovid and small ryaska, various compounds of nitrogen, phosphorus, sulfate, iron and other substances in wastewater are absorbed by 70-80% and nitrogen by 100%. , it can be seen that the demand for oxygen has decreased to 4.5% and that the degree of purification of wastewater generated in the poultry factory in this technological process has reached 95%. In addition, after growing pistachio plant, growing ryaska plant in the pond will speed up the sewage treatment process and prevent the spread of sewage odors.

Summary:

Algae and aquatic plants have the ability to significantly purify the wastewater coming to the salar aeration station by absorbing various substances.

It was found that the wastewater treatment efficiency of Salar aeration station was 86% after pistachio cultivation. In order to further increase the efficiency, as a result of the cultivation of algae-chlorella in the 2nd biological pond , it was proven that the level of wastewater treatment reached 90-92 % . phosphorus decreased by 73-15 mg/l, sulfate by 145-39 mg/l).

Therefore, we believe that it is appropriate to use the 2-stage technology to increase the efficiency of wastewater treatment at the Salar aeration station in Tashkent, i.e., to grow pistia, an aquatic plant, and algae-chlorella at the next stage.

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