An important role in the variety of active sludge composition in wastewater treatment

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Abstract: Informtion on wastewater treatment methods in the Bukhara city treatment plant is provided. Organic matter in the water that has passed through the mechanical cleaning system is bacteria in the aero tank. It is fully described that microorganisms are decomposed using active sludge. In Aero tank, active sludge index is 200-250 mg/l and for the first time more than 127 of its species have been identified. It has been studied that biogenic substances can be cleaned up to 90-97% with the help of the algae. Key words: Reconstruction, bio pool, microorganism, aero tank, station, anaerobe, bacterium, helminth, denitrophication, rotifer, logarithmic, zoo gel, organic, nitrophication, biomass, aeration, concentration, regeneration, photosynthesis.

1 Introduction

Bukhara Municipal Wastewater Treatment Plant, owned by the limited liability company "Bukhara Water Supply", was put into operation in 1972, and the initial treatment was mechanical, wastewater was treated at the facility and discharged into the Sakovich ditch through the building of iron barriers (chambaraks), sandboxes, primary sedimentation tanks and biological artificial ponds (bioprudes).

In 1984, the design capacity for one day was 100 thousand m^3, additional primary finders, aerotanks, an air drive station, secondary finders, sludge assembly sites, chlorination of buildings were built, commissioned in 1985 [1-3].

But the volume of wastewater entering the treatment facilities reached 45-50 thousand/m^3 due to wastewater from the Bukhara Textile Mill. The composition of wastewater was strongly alkaline, acidic, microorganisms died in the aeration tank, and the sludge index was 50-60 mg/l, which was 30-40% of the total efficiency of the installation. In accordance with the Decree of the President of the Republic of Uzbekistan dated October 29, 2009 No. PK-1216 "on measures for the implementation of the project "Reconstruction of sewage treatment plants and sewage systems in the cities of Bukhara and Samarkand", from 2014 to 2016, phase number 1 of reconstruction was carried out at the facility. 6 air drive pumping stations with modern equipment were reconstructed and re-equipped [5-18].

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2 The main part

Scan the water environment (pH) with a simple temperature thermometer that seasonally samples wastewater from all stages of treatment facilities. 30 (KHP), and all other components: oxygen dissolved in water-by the Winkler method, biogenic substances-by measuring coloropetiric mineral salts, cations-by complexometric methods. Hydrobiological samples were taken from aerotank biologics species composition of microorganisms seasonal dynamics of dominant species water sensitivity tests-experiments with daphnia were carried out in laboratory conditions.

The sewage treatment plants receive 38-40 thousand/m^3 of wastewater generated per day in the cities of Bukhara and Kagan. Its seasonal volume and chemical composition vary (Table-1). Wastewater entering the treatment facilities initially large mechanical impurities contained in them are treated in the iron grate building, and anaerobic bacteria, helminth eggs, sand, soil and metal particles contained in the wastewater are captured up to 65-70% using sand-containing devices.

Note: on average, 1608.3 m^3 of wastewater per hour is supplied to the treatment facilities. Since the wastewater entering the treatment facilities of the city of Bukhara does not contain oxygen dissolved in water, organic substances decompose with the participation of anaerobic bacteria. As a result, the content of nitrites and ammonium salts in wastewater increases. In the presence of anaerobic bacteria, organic substances in wastewater decompose to nitrites during denetrification with the formation of toxic gases such as ammonia and hydrogen sulfide [14, 11].

According to the data obtained, wastewater treatment processes from suspended solids take place in the primary desiccant. Primary finders consist of 4 radial finders with a capacity of 25 thousand m^3, 2 of which are working, 2 are reserve. Primary desiccants consist of the deposition of suspended impurities in wastewater for 2 hours in accordance with the wastewater treatment time (regulation). Wastewater in the facility is purified from suspended solids by 65-70% under the action of centrifugal portable force during rotation of special crushers and enters the air tank, where air is supplied under high pressure. The amount of dissolved oxygen in the water is brought to 4-6 mg. As a result, biodiversity develops in the water (bacteria, calcified animals, amoebas, slippers, infusoria).

While ammonium salts in wastewater average 77.8 kg/m^3 per hour in spring, it can be seen that this figure has increased to 84.8 kg/m^3 in summer. Similarly, nitrites in wastewater have a seasonal character: their amount in spring is 4.5 kg/ m^3, in summer-4.5 kg/ m^3, in autumn - an average of 4.1 kg/ m^3 and in winter-1.3 kg/ m^3, and nitrates-2.3 kg/ m^3, starting in spring and ending in winter 3.8. phosphates were recorded in the range of 4.6-7.7 kg / m^3 (Table-1). The maximum suspended solids content in wastewater is 389.2 kg/m^3 (in summer) and the minimum is 353.8 kg/m^3 (in winter). The content and content of mineral salts is 249.2-287.8 kg/m^3 [3, 12].

Table 1. Chemical composition of wastewater entering treatment facilities

		Spring		Summer		Autumn		Winter	
		Mg/l	Kg/m^3 hour	Mg/l	Kg/m^3 hour	Mg/l	Kg/m^3 hour	Mg/l	Kg/m^3 hour
1	Ammonius	48,4	77,8	52,5	84,4	45,3	72,08	40,07	65,4
2	Nitrites	2,84	4,5	2,86	4,6	2,58	4,1	2,38	3,8
3	Nitrates	0,8	1,3	0,5	0,8	1,2	1,9	1,5	2,4
4	Dry residue	1350	249,2	1640	263,7	1750	286,2	1790	287,8
5	Sulfates	480,3	772,6	560,6	901,6	612,4	984,9	668,5	1075,1
6	Chlorides	292,7	470,7	298,8	479,5	305,4	491,4	306,8	403,4

7	Oxygen	-	_-	-	_-	-	_-	-	_-
8	pH	6,2	_	6,6	_	5,7	_	6,4	_
9	Phosphates	3,5	5,6	4,8	7,7	3,8	6,1	2,9	4,6
10	Hanging substance	220	353,8	242	389,2	252	361,8	220	353,8
11	Water temperature °C	17-20		20-24		17-20		10-14	

For the complete decomposition of ammonium salts and nitrogen nitrites in the wastewater of the aeration tank to nitrate ions, the active sludge index 200-250 mg/l and the content of oxygen dissolved in water 5,2-6,5 mg/l must be in the aeration tank, and its active participation in the purification process allows to achieve complete decomposition of organic substances contained in the wastewater (Table-2). 1 m^3 of air is considered positive. The duration of complete wastewater treatment in the aeration tank is 10-12 hours [2].

Table 2. Indicators of wastewater after treatment in an aerotank (mg/l)

	Ingredents Mg/l	Spring	Summer	Autumn	Winter
1	Ion ammonium	6.4	6.8	6.4	5.7
2	Nitrites	1.12	1.2	1.14	1.2
3	Nitrates	4.5	5.3	6.4	7.8
4	Dry residue	1500	1800	1700	1550
5	Phosphates	3.4	4.4	3.8	4.6
6	Suspended matter	20.4	24.2	26.2	28.6
7	Oxygen dissolved in water	5.2	5.6	6.5	5.2
8	PH of the aqueous medium	8.6	8.2	8.5	8.4
9	Water temperature °C	17-20	20-26	17-20	10-14
10	Active il index	189,6	221,3	232,3	192,3

During the observations, it was noted that the organic substances contained in the wastewater in the aeration tank are primarily determined by the activity of bacteria, the diversity of their number. According to Rodina (1965), in wastewater, the decomposition of bacteria into organic pollutants contained in wastewater occurs in the logorhythmic graphic phase, at the remaining stages, the transition of bacteria to the zoogel (turbid) phase is noted. Wastewater treatment from organic substances during decomposition with the participation of aerobic bacteria involved in the nitrophication process, a variety of microbial composition can be observed. Microorganisms are based on the use of organic substances contained in wastewater as nutrients for their vital activity. Due to the acceleration of the nitrophication process in wastewater, i.e. with the transition of the amount of oxygen dissolved in water (4-6 mg/l) to ammonia salts, nitrogen dioxide to nitrates, in the active sludge, the representatives of the rotifer began to dominate, taking the place of standing and free-floating infusoria. Of these, the fact that several species of lekana, brachionus, microcolidia, asplanchia and keratella are among the dominant species was reflected in the analysis and testing.

The wastewater index refers to the number of organisms contained in the sludge. Specific indicators of active Il in terms of affectivity were determined using broadcasts. The degree of sensitivity was determined by conducting rapid experimental tests using seriodaphnia. Such rapid experiments are carried out with samples taken from the sewage treatment plants of the Department of Ecology and Environmental Protection of the Bukhara region in cooperation with the specialists of the analytical center.

The active sludge found in the aeration tank of the Bukhara municipal sewage treatment plant revealed a wide variety of naive microorganisms of the following 69 species: *Amoeba limax, Amoeba radissa, Amoeba diploida, centropyxis lalvipata, difflugia mulesta, centropyxis aculeata, trepemenas sheini, bedo, euglupha laevis, pamphagus hyalinus, actinophrys vesigularis , Arcella discoides, olcomonas socialis, Aspidisca costata, Aspidisca cicada, Aspidisca sulcata, Aspidisca turrita, Aspidisca aculeata, Euplodes charon, Euplodes padella, Oxytrixa pellionella, Stylenuchia pestulata, Cielidiam clausoma, Colpoda steini, Paramaesiam caudatum, Rhabdostylla ovum, Vorticella alba, Vorticella microstoma, Vorticella convallaria, Opercularis glomerata, Podophrya fixa, Trixophrya epistilis, Spracrotillus natens, Cladothrix dixotoma, Biggiaoba alba, Thicthrix nivea, Zooglea Ramigera, Olkomonas Mutadillis, Bedo gladesus, Bedo Edax, Bedo Caudatus, Coleps Uncinatus, Synura Hella, Citelechillium, Aelosoma lezebrarum, Aelosoma, Nematoda, Carchesium polypitum, Colpidium colpeda, Arcella vulgaris, Amoeba proteus, Amphileptus carchesu, Deepcus anser, Deepcus lamella, Rotathria marcoceria, Psilodina megolatrecha, Lecane lunaris, callidina vorax, epistylis plicatilis, tecophrya lemnarem, akineta Flava, infuzoria vorticella, Infuzoria slector, braxionus, euglefa alveglata, nereis pelagica, opalina, stylonichia mytilus, pedophrya Cellini.*

Together with this, representatives of fauna and flora consisting of the following 58 species were identified in active sludge biocenosis: *Leptomitus lacteus, Nehamitus fissus, Rotifer vulgaris, Tubifox ruvilorum, Chironamus thummi, Eristalis tenax, Zooglea ramigera, Oscillatoria tonuis, Oscillatoria cryptoceps, Ohormidium autunole, Ciclotella meneghiniana, Chlamydomonas debaryana, Navicula princephala, Navicula rhynchosephala, hatrshia amphiaxis, Astasia klebsii, Euglena viridis, Stratiomys chamaelon, ciclidium Ciltrillus, cryptomonas Erosa, pelomyxa paradoxa, Anthoophysa vegetans, sphaerium Carneum, vorticella Campanula, Cladophora glomerata, Coleps hirtus, Loxophyllum fasciolatum, Paramaecium aurella, Stentor raeseli, Asplanchna vitullus, Halteria grandinella, Difflugia pyrifarmis, Mallomonas acrocosmus, Keratella longicauda, Scenedesmus quadrata, Scenedesmus acuminotuz, Aakistrodesmus falcatus, Keratella simplex, Pediastrum duplex, Seratium hirundinella, peridinium aciculiferium, Glenodinium oculatium, Rhoicosphenia curvata, surirella lincata, Spirigyra elondatum, ulothrix Zonata, Dileptus Anser, Strobilidium gyrans, tetracyclus braunii, ulothrix Limnetica, rivularia Hacmatites, Aegagropila Sauteri, Pinnularia borealis, Cyclatella bodanica, Surirella spiralis, Diplosida frequentisima, Ophridium versatile, Vorticella similis.*

In most cases, 20-25 permanent species of active sludge composition occur, and 15 of them are dominant. Coptic species are rare, may not always occur. Active sludge contains indexing organisms and is adapted to the organic substances contained in wastewater [1, 9, 10].

Microorganisms were recorded as dominant species in the active sludge:

From amoebas - *Pelomyxa paradoxa*.

From infusories-*Colpidium Cotruit, Colpidium Colpoda, Euplotes charon, Collidina vorax, operculari glomerata, Poramaeccium aurella, Vorticella microstoma, V.convularia, Astasia klebsii, Calidina vorax, Acpidiska turrita*. From kolovratkas-*Keratela longispina, Notholca longispina, Keratela quadrata, Leucane lunaris, Rotaria marcoceria, Opalina sp., Asplanchna vitullus, Brachionus sp*, etc.

Colorless cypresses-active sludge occurs when running in a high load state with a high content of organic matter in the wastewater, and when the oxygen content dissolved in the water is below 2 mg/l, and its size was recorded in an atrif of 10 mk.

The dominance of stable and free-floating infusions in a well-developed active sludge is evidenced by the high sludge index of 250 mg/l indicators. Filamentous bacteria-*Cladothriks* and *sfhaerothilus* have been observed to be mainly contaminated with hydrocarbons in the effluents and to be involved in cleaning when the textile industry has an alkaline or acidic

environment in the effluents. Even these bacteria synthesize *cladothriks* nitrogen from any compound content depending on the type of diet, and *sfhaerothilus* grows only at the expense of organic nitrogen and forms long strands [6]. It develops well under aerobic conditions and forms foamy tumors of the il mass by portioning it into an active sludge composition.

Filamentous *serobacteria*-specialises in the purification of hydrogen sulfide in industrial effluents, and in the purification of burnt proteins in household effluents. Oxidation of hydrogen sulfide occurs in two phases. Initially, hydrogen sulfide is oxidized to sulfur. Under oxygen-free conditions (anaerobic), the oxidation process of hydrogen sulfide stops.

Fusdarium aquadectum fungus develops when the wastewater composition has an acidic environment, adhering to aerotenk walls. A bacterial species appears on the *Verticelle* when the active sludge load is lower than 2 mg/l of dissolved oxygen with a high oxygen biological absorption (KBS-5) of 15-20 mg/l. During the period of active activated sludge regneration, *verticella* (infusoria) occurs in the formation of ilni. Under unfavorable conditions, when the dissolved oxygen content in the wastewater is lower than that of Meyer (2-3 mg/l), the water environment is acidic (pH 6-5), under conditions of penetration of highly effective substances, infusions containing active sludge forms a cyst.

Representatives of infusoria in the active sludge composition *Aspidisca kcosta*, A. it has been noted that the process of nitrophication intensifies in the composition of wastewater, which is a constant occurrence in the species, especially dominant in the summer season. A number of representatives of colovratkas believe that in species such as *lecane, brachionus, micropoludia, caratella, asplanchna*, these species develop well when they are high in oxygen (4-6 mg/l) and under sufficient nutrient conditions for active sludge. The satisfactory performance of aerotenk depends on its diversity in the composition of the active il and is one of the main factors in the dominance of some species. The mobility of the activity of the Dominant species are of great importance even the appearance color of the active sludge. The appearance of an active motile sludge is brown in color [6.12.11].

The period of active activated sludge starvation is also recorded in aerotenk. During this period, the active sludge color acquires a whitish-green tint. This condition occurs when the effluent is low in nutrient organic matter-some of the infusors contained in sludge die and some of it becomes cyste. Representatives of rifles will sink under the aerotenk, forming a sista a little later. The active sludge is discolored and produces the sludge surface color produced by the sediment. It was noted that the efficiency of wastewater treatment in aerotenk depends on three important indicators [15].

*To the period of aeration of wastewater;

*To the concentration of active sludge and to the regeneration of sludge;

*Aerotenk consumable air bath

The effectiveness of purification of the Bukhara city wastewater treatment facility with the help of microorganisms in aerotenk is determined by an indicator above 5/l of the dose of active sludge. The index of active sludge, on the other hand, was recorded in the 100-250 mg/l range. Changing this indicator has a negative or positive effect on wastewater treatment. Due to this, it leads to a decrease or increase in the transparency of the purified water. While the transparency indicator is 3-4 cm or higher, other environmental general sanitary indicators provide a high level of cleaning [7. 8].

Biopruts consist of 3-4 stages. In basins, bacteria are used to oxidize oxygen contaminants produced during photosynthesis. High-water plants in turn consume nitrogen nitrates, the CO_2 gas produced in the biochemical decomposition of organic matter, and produce a large amount of phytomassa. In particular, experiments conducted at one of the Biopruds of the Bukhara city treatment plant (Yuldoshov 2022) found that planting 150 g of small ryaska (*lemna minor*) plant on 1 m^2 surface produces 625 g of biomass for 8 days.

The effectiveness of seasonal cleaning of the treatment plant from biogenic substances according to the data presented in Table-3, from ammonium salts to spring-summer seasons

95-96%, and in autumn-winter seasons up to 91% were recorded. Similar rates have been achieved in nitrates purification from 87.4% to 93%, while phosphates are purified from 93-97% (Table-3).

Completely purified wastewater was passed through biological products, decontaminated and tested in several stages for 48 hours using a representative of zooplankton *Daphnia longispina Mull*. A test conducted in an experiment using 5-7-day-old nauplius (larvae) of *daphnia* showed that 85-90% of the experiments were viable. The treated wastewater has been completely purified and recommended for harmlessness to the surrounding aquatic fauna, flora and reuse

Table 3. Seasonal (2022-2023) efficiency of the Bukhara City Sewage Treatment Plant

	Ingredents (Mg/l)	Permitted Major (mg/l)	Spring		Summer	Autumn			Winter	
			Mg/l	%	Mg/l	%	Mg/l	%	Mg/l	%
1	Ion ammonium	2.0	2.2	95.4	2.0	96.1	1.92	95.7	3.6	91.1
2	Nitrites	0.32	0.24	91,5	0.28	93.0	0.25	90.3	0.29	87.4
3	Nitrates	9-25	28	-	26	-	22	-	20	-
4	Dry residue	1000	1570	-	1600	-	1820	-	1750	-
5	Sulfates	500	480	-	456.4	-	470.1	-	452.4	-
6	Chlorides	350	295,2	-	305.2	-	304,3	-	298.6	-
7	Oxygen	6-8	8.0	-	7.4	-	6.7	-	8.2	-
8	pH	6.5-8.5	7,6	-	7,8	-	7,6	-	8,1	-
9	Phosphates	1.2	0.20	94.2	0.14	97.0	0.18	95.2	0.20	93.1
10	Hanging substance	30	16.4	92.5	18.2	94.2	26.4	89.5	26.6	88.1
11	Water temperature °C	-	16	18	20	26	16	20	10	14

3 Conclusion

In order to ensure the activity of microorganisms at treatment facilities and to ensure high cleaning efficiency, it is necessary to ensure that the oxygen content in the aeration tank does not exceed 4.6 mg/l, and the sludge index does not fall below 150 mg/l. Treated wastewater can be used for irrigation of industrial crops and ornamental plantings.

For the first time, more than 127 species of microorganisms were identified at the treatment facilities owned by Bukhara Water Supply LLC, and 15 of them were marked as dominant indicator species.

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