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SEWAGE TREATMENT AT LUNINETS COMMUNAL UNITARY ENTERPRISE WATER SUPPLY SEWERAGE "VODOKANAL" WITH THE APPLICATION OF THE BIOLOGICAL TREATMENT METHOD

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Despite the noted shortcomings, biological treatment of municipal wastewater and drains of many industries are widespread. In the Republic of Belarus there are more than 140 biological treatment facilities, including 72 facilities with a capacity of more than 1 million m^3 purified water per year, where 90 % of the total runoff in the Republic is treated.

Keywords: wastewater, biological cleaning, aerotenks, contaminants,activated sludge.

The purification facilities in Luninets were built in 1970 and the technological project provides for mechanical and biological wastewater treatment. The project is made up of:

- mechanical cleaning: a receiving chamber, a sand trap with a circular movement of sewage Ø 4 m – 2 pcs., primary two-level settling tanks Ø 12 m – 8 pcs. (3 of them were set out of operation at the time of reconstruction);
- biological cleaning: highly loaded filters Ø18 m – 4 pcs. (2 of them standby), secondary horizontal sedimentation tanks of two corridors 12 × 27 m – 2 pcs.

Combination of pollutants in the increasing wastewater is determined by characteristic of wastewater municipal, from the population and industrial effluents of enterprises. Biological wastewater treatment is based on the ability of microorganisms to use many organic and non-organic substances contained in wastewater as nutrients. Biological purification can be carried out in natural conditions in bioponds on the filtration and irrigation fields and in artificial treatment plants. In these structures, aerobic conditions can be created, with the use of technical oxygen, anaerobic conditions, or the process takes place in several stages with alternation of aerobic, anaerobic and anoxic conditions, when oxygen is contained only in a bound state. Microorganisms in such structures are either free or immobilized. Biological cleaning has the following advantages, due to peculiarities vital activity of microorganisms:

- a wide range of organic and inorganic compounds, including toxic ones;
- the formation of simple final products (carbon dioxide, nitrates, sulfates – under aerobic conditions and methane, ammonia, hydrogen sulfide – under anaerobic conditions). In both cases, biomass of microorganisms accumulates;
- no secondary water pollution.

Great problems in the operation of aerobic treatment facilities are caused by a high increase in the biomass of activated sludge. The costs for dehydration and disposal of excess activated sludge account for up to 40 % of the total cost of water treatment.

Average daily wastewater passes through water disposal facilities of the city and district is 17700 m^3 per day. The production capacity of treatment facilities is 5,5 thousand m^3 per day.

Table

Wastewater Characteristics at the entrance and exit after of sewage treatment plants in the city of Luninets

Pollution index	Concentration of pollutants in wastewater entering treatment, mg/dm^3		Concentration of pollutants in waste water discharged after treatment facilities, mg/dm^3		Efficiency purification, %	
	medium	maximum	medium	maximum	actual	project*
COD	280,0	780,4	89,58	135,0	68	**
BOD5	148,3	546,4	22,1	33,6	85	90
suspended solids	181,0	321,0	30,2	38,2	83	90
Ammonium ion, mgN/dm^3	37,3	63,9	17,6	24,7	53	
Oil and oil products	1,07	1,71	0,29	0,47	73	–
Synthetic surfactants (anionic)	1,18	1,98	0,42	0,76	64	–
total iron	2,44	4,57	0,88	1,52	64	–
Zinc	0,026	0,066	0,013	0,025	50	–

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ONE-DIMENSIONAL MODEL OF NON-ISOTHERMAL MOISTURE TRANSFER IN ENCLOSING CONSTRUCTION

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In modern construction multilayered enclosing structures with effective heat-insulating materials are applied. Such constructions increase the requirements for the quality of their design because the heterogeneity of used materials exacerbates possible design errors and leads to decrease in heat-shielding properties and durability of structures. It is associated with a sharp change in their moisture regime. Therefore, it determines the requirements of improving reliability in forecasting of moisture regime and the level of thermal protection of enclosing structures. In the work, one-dimensional model of non-isothermal moisture transfer is created for the enclosing construction.

Keywords: non-isothermal moisture transfer, enclosing construction, software package «SPS», equation of moisture transfer, adapted equation.

Moisture content in building structures has a significant effect on both the thermal insulation and the operational properties of building structures. Moisture causes or accelerates the following processes: electrochemical corrosion of metal products and details, chemical damage of materials, destruction of concrete, stone and brickwork during freezing and thawing, change the color of architectural details of buildings, change in the volume of construction materials (swelling, buckling, shrinkage). It can lead to deterioration in appearance, the appearance of cracks and deformation of structures, biological damage. Increasing the moisture content also leads to a decrease of thermal resistance of enclosing structures.

Nowadays biological damage caused by moisture is given special importance because these phenomena can affect the health of people, condition of structures and appearance of buildings. Therefore, at present much attention is paid to modeling of moisture transfer in enclosing structures.

To analyze the processes of moisture transfer in building structures a software package «SPS» (Simulation Processes in Soil) was adapted [1].