

EFFICIENCY ESTIMATION OF A WASTEWATER TREATMENT PLANT IN AN INDUSTRY IN KALININGRAD

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ABSTRACT

The main objective of this study is the industrial establishment "System". This study also aims to estimate the influence of machine - building plants in the environment. Recommendations and conclusions were given for the improvements of ecological situation. There are various problems concerning the protection of the environment. Pollution is the main problem. Plant "System" influences negative effect upon air, water and its quality. Waste products of different classes of danger, which are formed on the industrial establishment "System", pollute soils of districts. It is necessary to devise different methods for improving the ecological situation. There are various measures to be done to prevent the environmental pollution

KEYWORDS

Environment; Pollution; Wastewater treatment plant; Heavy metals pollution; Eutrophication.

1 INTRODUCTION

Kaliningrad district is a highly developed industrial region. Mechanical engineering companies play the important role in the economy of this region. One from such companies is the enterprise "Systema" which produces the equipment for banks. The technological process of production is complex and multi-stage. It needs a lot of raw materials. As a result, this industrial activity has negative effects on the environment: air and water pollution, extension territories for waste products. For estimation of treatment plant's efficiency, it is necessary to analyze the enterprise's impact on the water bodies.

2 TREATMENT PLANT OF SYSTEMA COMPANY

The enterprise consumes about 107.00 m³/year of water, water irrevocable losses are 0.40 m³/year.

The enterprise has waste water treatment plant which was built in 1974. Treatment system is shown in *Figure 1*.

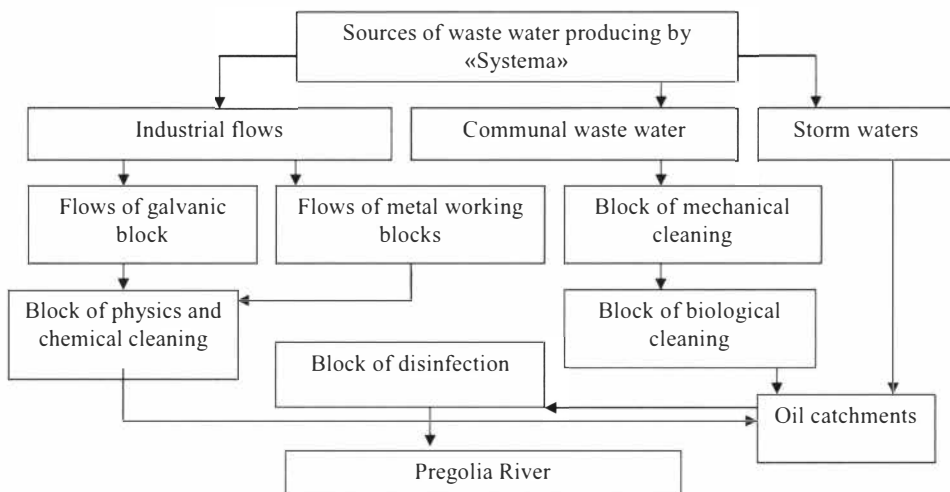


Figure 1. Scheme of Systema's treatment plant.

Flows are coming in installation of mechanical treatment which productivity is 1,300 m³/day. It is four section horizontal setting tank oil detectors. Siphons with the filters for the refinements of flows from oil products are installed between sections.

2.1 Block of biological cleaning

The total biological treatment of communal flows is realized on the compact installation with productivity of 700 m³/day. It includes three blocks; two from them are zone of aeration, zone of aerobic fermentation of sedimentation. Wastewater goes to canalization pumping station and then transferred by pumps to the treatment plant through the wells of pressure extinguishers. Then wastewater goes on the trough where filtration is going on and then to canal with active sludge for biological treatment. There is the grid installed before trough for catching large pieces of trash coming to the canalization system. From canal draft treated water goes to reservoir for sedimentation. Here, mechanic particles settle down. Then water goes to the canal for disinfection and to the Pregolia River.

When active sludge exudes maximum volume part of it removes to the sludge cards designed as gravel filter. Here water gets off from sludge and disinfected by bleaching powder. The effectiveness of the biological treatment block decreases in autumn period and does not work during the summer.

2.2 Block of chemical cleaning

Chemically polluted industrial water from galvanic block and production of printed matrixes which contains heavy metal ions in its compound goes to the physics and chemical treatment process based on the electrochemical method. The productivity of this treatment plant is 695 m³/day. Chemically polluted water comes to the accumulating volume and then to 10 electro coagulators with capacity of 5.5 m³/hour for each. After that water goes to the setting tank

where the supplementary machining by staked lime is produced. Its capacity is 180 m³. Storm water and melted water are mixed with the communal and industrial flows and are treated in oil catch. Water refined from oil is thrown down river Pregolia.

3 ANALYSIS OF WASTEWATER

The analysis of wastewater content on this enterprise's outflow has showed that the concentrations of the main fixed parameters for treated water are exceeded established norms for these parameters (*Table 1*).

Table 1. Composition and quality of sewage of the enterprise.

Monitoring parameter	Treated water, mg/L	Fishery MAC, mg/L	Repetition of increasing
BOD _{tot}	14.84	< 3	4.96
Oil-product	0.04	0.05	-
Phosphates	0.34	0.15	2.26
Iron	0.33	0.1	3.3
Sulphates	65.73	100.0	-
Nitrogen	0.80	0.50	1.6
Chlorine	34.28	300.0	-
Nickel	0.21	0.01	21
Dissolved oxygen	11.86	< 6.0	-
Copper	0.02	0.001	20

3.1 The dynamic concentrations of the biogens

Due to an excess by enterprise's wastewater of normative requirements there is a threat for Pregolia River for heavy metals pollution and eutrophication (*Figure 2-5*).

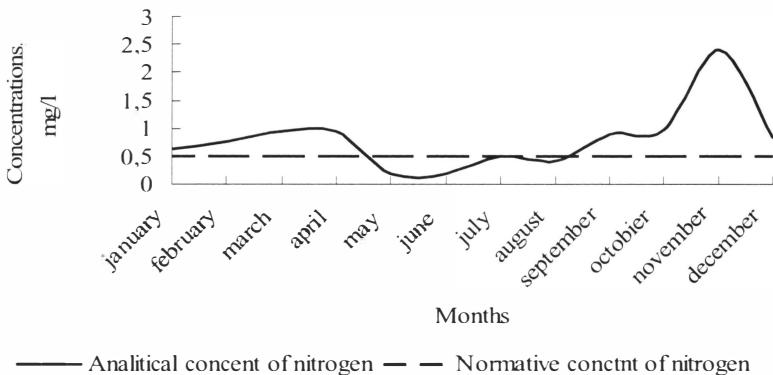


Figure 2. The dynamic of nitrogen content in wastewater of Systema during a year.

The dynamic content of nitrogen is exceeded MAC 1.4 times in wastewater. The least content of this parameter is observed in the spring – summer period. The content of phosphates in industrial flows is varied about 2.26 MAC (*Figure 3*).

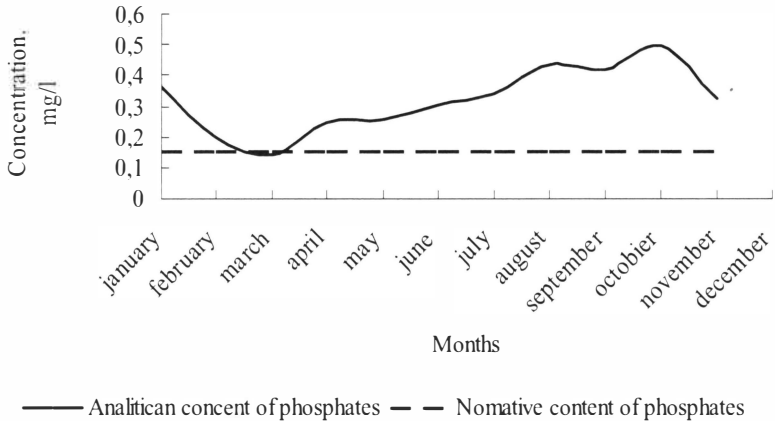


Figure 3. The dynamic of phosphates content the flows of Systema during a year.

3.2 The dynamic the concentrations for the heavy metals

Figure 4 shows the dynamics of nickel content in industrial flows during a year. It was observed that the industrial flows of the enterprise (in average 0.21 mg/L during a year) exceeded the normative parameter (0.01) in several tames (in average 21 MAC).

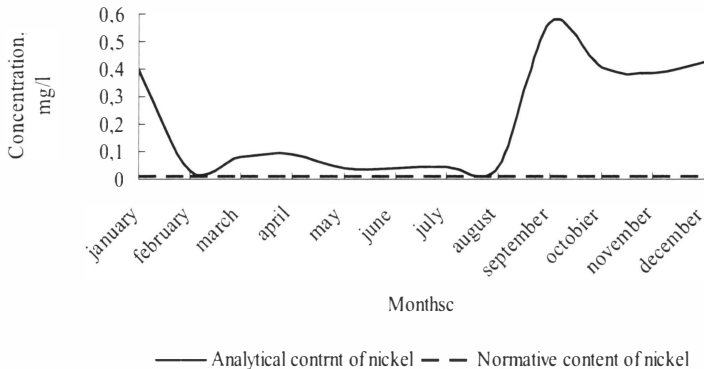


Figure 4. The dynamics of nickel content in the flows of Systema during a year.

The content of copper in industrial flows is varied about 20 MAC (Figure 5).

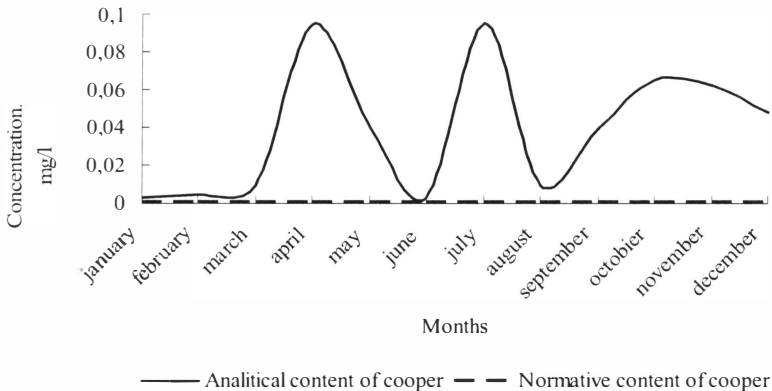


Figure 5. The dynamics of copper content of in the flows of Systema during a year.

4 CONCLUSIONS

So, the concentration of researched substances reached its maximum in winter months and is reduced in summer months. This dynamic content of soiled substances is dependent on the work of enterprises. The work of enterprise was more intensive in autumn–winter period than in spring–summer period. The enterprise had the great quantity of orders for the production of machines for the account of money. There was the failing off production in spring–summer period, so the quantity of soiled substances was reduced.

The low concentration of researched parameters in industrial flows is explained of failing off of production. Wastewater treatment plant work in incomplete regimen because the average daily load on the system of refining is 200 m³/day instead of 800 m³/day. The results of effectiveness analysis show that there is exceeding of MACs for several parameters due to ineffective operation of waste water treatment plant. There is no worker who is responsible for the exploitations of wastewater treatment plant, the normative documents were not prepared for the rules of exploitation the wastewater treatment system.

The system of ecological monitoring is not effective. That is why Systema pays about 1.8 mln. rubles for the exceeding established norms. It is 5% from yearly expenditures of Systema for production activity.

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