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DEGREE OF CHARGE WITH NUTRIENTS OF WASTE WATER FROM A MEAT INDUSTRIALIZATION UNIT. CASE STUDY

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Abstract

The purpose of this paper is to track the amount of nutrients that reach the waste water coming from a unit of the meat industrialization. Waste water resulting from such a unit, insufficiently treated, affect negatively the quality of the ground water in the area, or the emissary it reached. The intended indicators in this study were those which pollute emissaries in particular: chemical consume of oxygen, biochemical consume of oxygen, ammonia nitrogen, total phosphorus. From the evolution of the analyzed indicators, there are low values, similar to those provided by legislation in force for ammonia nitrogen and hardly biodegradable organic compounds, recording small exceeding for the biochemical consume of oxygen. Powerful agent of eutrophication, total phosphorus has quite high exceeding. In conclusion, the impact of the discharge of waste water on the environment from such a unit, exists, although it is quite low.

Key words: *emissary, nutrients, quality indicator, waste water*

INTRODUCTION

The unpolluted water is vital for the human survival and for the integrity of the natural ecosystems, so it is imperative that water resources are managed wisely [3].
By using, water changes its initial physical, chemical and microbiological characteristics transforming into waste water, due to pollution or contamination.
The high consumption of water for different specific uses leads to high values of waste water flows, often concentrated on a relatively small area, due to discharges of untreated waste water into the environment [4].
Thus, without adequate treatment technology and implemented, the quantities of contaminating substances and pollutants reach the environment and degrade irreparably the water of natural receptor.
Waste water treatment can be more or less complex, depending on the physico-chemical and microbiological characteristics of water and the quality requirements for discharge into receiving rivers.
The risk of nutrient pollution of groundwater is high around the units in the food industry due to their high solubility in water in the soil. The effective pollution of soil and groundwater can be reached when the harmful substances that reach the soil exceed the quantitatively the soil capacity to degrade these substances [2].
Wastewater (effluents), reach the receiver (in this case Borcea Branch) and they flow into emissary (the Danube), to which transmit pollutants [5]. The pollution degree receptor is highest during periods of drought, precisely in the periods that need to be irrigated and can act phytotoxically on irrigated crops [11].

MATERIALS AND METHODS

In this paper I tried to identify the current situation of the waste water which reach Borcea Branch and then the Danube and their treatment mobility. The quality of Danube river water is strongly influences by the quality of the waste water before being evacuated into the receptor. This water comes both from the town sewerage and from the economic activity [7].
A major source of pollution in the area of Borcea branch and the Danube River is the

waste water derived from the factory of meat processing and meat products in Calarasi municipality.

The Agency of Environment Protection Agency Calarasi carries monthly surveys for the wastewater evacuated from the companies, with significant impact on surface water quality. It performs analyzes for wastewater discharged into the emissary [1].

The pollutant loading of waste water from the food industry consists of: nutrients, organic substances, materials in suspension, detergents and extractable.

The Council Directive 91/271/EEC of 21st May 1991 on urban waste water treatment, as amended by Commission Directive 98/15/EC of 27th February 1998 is the legal basis of EU legislation in the field of waste water. This directive has been fully transposed into the Romanian legislation by the Government Decision no. 188/2002 approving the rules on conditions for discharge of waste water into the aquatic environment, as amended by the Government Decision no. 352/2005 [1].

The central objective of the directive is to protect the environment from the adverse effects of discharges of urban waste water and waste water from certain industrial sectors (mainly food industry processing and manufacture) [10].

Waste water from the food industry consist of water transport and washing of raw materials, technological water, condensate or cooling water from washing and disinfecting of manufacturing rooms, of machinery and packaging, water from the sanitary facilities. This waste water is characterized by a high fluctuation of physico-chemical and microbiological characteristics, due to the variety of source and their composition.

From the meat processing units, the waste water derived from slaughtering animals, cleaning the digestive tract, processing of meat, fat and skins. They show a very high content of organic materials, large amounts of nitrogen and phosphorous and a temperature of 30-40ºC in general.

The wastewater cleaning derived from the process of this factory operates on the principle of biological treatment with activated sludge.

The principle of the method for the biological treatment with active sludge is that microorganisms are intimately mixed with waste water containing organic material in the presence of oxygen, followed by flocculation microorganisms forming activated sludge, which is an active microbial mass. The active sludge constitutes the basic structural unit of biological treatment process, it contains all the species in their common work can metabolize organic matter until CO_2 and H_2O. The active sludge can be defined by depositing floaters when interrupting the aeration [10].

In order to determine the amount of nutrients in this water, five samples of waste water were collected, both from entrance and from exit of the treatment plant and more indicators were analyzed that indicate the degree of nutrients discharge of this water: chemical consume of oxygen, biochemical consume of oxygen, ammonia nitrogen, total phosphorus.

Table 1. Situation of parameters depending on the sampling period

Crt. No.	Waste water sampling date	Quantity of treated waste water (mc)	Number of slaughtered animals	Quantity of processed meat (Kg)
1.	25.01.2016	108	16	1,280
2.	26.01.2016	98	14	1,120
3.	27.01.2016	201	29	2,320
4.	28.01.2016	84	12	960
5.	29.01.2016	49	7	560

RESULTS AND DISCUSSIONS

In the period 25-29th January 2016 waste water samples were collected both from entry and from exit of the treatment station. In this period, a total amount of 540 m^3 waste water was treated, and the number of slaughtered animals was of 78 (amount of processed meat - 6,240 kg).

Following the analyses, it was found out that:
-An increase on the entry into the treatment plant of the analyzed indicators: chemical consume of oxygen (COD-Cr), biochemical consume of oxygen (BOD_5), ammonium nitrogen (NH_4^+), total phosphorus - probably due to the contribution of organic matter from soluble fat following washings and nutrients in the blood.

-Concentration of the analyzed indicators out of the treatment plant: chemical consume of oxygen (COD), biochemical consume of oxygen (BOD_5), ammonium nitrogen (NH_4^+), total phosphorus, is greatly reduced compared to the initial values.

-The only exceeding, according to NTPA - 001/2002, Norm approved by GD 188/2002 amended by GD no. 352/2005, is that of total phosphorus indicator, that in concentrations higher than 34 mg/dmc in waste water before treatment cannot be brought below the permitted maximum of 1 mg/dmc when water discharges into the environment. Waste water treatment in physico-chemical level and biological level is effective for the organic phosphorus, such inorganic phosphorus in treated water remains soluble.

Table 2. Average concentration of the indicators analysed in the period 25-29th January 2016

Crt No	Indicators/ Measure unit	Values of entry into station	C.M.A. *	Values of exit out of station
1.	Chemical consume of oxygen (COD-Cr) (mg O_2/dmc)	3,518.51	125	33.66
2.	Biochemical consume of oxygen (BOD_5) (mg O_2/dmc)	1,484.95	25	14.58
3.	Ammonia nitrogen (NH_4^+) (mg/dmc)	41.32	2.0	0.15
4.	Total phosphorus (mg/dmc)	34.74	1.0	1.1

* C.M.A – maximum concentration admitted imposed according to NTPA 001-2002

The efficacy resulted of introducing modern methods of wastewater treatment resulted from the production of this factory, representing companies in the county in the last three years are shown in Table 3. The analyzes were made in the laboratory of the Agency of Environment Protection Calarasi. [1]

Table 3. Quality indicators of waste water evacuated in the emissary in the period 2013-2015

Indicators	Measure unit	CMA*	2013	2014	2015
COD-Cr	mgO_2/dmc	125	79.85	51.5	70.25
BOD_5	mgO_2/dmc	25	30.76	27	26.15
[NH_4^+]-Ammonia nitrogen	mgN/dmc	2	0.17	0.28	0.37
Total phosphorus	mgP/dmc	1	3.38	3.63	3.05

* C.M.A – maximum concentration admitted imposed according to NTPA 001-2002

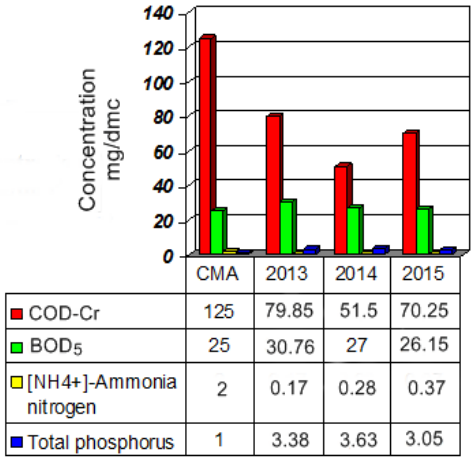

Fig. 1. Quality indicators of waste water discharged in the environment in the period 2013-2015

As we can see from the data presented in Table 3 and Figure 1, nor hardly biodegradable organic compounds or ammonia nitrogen do not cause problems when discharged into the emissary. But there are problems in the case of total phosphorus, which show quite large excess (about three times the maximum admitted limit). Exceeding is reported in the case of biochemical consume of oxygen, maximum 23%.

The results of measurements and analyzes made by the expertise of the Agency for Environment Protection Calarasi revealed the efficiency of the purification and treatment system of waste water discharged into Jirlău river, then Borcea branch, reducing this way the content of organic material discharged into the environment and at the same time reducing the amount of nutrients (eutrophication agents) - total phosphorus and ammonium ion.

Operating to the parameters presented, with the organic load and eutrophication parameters according to legal norms, the environment impact is reduced, thereby preventing the pollution of surface waters, soil and groundwater [6].

CONCLUSIONS

Regarding the case study made in the factory of meat processing, representative unit in Calarasi town and an important contribution of pollutants that reach the Borcea Branch and

then into the Danube, we see an exceeding of the concentration of pollutants: total phosphorus (an important agent of eutrophication) and to a smaller extent organic material.

Most indicators analyzed, at the exit out of the treatment plant were within the maximum limit - the maximum admitted concentration, thus demonstrating the effectiveness of the treatment method used.

The biological treatment is the most effective, most economical and the cleanest method of removal of organic substances in the waste water. The biological processes, aerobic or anaerobic, are the most complex processes in the modern science, involving both biological parameters and physical and chemical ones.

The biological treatment with active sludge is a treatment technology that must be recommended for the waste water treatment derived from food industry, due to the efficiency of this treatment that has less expensive technology, cleaner and at the same time - organic.

We can conclude that if indeed quite large efforts are made in the recent years not to reach any pollution by nutrients due to nitrogen and phosphorus in the terminal basin of the Danube, there are still problems with a much lower rate compared to the previous years [8].

We must not forget the waste water derived from the waste water treatment plant in the city, as well as large amounts of nitrates derived from the agricultural sector, which have a substantial contribution to the pollution of the groundwater, and finally reach the Danube [9].

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