Annals. Food Science and Technology
2016

THE STUDY OF QUALITY INDICATORS OF WASTEWATERS IN BUMBEȘTI TOWN OF GORJ COUNTY

Camelia **Căpățînă**, Daniela **Cîrțînă**
„Constantin Brâncuși" University of Tg-Jiu, Faculty of Engineering and Durable Development, 3, Geneva Street, Tg-Jiu, 210135, Gorj, Romania; E-mail: camelia_capatina@yahoo.com

Abstract
Monitoring the quality of wastewater before being discharged into the enviromment is a fundamental part, that's why wastewaters based on their nature and concentration of pollutants. Malfunctioning of the existing wastewater treatments stations, the reduced rate of population connected to sewage systems and treatment and inadequate waste management are the main causes of pollution of wastewater natural receptors.
The purpose of this paper is to present the studies on wastewater treatment in Bumbeşti-Jiu town from Gorj County. In this regard, samples were taken and chemical analyses of water discharged from the treatment plant Bumbeşti Jiu were carried out, to see if rules of the the discharges of wasterwaters in their emissaries are respected. In this case the natural receiver is the creek Tetila. The analysis primarly consisted in determining specific indicators of waters with organic charge, total suspension matters, biochemical, chemical consumption of oxygen, forms of nitrogen, total nitrogen, ammonia nitrogen and total phosphorus. In the case of municipal wastewater, advanced treatment is used for removing nitrogen and phosphorus present in excess, that can't be removed through traditional means. The wastewater treatment station in Bumbeşti Jiu is of biological and mechanical-type was designed for a capacity of 7500 PE. All components of the treatment station are operating in automatic mode. The treatment of wastewater in the biological stage of the station is carried out on the principle of biodisks, which by the partial and repeated immersing in the waste water, forms a biological film that contains microorganisms that contribute to the purification of biodegradable substances contained in them.

Keywords: wastewater, indicators, pollutants,biodisk, clarifiers

Submitted: 05.10.2016 Reviewed: 11.11.2016 Accepted: 16.12.2016

1. INTRODUCTION

Bumbești Jiu town is situated in the north end of Gorj County at the exit of Jiu from the gorge, at north it shares borders with Petroșani, at south with Targu Jiu, at east with commune Mușetești and at west with the Schela commune. The treatment station is a mechanical-biological type and is located in the south of the vilage in Curtișoara. This provides treatment for wastewater discharged from Bumbești Jiu, Tetila, Curtișoara and Lăzărești In numerous papers the problems of waste water treatment in Gorj county were presented. (Negulescu and Secara, 1976; Cîrțînă et al, 2015; Căpățînă and Lazăr, 2004; Căpățînă and Lazăr, 2005; Căpățînă and Cîrțînă, 2015; Cîrțînă and Căpățînă, 2015; Gămăneci and Căpățînă, 2010; Gămăneci and Căpățînă,2011). The station was designed for a capacity of 7500 population standard (P. S.). Wastewater that is to be treated is collected from the sewage system and have the following source:

- Domestic wastewater resulted from the needs of individual houses;
- Domestic wastewater resulted from the needs of the public institution;
- Wastewater from the economic activities in the area.

The treatment station was sized to wastewater flows and loads presented in table.1.
The mechanical treatment of wastewater comprises several elements:

✓ Mechanical grating, sand cleaning basin-fat separator, electromagnetic flow meter, equaling, pumping basin and primary clarifiers.

The biological treatment of wastewater comprises several elements:

✓ Biological disk or biodisks and secondary clarifiers.

Table.1. Parameters of the treatment station Bumbești Jiu

Parameter	U.M.	Value
Q_{med}	m^3/days	1400
Q_{max}	m^3/days	1708
$Q_{h\ max}$	m^3/days	146
CBO_5	kg/days	450
CCO	kg/days	900
MTS	kg/days	525
N_t	kg/days	91
P_t	kg/days	21

The treatment station is equipped with four lines of biodisks. Biodisks are partially submerged in the waste water so that their surface is formed on an organic film of microorganisms that contribute to the cleaning water. Water treated in this way is then discharged into the secondary clarifier. Secondary clarifiers are two in number and receive water pumped from the vats with biodisks. Permanent working regime of the treatment station is automatic. Manual operating mode is only used during commissioning and disaster.
The treatment station is equipped with an automatic measurement station for treated water parameters: wastewater flow meter, automatic sampling equipment, equipped with online sensor for temperature, water and pH determination.

2. MATERIALS AND METHODS

Analysis consisted in determining specific indicators of water with organic charge or total suspended materials (MTS), biochemical oxygen demand (CBO_5), chemical oxygen demand (CCO), ammonia nitrogen and total phosphorus. pH was determined using a pH - meter Hanna and to determine total suspended material was used the gravimetrical method. The consumption of biochemical oxygen was determined using the Winkler method.
The consumption of oxygen was determined by titration with ammonia with $K_2Cr_2O_7$. The ammonia nitrogen was determined using photometer and the total phosphorus was determined using spectrophotometer.

3. RESULTS AND DISCUSSION

The results of the analyzes conducted during 2015 are presented in table 2.

The values obtained for the analyzed indicators in water discharged from the treatment station were compared to the loaded limit values with pollutants from industrial and urban wastewater discharged into the natural receivers, set in NTPA 001/2002, approved by H.G. no. 188/2002 for approving the rules on conditions for discharge wastewater into the aquatic environment, as amended by H.G. no. 352/2005.
The pH of the water when is discharged from the treatment station has values within the permissible limits of NTPA 001/2002 on municipal wastewater discharge into natural receivers. Measurements taken during the year, with monthly frequency measurement showed values between 7.31 and 7.71 pH units.
Suspended matter influences the treatment process especially in a functional way. The higher concentrations of suspended matter (above 80 mg/^{3}) the amount of sludge is increased, which can lead to clogging installations.

Table. 2. The physico - chemical parameters of wastewater from the treatment station Bumbești Jiu

Indicators / Period (month)	pH	MTS mg/L	CBO_5 mgO_2/L	CCO_{Cr} mgO_2/L	$N\text{-}NH_4^+$ mg/L	P_t mg/L
January	7,63	37	21,2	46,88	2,01	2,07
February	7,51	38	22,5	51,55	2,65	2,81
March	7,50	41	20,4	48,0	1,46	1,29
April	7,58	40	22,5	51,66	1,42	1,64
May	7,57	33	20,4	46,52	1,55	1,52
June	7,41	32	22,3	51,30	1,25	1,58
Jully	7,59	30	20,4	47,24	1,4	1,71
August	7,68	33	18,3	43,00	1,79	1,80
September	7,61	44	21,6	46,66	1,66	1,72
October	7,41	36	22,6	48,62	1,61	1,39
November	7,57	33	21,5	46,28	1,68	1,77
December	7,60	35	20,6	50,16	1,64	2,12
Limit values according to NTPA 001/2002	6,5 – 8,5	35,0	25,0	125,0	2,0	2,0

Analyzing values for suspended matter (that are presented in Fig.1) during a year and comparing them to the limit, in 50 % of cases were recorded highest of the allowed limit.

In this case the overruns frequency was of 58.3%. The highest value was recorded in September, the concentration of total suspended matter measured passed by 28.6% over the limit.

July was the time of year when it was recorded the lowest concentration of total suspended material, the measured value representing 85.7% of the limit admitted values. The permissible limit value of municipal wastewater discharge into natural receivers is $25mgO_2/dm^3$. Comparing the threshold concentration obtained for CBO_5 of 2015 with the limit value, it can be remarked that they were all below this limit are presented in Fig. 2.

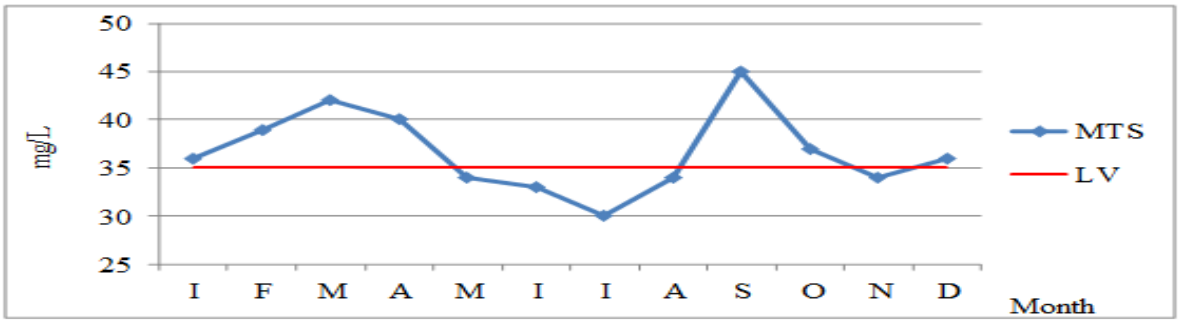

Fig. 1. Variation of concentrations of MTS

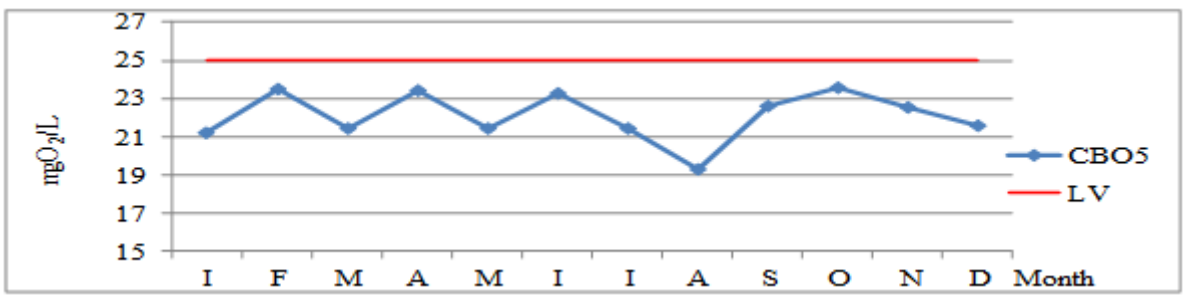

Fig. 2. Variation of O_2 concentrations for CBO_5

The highest concentrations of biochemical oxygen consumption are presented in Figure no. 3 and represented in average 94 % of the limit, which were registered in several periods of the year . The concentration of the lowest value was recorded in August and represented 77 % of the limit. All concentrations of chemical oxygen demand measured during the year were below the limit value set by the current.

The concentrations with the highest values were recorded in three periods of the year (February, April, June) and represented 42% of the limit, while the lowest concentration was determined in August, accounting for 34% of this limit. According to the EU directive on urban wastewater treatment, total nitrogen (N_t) of the exhaust flow of an installation of sewage treatment should not exceed the limit of 15 mg/L or 10 mg/L (depending on the size system) and must be at least 70-80% less than the flow rate of entry into the system.

In this case the permissible limit for total nitrogen discharge domestic wastewater into natural receivers is 15 mg/dm^3. All total nitrogen concentrations determined during 2015 were values that were below the permissible limit and are presented in Figure no. 4. The highest concentration of total nitrogen in discharged water was recorded in July and December, representing 91% of their value limit. The lowest concentration was measured in April and represented 58% of the limit.

When waste water enters urban area at treatment station is present mostly organic nitrogen (urea, proteins, etc.) and ammonia nitrogen (N-NH_4^+). The presence of nitrogen in these forms depends on various factors such as the length of the sewerage network, where they start converting organic nitrogen in ammonia nitrogen. This process of ammonification continues in the city wastewater treatment station so that (in the most optimum operating conditions), most nitrogen inflow in the biological stage is presented as a form of ammonium nitrogen (N-NH_4^+).

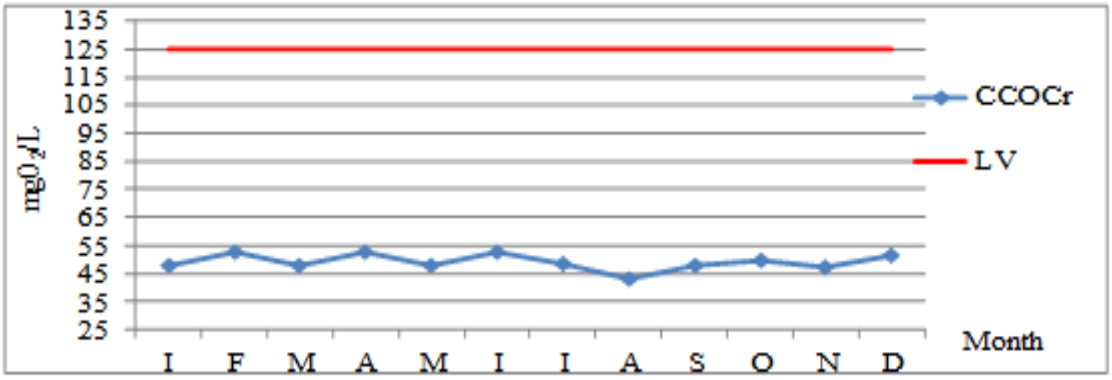

Fig. 3. Variation of O_2 concentrations for CCOCr

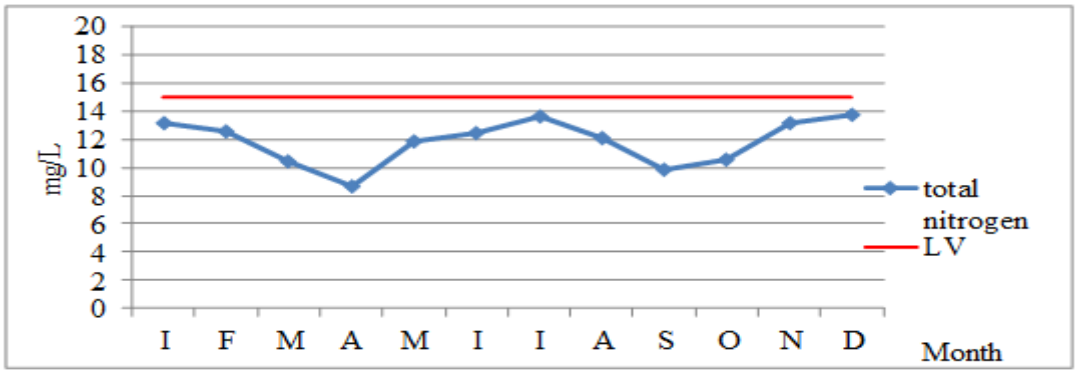

Fig. 4. Variation of the concentrations of total nitrogen.

For ammonia NTPA 001/2002 sets the limit value to the discharge of municipal wastewater in natural receptors 2 mg/dm^3. In the case of treatment station in Bumbeşti Jiu, of all measurements taken in two periods of the year there were breaches of the limit. The periods whose concentrations were above the limit value were January and February. In January the measured value for NH_4^+-N, that is shown in Fig.5) was 1% higher than the permissible and in February by 33%. The remaining periods of the year recorded values were below the permissible limit, the lowest being in June, representing 64% of this limit.

Along with nitrogen, the presence of phosphorus into surface waters beyond certain limits contributes to eutrophication. The permissible limit value for total phosphorus for discharged wastewater into natural receivers is 2 mg/dm^3. Of the 12 measurements taken in 2015, three were located above the permissible limit and they are presented in Fig. 6. Concentrations above the permissible limit were recorded in January, February and December, the largest being measured in February, whose value was above the 44% limit while the lowest concentration was measured in March and represented 70 % of the limit.

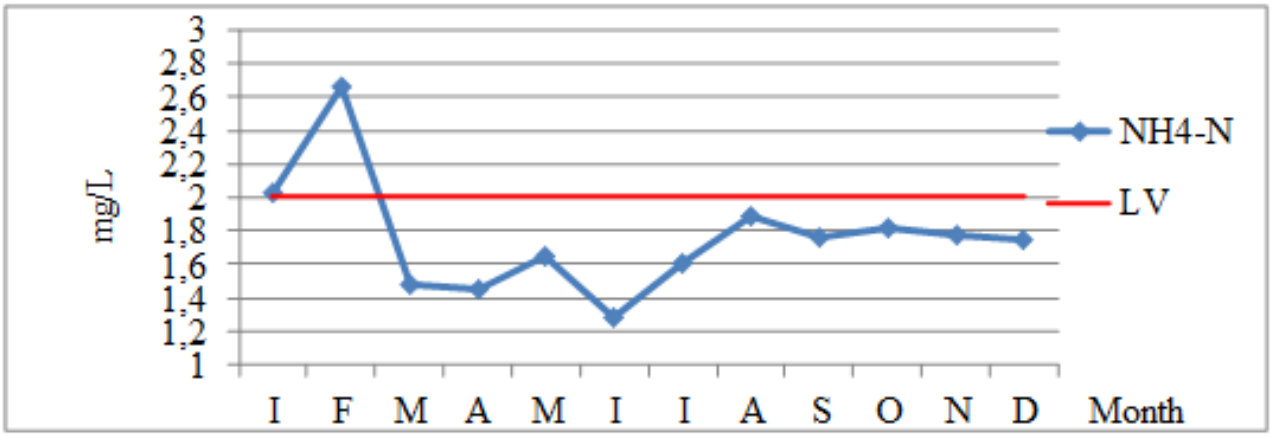

Fig. 5. Variation of the concentration of NH_4^+-N.

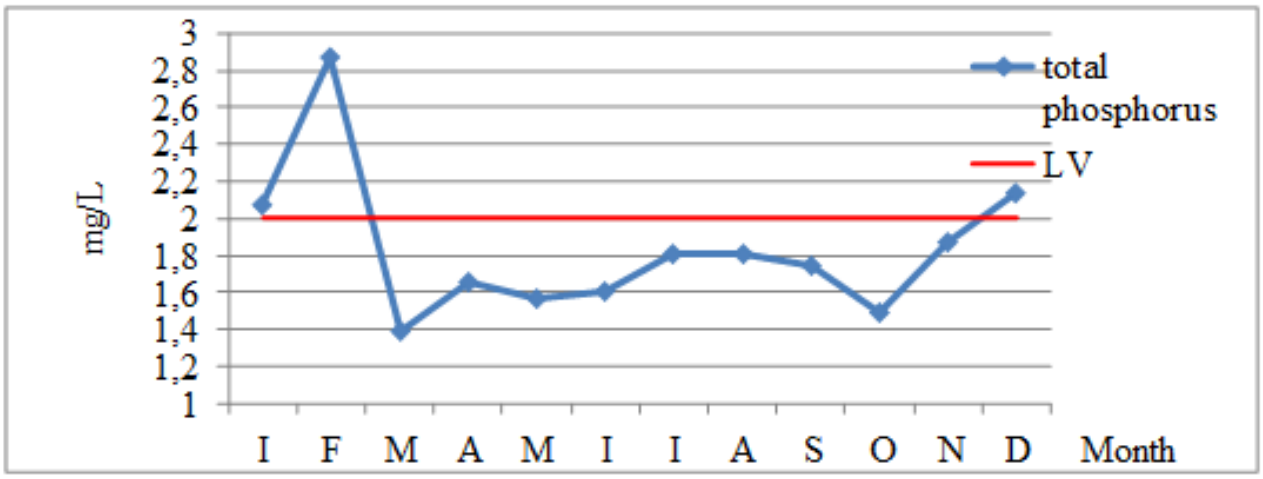

Fig. 6. Variation of the concetration of the total phosporus

4. CONCLUSIONS

The wastewater treatment station in Bumbeşti Jiu is of biological and mechanical - type was designed for a capacity of 7500 population standard.

The treatment of wastewater in the biological stage of the station is carried out on the principle of biodisks, which by the partial and repeated immersing in the waste water, forms a biological film that contains microorganisms that contribute to the treatment of biodegradable substances contained in them.

Treated wastewater is discharged into the creek Tetila and the sludge resulting from technological process is stabilized in special installations than is evacuated in drying beds. The technological processes for advanced treatment of wastewater removed those substances that cannot be removed by conventional treatment processes.

Advanced wastewater treatment is based on the use of physical, chemical and biological methods on the nature of the pollutants that are to be removed or reduced to acceptable limits. In the case of municipal wastewater, advanced treatment is used particularly for removing nitrogen and phosphorus present in excess in waste water that cannot be removed until the permissible limits at the evacuation through classical processes. Currently various methods are used for municipal wastewater desinfection, chlorination is most often used with various chlorine compounds.Wastewater disinfection process is influenced by several factors , most important being chemical and biological characteristics of wastewater, especially the temperature and the contact time. A proper treatment of urban wastewater followed by an equally good disinfection helps to reduce risks of diseases caused by water.

5. REFERENCES

[1] Negulescu M., Secară E., *Operating Residual Waters Treatments Plants*, Technical Press, Bucharest,1976.

[2] Cirtina D., Gamaneci Gh.**,** Căpăţînă C., *Aspectcs of the impact of industrial activities on the quality of surface water*, Proceedings of 15th International Multidisciplinary Scientific Geoconference SGEM 2015, Albena, Bulgaria.

[3] Cîrţînă D.**,** Căpăţînă C.,. Simonescu C. M., *Assessment of Motru Sec Rivers Quality by Monitoring of Physico- chemical Parameters and Water Quality Index*,Revista de Chimie, 2015, 8, 1184-1189.

[4] Căpăţînă C., Lazăr Gh., *Studies of the quality indicators for municipal wastewater in a town from Gorj County*, Environmental Engineering and Management Journal, 2005, 4, 513-518.

[5] Căpăţînă C.,. Lazăr Gh., *Aspects of surface and ground waters pollution due to the mineral oil activities*, Environmental Engineering and Management Journal, 2004, 4, 733-736.

[6] Căpăţînă C**,**. Cîrţînă D., *The study of quality indicators of wastewaters in Drăguţeşti locality,* Annals of Constantin Brâncuşi University, 2015, 4, 183-189.

[7] Cîrţînă D., Căpăţînă C., *Considerations on the evolution of quality indicators of water courses in Gorj County,* Annals of Constantin Brâncuşi University, 2015, 4, 196-202.

[8] Cîrţînă D. , Căpăţînă C., *Aspects regarding ground water s quality in Gorj County*, Annals of Constantin Brâncuşi University, 2015, 4, 203-209.

[9] Gamaneci Gh.**,** Căpăţînă C.**,** *Experimental determinations regarding residual waters treatment process in Drăguţeşti locality from Gorj County*, România, Annals of Dunărea de Jos, University of Galaţi, 2011, III (XXXIV), Fascicle II**,** 75 – 82.

[10] Gamaneci Gh.**,** Căpăţînă C.,*Study regarding the improvement of Motru river water quality on the territory of Gorj County,* Annals of the „Constantin Brâncuşi" University of Târgu-Jiu, 2010, 3, 460-468.

[11] Gamaneci Gh.**,** Căpăţînă C., *Studiul indicatorilor de calitate ai unei ape uzate din localitatea Motru*, Annals of the „Constantin Brancusi", 2010, 2, 71-77.