STUDIES REGARDING THE WATER QUALITY IN MĂTĂSARI TOWN OF GORJ COUNTY

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ABSTRACT: This paper presents studies regarding the quality of the used waters in Mătăsari town of Gorj county. The wastewater treatment plant is placed in the south of Mătăsari town and it provides the protection of the water quality of Jilţ stream downstream the town. In 2012, quality indicators for the water evacuated from the wastewater treatment plant were experimentally determined. The quality indicators analysed according to STAS were: the pH, the total matters in suspension (MTS), the biochemical oxygen consumption every 5 days (CBO_5), the chemical oxygen consumption (CCO_{Cr}), the filtered waste, the chlorides (Cl^-), the sulphates $\left(SO_4^{2-}\right)$, the ammoniacal nitrogen $\left(NH_4^+\right)$, the nitrites $\left(NO_2^-\right)$, the nitrates $\left(NO_3^-\right)$, the total nitrogen (N_{tot}), the total phosphor (P_{tot}) and the synthetic detergents. Among the seven indicators registering overdrawing, in four of the cases all the concentrations measured for them were placed above the admitted limits.
For most of the indicators that registered overdrawing, the highest values were registered in the lapse of time with high temperatures when the biological processes should actually develop with the highest intensity. Based on the results of the measurements accomplished on the evacuated used water, we may say that the most important measure for improving the quality of the used water and implicitly of the surface waters in the area, would be the functioning of the wastewater treatment plant at normal parameters.

KEY WORDS: pollution, purification, used, indicators, limits, overdrawing, normal.

INTRODUCTION

The hydrology of Mătăsari area is mainly determined by Jilţ stream which is placed on the east side, towards which there are a series of valleys.

Jilţ stream crosses Mătăsari town, from north-west to south-east. It has a sinuous flow and it joins Jiu river in front of Turceni town.

The field where the wastewater treatment plant is built, is in the south of Mătăsari town, about 50 m from the closest lodgement.

The building of this wastewater treatment plant provides the water quality protection of Jilţ stream, downstream Mătăsari town.

When placing the wastewater treatment plant, we generally wanted the capitalisation of the fields inadequate for other uses and also the capitalisation of the level differences for the gravitational drain of the gross and purified waters.

The used residual waters[1,2] which are collected by the draining network and

led to the wastewater treatment plant have the following provenience:

►used residual waters resulted from satisfying the household water needs – individual and collective lodgements;

►used residual waters resulted from satisfying the water needs of the public institutions

►used waters coming from the economical activities in the area (public alimentation, trade, industry, etc.).

The wastewater treatment plant is completely automatic and the routine operation, the service, the support and the surveillance needs the presence of only one operator.

The sizing of the wastewater treatment plant was made according to the European Norms and the German Standard ATV -Standard A-131: Sizing the treating with activated mud for the wastewater treatment plants having a capacity of maximum 5500 PE.

The purification technology of the urban used waters in Mătăsari town is mechanical-biological. In the mechanical purification step, there is the keeping of the gross substances or materials, of the sand and of the non-biodegradable materials.

The used gross residual water is led from the pumping station to the grill of the fine channels. The distance between the grill bars is 3 mm, so that it would keep all the gross material overdrawing this size. The material kept on the fine grill is discharged into a container placed in the area. These materials are collected and deposited at the landfill.

After passing through the fine grills, the water is further led to the sand trap whose volume is 2.75 m^3. This component of the mechanical step keeps the sand in order to avoid its accumulation in the basins of biological step. The sand kept in the sand trap is periodically pumped into a container.

After crossing the mechanical purification phase, the used water gravitationally gets to the aeration basin, where the biological purification step or the secondary step begins. The biological purification[3] is accomplished by crossing several technological phases.

The technological proceeding of biological purification, chosen for purifying the used waters of Mătăsari town, was the one with activated mud, a case when the microorganisms mass or the biomass is in suspension in all the water mass.

In case of Mătăsari wastewater treatment plant, the aeration is made by means of 96 aeration elements (porous membranes) with a capacity of 4.6 m^3/hour/element.

The activated mud basin is intensely aerated and homogenized in order to keep an optimal oxygen concentration in the water mass for obtaining a good efficiency of the purification and for stopping the mud depositing on the bottom of the basin.

The air injection is accomplished by means of rotary blowers.

From the aeration basin, the aerated water enters the secondary basin by horizontal flowing. In the secondary basin, it is accomplished the separation of the purified water from the biological mass (activated mud). The secondary basin has a volume of 242 m^3 with a stationing time of 7 hours.

The mud deposited on the inferior side of the basin is assembled by means of the bridge on the eraser towards the outlet of the basin. Further on, the biological mud is pumped by means of the centrifuge pumps into the mud regeneration basin, and the excessive mud is discharged in the mud stocking basin.

The purified water of the secondary basin is evacuated by "V" louvers in lateral drains, where, by means of the discharging system, it is discharged into the emissary, Jilţ stream.

In order to measure the debit of used waters evacuated into the emissary, an electromagnetic debit-meter is installed on the evacuation pipe.

In case of the waters with a high content of organic, biodegradable matters,

like the residual ones, the biological step has the most important role, as the purification degree of the residual waters depends on the intensity of the biological processes in the installations of this step.

The biological purification process developed in the aeration basins occurs as following: the used substances of the used waters are absorbed and concentrated at the biomass surface

EXPERIMENTAL

The physical-chemical analyses consisted of determining the indicators specific to the residual waters, [5]respectively the pH, the total matters in suspension (MTS), the biochemical oxygen consumption every 5 days (CBO_5) , the chemical oxygen consumption – the method of the potassium bicarbonate (CCO_{Cr}), the waste filtered at 105 ^oC, the chlorides (Cl^-), the sulphates (SO_4^{2-}), the ammoniacal nitrogen (NH_4^+), the nitrites (NO_2^-), the nitrates (NO_3^-), the total nitrogen (N_{tot}) , the total phosphor (P_{tot}) and the synthetic detergents.

Results and discussions

The results of the measurements accomplished during the year 2012 are presented in *table no. 1 and table no. 2*.

Table no. 1. Quality indicators of the purified water in Mătăsari town

Sampling time	pH unit. ph	MTS mg/L	CBO_5 mg O_2/L	CCO_{Cr} mg O_2/L	Rez. fix mg/L	Cl^- mg/L	SO_4^{2-} mg/L
February	7.44	54	21.7	47.6	202.6	17.017	46.0
May	7.47	53	24.4	55.1	252.6	15.599	26.0
June	7.15	57	24.8	54.82	241.2	17.726	31.1
July	7.48	55	29.2	59.61	237.2	21.271	24.3
August	7.35	51	36.2	68.88	217.4	19.853	27.2
September	7.98	56	24.0	54.57	182.4	14.890	20.7
October	7.30	53	24.8	55.34	171.6	13.472	24.1
November	7.38	56	24.5	58.55	178.6	14.535	25.4

Table no. 2. Quality indicator of the purified water in Mătăsari town

Sampling time	NH_4^+ mg/L	NO_2^- mg O_2/L	NO_3^- mg O_2/L	N_{tot} mg/L	P_{tot} mg/L	Deter. mg/L	Subst. extract
February.	8.99	0.29	1.15	9.07	0.91	1.31	23.0
May	9.2	0.10	3.36	9.63	1.1	1.55	44.4
June	9.46	0.15	4.11	10.08	1.31	1.67	19.4
July	13.64	0.18	4.50	13.22	1.44	1.71	17.1
August	14.25	0.20	3.99	14.01	1.35	2.33	18.2
September	13.77	0.22	6.02	15.13	1.42	2.44	31.8
October	13.36	0.29	4.94	13.9	1.8	2.25	27.6
November	11.95	0.25	5.77	11.21	1.28	2.55	17.8

In case of the indicators analysed for the water evacuated from the wastewater treatment plant, the results interpretation was made according to the Normative NTPA 001/2002, regarding the establishment of the limits of polluters

charging of the industrial and urban used waters at the evacuation into natural receivers.

Based on the results obtained for every monitored indicator, there may be certain appreciations regarding the degree of polluters charging of the waters evacuated by Mătăsari wastewater treatment plant in Jilţ stream.

In case of Mătăsari wastewater treatment plant, the pH measured values were within the limits stipulated by the valid regulations. In all the analysed situations, it presented values from neutral to weakly alkaline, the highest one having the value of 7.98 pH units and it was registered in September.

For the matters in suspension, the Normative NTPA 001/2002[4] stipulates a limit of 35 mg/ L and, by analysing the obtained values, it is found that in all the cases they overdrew the limit value. *(Fig.1)*

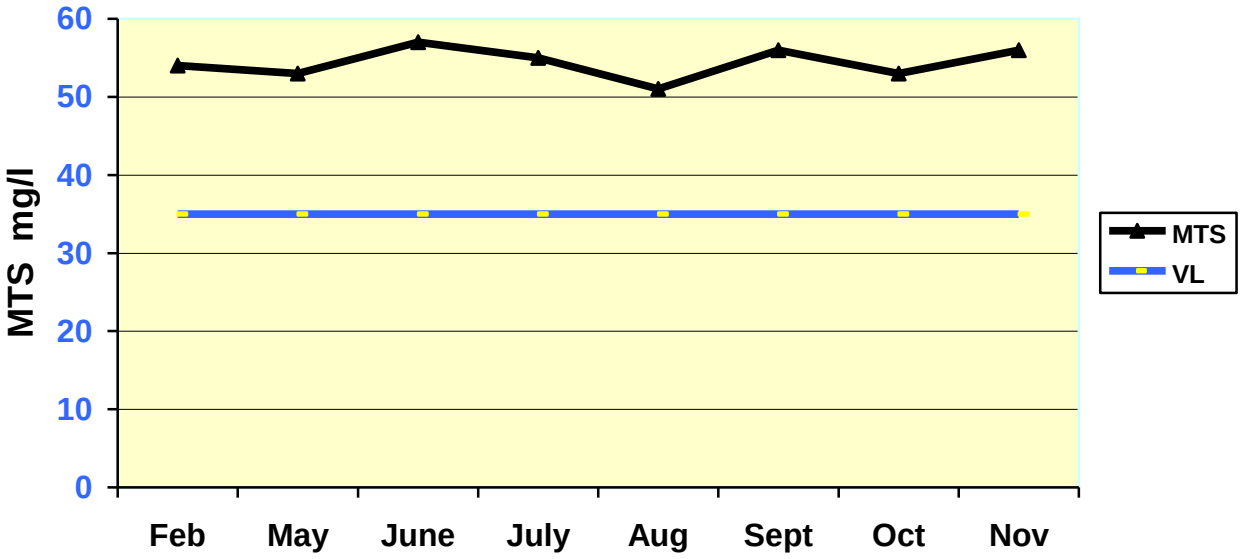

Fig. 1 MTS variation in evacuated waters

The highest quantity of matters in suspension was registered in June, when the registered value was almost 65% above the admitted limit, and the lowest concentration was measured in August and it was about 46% above the limit.

By analysing the obtained values, it is found that there was overdrawing during all the sampling times (Fig.2).

The highest overdrawing was registered in July-August, when the measured values were 46%, respectively 81% above the admitted limit.

The lowest concentration was registered in February and it registered a 8.5% overdrawing of the limit value.

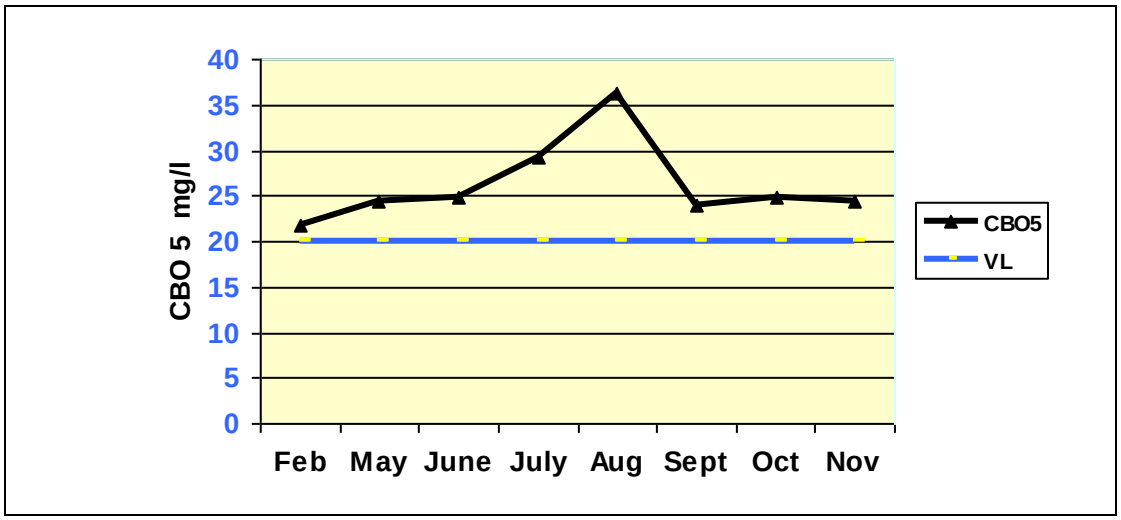

Fig. 2. CBO_5 variation in the evacuated used water

One more time, the highest values of the chemical oxygen consumption presented in table no. 2 were registered in July-August, as they are about 15% and respectively 1.5% under the limit value. The other concentrations represented between 68% in February, as this is the lowest one, and 78% of the limit value.

For the treatability of used water, the report CBO_5/CCO is biologically important. The values of the report $CBO_5/CCO < 0.4$ indicate used water having a high content of hardly biodegradable organic substances.

Thus, the highest concentration of salts dissolved in water was registered in July and it represented 12.8 % of the limit value. The lowest concentration represented only 8.6 % of the admitted limit and it was registered in October. By watching the evolution of the stable waste, it is found that the highest salt concentrations were present in May-June.

The limit value admitted for chlorides in the evacuated used water is 500 mg/L. The chloride concentrations presented in table no. 1 of the evacuated water by Mătăsari wastewater treatment plant, represents one of the lowest values among all the analysed indicators. Thus, the highest chloride concentration in 2012 was registered in July and it represented only 4.25 % of the admitted limit value. The lowest concentration represented 2.7 % of the limit value and it was measured in October.

As in case of the chlorides, the sulphates also represented very low values reported to the limit value. The highest concentration of sulphates in the water presented in table no. 1 was registered in February and it represented 7.6 % of the admitted limit value. The lowest value was registered in September and it represented only 3.45% of the admitted limit.

The nitrification and the de-nitrification should be controlled as efficiently as possible, in order to provide the respect of the norms regarding the concentration of the evacuation debit.

For the ammoniacal nitrogen NH_4^+ the normative NTPA 001/2002 stipulates a limit value of 2,0 mg/L.

By analysing the concentrations obtained for the ammoniacal nitrogen, it is found that this chemical indicator registered the highest overdrawing compared to the admitted limit values. The highest concentrations were measured in July-October 2012.

Thus, the highest concentration of NH_4^+ was registered in August and it was 7 times higher than the limit value.

The lowest concentration presented in table no. 2 was registered in February and it was about 4.5 times above the admitted limit.

The presence of the ammonium in high concentrations indicates the fact that the biological step, more specifically the water aeration in order to oxidize the organic substances in the water, is very low. In the absence of oxygen, the nitrification develops with a very low intensity.

The nitrites constitute, next to the ammoniacal nitrogen, an indicator whose limit in the waters is very low, and it is another type of toxic nitrogen for the creatures.

The limit value admitted for the nitrites in the urban used waters is 1,0 mg/L. By analysing its concentrations in the water, it is found that there was no overdrawing of the admitted limit in 2012. The highest concentrations were registered in February and October and they represented 29% of the limit value.

The lowest concentration was measured in May and it represented 10% of the limit value. The nitrates constitute the type of nitrogen which is not toxic for the creatures. The limit value admitted for the nitrates in the urban used waters, before discharging them into natural receivers, is 25 mg/L.

By analysing the values obtained for the nitrates in 2012, it is found that there was no overdrawing of the limit value.

The highest concentration of nitrates in the evacuated used water was registered in September and it represented 24% of the limit value, and the lowest one was registered in February and it represented only 4.6% of the admitted limit.

The presence of the nitrates in low concentrations indicates a weak water aeration.

In the current case, it is found that this limit was overdrawn in most of the cases.

Thus, from the total of 8 measurements accomplished in 2012, there was overdrawing in 6 of the cases. The highest concentration was registered in September and it represented an overdrawing with 51.3% of the limit value. The lowest concentration was in February, almost 10% below the admitted limit.

In case of the used waters evacuated by Mătăsari wastewater treatment plant, it is found that most of the values registered for the total phosphor and presented in Table no. 2 in 2012 were above the admitted limit.

The highest phosphor concentration was registered in October and it was 48% above the admitted limit, and the lowest one in February and it represented 91% of the limit value.

In case of the used waters evacuated by Mătăsari wastewater treatment plant, all the values measured for detergent in 2012 were above the admitted limit.

The highest concentration was registered in September and it was 4.88 times above the admitted limit. The lowest value was registered in February and it represented a 2.6 times overdrawing in report to the limit value.

The substances extractible from waters may be: vegetal and animal fats, hydrocarbons (mineral oils, hard hydrocarbons), fat acids, some insecticides, soaps, resins produced by the plankton decomposition, tars, etc.

The limit admitted by NTPA 001/2002 for extractible substances in the used water is 20 mg/L.

By analysing the obtained values, it is found that, from the total measurements accomplished in 2012, there was overdrawing in four of the situations.

Considering the results of the measurements accomplished on the used water evacuated by Mătăsari wastewater

treatment plant, we may conclude that it does not work correspondingly.

For the organic substances present in the gross used water to be destroyed (mineralized), it is needed the presence of oxygen in sufficient quantities in the aeration basins. In the absence of oxygen, the microorganisms composing the active mud cannot develop their activity in optimal conditions, so the purification process is incomplete.

The presence of ammoniacal nitrogen even 7 times above the admitted limit indicates the fact that the nitrification process is interrupted because of the lack of oxygen in the water.

Therefore, the first measure for improving the used water quality could be the corresponding functioning of the wastewater treatment plant. This would mean to provide the oxygen necessary for the functioning in good conditions of the aeration basins, the place where the degrading processes of the organic substances have place by means of the aerobic microorganisms used before the evacuation into the emissary.

CONCLUSION

♦ The used residual waters, by their high content of organic matters, have a negative influence on the natural receiver by changing the oxygen system and the nutrients.

♦ The values obtained for the analysed quality indicators of the used waters evacuated from Mătăsari wastewater treatment plant, spotlight the fact that these do not work correspondingly.

♦ From the total analysed indicators, half of them presented overdrawing of the limit valued admitted at the evacuation into natural receivers.

♦ From the 7 indicators registering overdrawing, in four cases, all the concentrations measured for them were above the admitted limits.

♦ The fact that ammoniacal nitrogen and the biochemical oxygen consumption every 5 days (CBO_5) present overdrawing of the limit value, and the nitrites and the nitrates are much below the admitted limits, spotlights the fact that the biological purification step does not work correspondingly.

♦ The highest overdrawing, reported to the limit value, was registered by the ammoniacal nitrogen whose concentrations were even 7 times above the admitted limit.

♦ Based on the results of the analyses accomplished on the evacuated used water, we may say that the most important measure for improving the quality of the used water and implicitly of the surface waters in the area, is the functioning in normal parameters of the wastewater treatment plant.

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