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STUDIES AND RESEARCH ON WATER POLLUTION IN GALATI URBAN AREA

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ABSTRACT

The purpose of the work was the study of wastewater treatment at the Galati sewage Station in June, August 2017 and January, February, April and May 2018. The treatability can be expressed by removing the total organic substances from water (determined by CCO or cot tests) or by removing equivalent substances (determined by the CBO test). The reduction of CCOCr and CBO_5 from wastewater after passing through the installation of the Galati treatment station is an estimate of the quantity of organic substances removed in the treatment process. As a result of the determination of the concentration of organic substances in the influence and effluent of the Galati treatment station, the following were found: The Symons environmental treatment ratio achieved for influence was 0.554 which framed the influence in S.E. Galati in the category of wastewater readily treatable by biological methods, in the presence of naturally occurring micro-organisms in these waters. Another criterion for assessing the treatability of wastewater is the efficiency of reducing CCOCr and CBO_5. The efficiency of reduction of CCOCr (81%) and CBO_5 (84%) allow for the characterization of wastewater as a biological treat in S.E. Galati and alongside the operation at optimum parameters of treatment plants.

KEYWORDS: water pollution, organic substances, efficiency of reducing CCOCr and CBO_5, characterization of wastewater

1. Introduction

The purpose of the work was the study of wastewater treatment at the Galati sewage Station in June-August 2017 and January-May 2018. To determine whether a wastewater is cleansed biological, the notion of treatability has been introduced. Treatability is the capacity of a wastewater to reduce its complexity and number of organic components due to the action of microorganisms present in wastewater treatment plants. This notion accumulates several factors, such as: the ability of organic constituents to be biodegraded; the ability of micro-organisms to degrade organic components; the time it takes to biodegradation organic components [1-3]. The treatability can be expressed by removing the total organic substances from water (determined by CCO or COT tests) or by removing equivalent substances (determined by the CBO test). The Galati treatment station receives and encloses about 3200 L/s wastewater from Galati, of which ~80% are household waters and ~20% are industrial wastewater and partly rainwater from most of the city's territory. Galati Treatment Station is an installation that comprises the stages of primary physico-mechanical treatment (gratings, fat separators, decanters) and biological secondary with active sludge [4-6].

2. Experimental conditions

In order to achieve the proposed purpose, samples of wastewater were collected from three harvest points, twice a week, during the periods of the year 2017 and 2018 respectively. The scheme of the treatment plant and the harvesting points are shown in Figure 1.

The daily average test of influence is made up of samples of 100 mL of time harvested through an automated device for 24 hours that have been homogenized. The EM sample represents a 12-hour average sample consisting of samples of 400 mL harvested every 2 hours that have been homogenized. The EB samples were harvested and processed similarly as EM. The daily harvest hours of the two effluents were: 7, 9, 11, 13, 15 and 17.

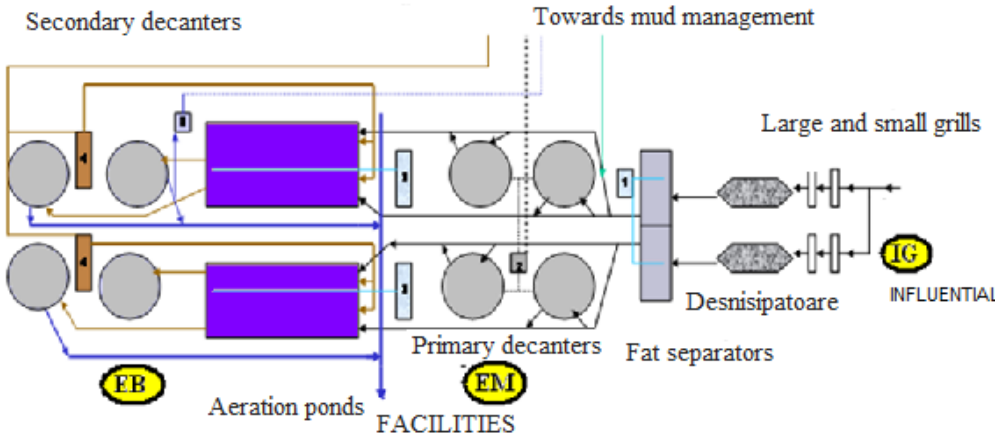

Fig. 1. *Diagram of the treatment plant Galati and sample sampling points: IG-General entry; EM – Mechanical step evacuation; EB – Removal of the biological step*

The samples analysed are representative samples for the collection points. Thus, the influence represents a 24-hour average sample, and effluents average samples for 12 hours. Considering that the average retention time of wastewater through wastewater treatment equipment is 8 hours, it can be considered that analyses carried out on the influence and effluent are appropriate. Following the quantitative determinations of the main parameters indicating the degree of pollution of the emissary with global organic material, the results have been synthesized and processed in order to determine important treatment indicators, such are the report of Symons treatability and treatment efficiency. The Symons treatability report expresses, indirectly, the ratio between the quantity of biodegradable substances and the quantity of oxidizable substances in the waters subject to pollution.

3. Results and discussions

The characterization of wastewater taken from each step of the technological process determined the content of organic materials by means of global parameters (CCOCr, CBO_5). The reduction efficiency of CCOCr and CBO_5 was also calculated. The obtained results were compared with the limits laid down in the legislation. The CBO_5 and CCOCr load limit values according to HG 352/2017 and the minimum reduction percentage are shown in Table 1.

The results obtained in the months, August 2017 and May 2018 are presented in Figures 2 to 3, 2017 and 4-5, 2018.

Table 1. *The CBO_5 and CCOCr load limit values according to HG 352/2017 and the minimum reduction per centage*

Parameters	**Concentration, mgO_2/L**		**Minimum discount percentage %**	**Reference method of measurement**
	Influent NTPA 002/2017	**Effluent NTPA 001/2017**		
CBO_5 la 20±1ºC no nitrification	300	25	70-90	Homogenized, unfultered sample, nolodged. Determination of the O_2 disolved before and after an incubation of 5 days at 20 ºC±1 ºC, in complete darkness. Addition of nitrification inhibitor.
CCOCr	500	125	75	Homogenized, unfultered sample, nolodged. Potassium dichromate.

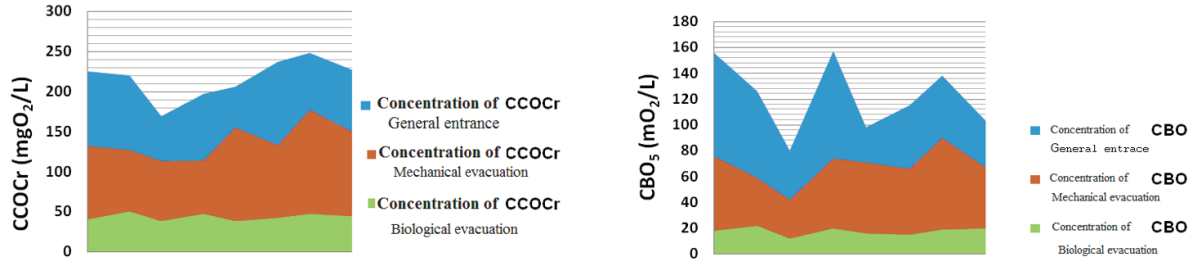

Fig. 2. *Dynamics of the evolution of CCOCr and CBO_5 concentrations month August 2017*

In August 2017 the average reduction efficiency of CCOCr was 36% at the mechanical stage, 69% at the biological stage and 80% total station.

In August 2017 the average reduction efficiency of CBO_5 was 44% at the mechanical stage, 74% at the biological stage and 86% total station.

In May 2018 the average reduction efficiency of CCOCr was 45% at the mechanical stage, 51% at the biological stage and 72% total station.

In May 2018 the average reduction efficiency of CBO_5 was 42% at the mechanical stage, 67% at the biological stage and 81% total station.

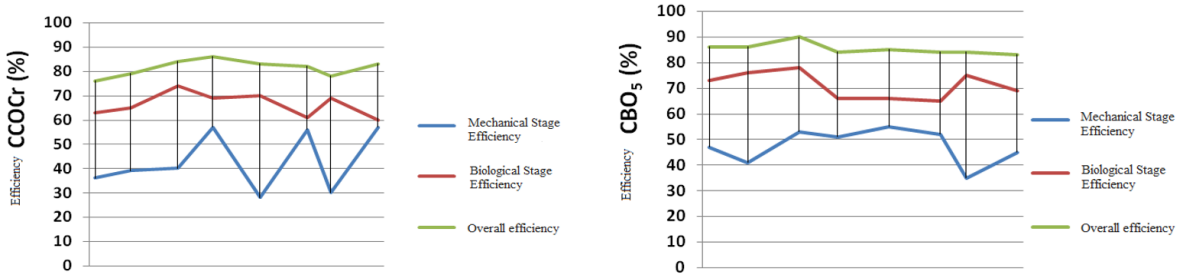

Fig. 3. *The dynamics of efficiency of reduction of CCOCr and CBO_5 in August 2017*

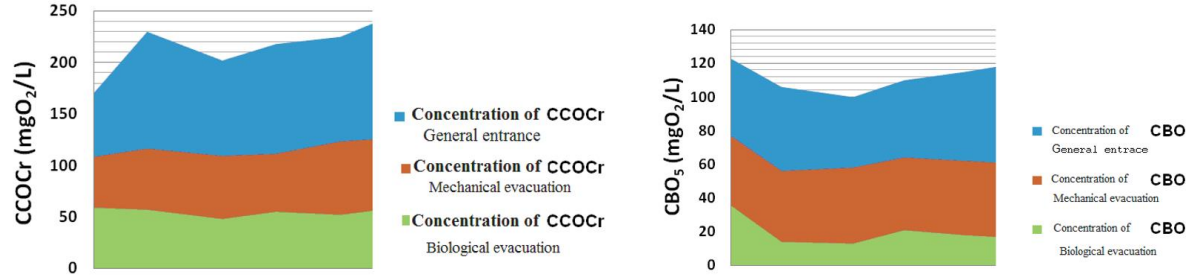

Fig. 4. *Dynamics of the evolution of CCOCr and CBO_5 concentrations in May 2018*

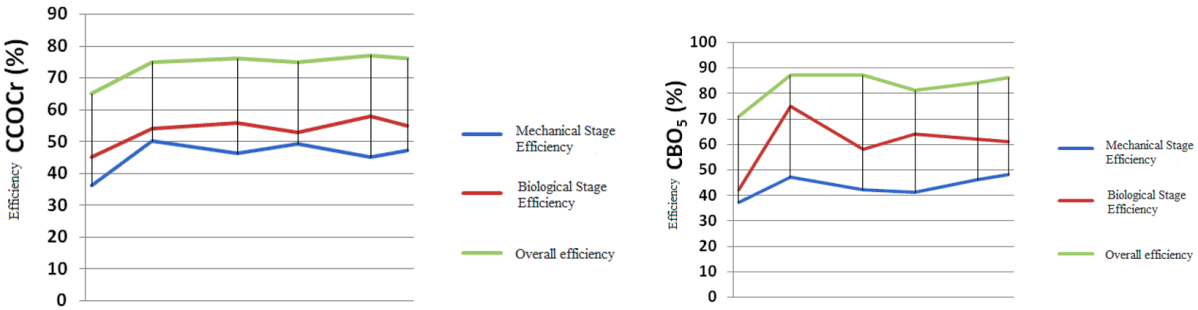

Fig. 5. *The dynamics of efficiency of reduction of CCOCr and CBO_5 in May 2018*

All concentrations recorded in CCOCr both in the influence and the effluent of Galati respected the limits permitted by the legislation in force (500 mgO_2/L in influence and 125 mgO_2/L in the effluent). As regards CBO5 it is observed that in influence and in effluent the concentration was within the permissible limit value (300 mgO_2/L) and (25 mgO_2/L) respectively.

The concentrations of the analysed parameters present homogeneous values in all the samples analysed.

In Figure 6 the dynamics of the average efficiency reduction of CCOCr and CBO_5 in mechanical, biological step compared to the general efficiency of the Galati station in 2017 and 2018 are presented.

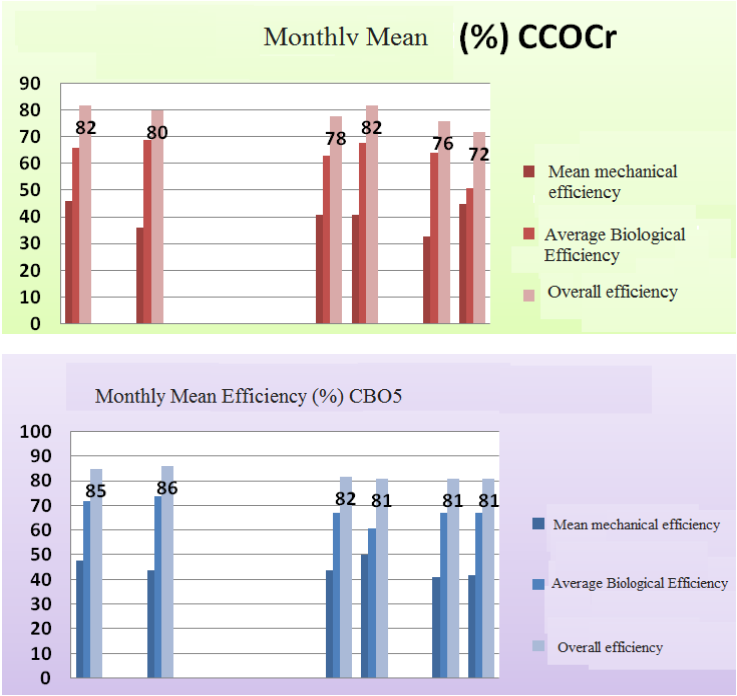

Fig. 6. *The dynamics of the average monthly reduction efficiency of CCOCr and CBO_5 in 2017 and 2018*

The average reduction efficiency of CCOCr falls between 36-46% for the mechanical step, with the average of 40%, and between 67-74% for the biological step, with the average of 64%. The average reduction efficiency of CBO_5 falls between 41-50% for the mechanical step, with the average of 45% and between 61-74% for the biological step, with the average of 68%.

The general reduction efficiency of the Galati treatment station is between 72-82% at CCOCr, with 78% average and between 81-86% at CBO_5 with 83% average, in 2017 and 2018, is shown in Figure 7.

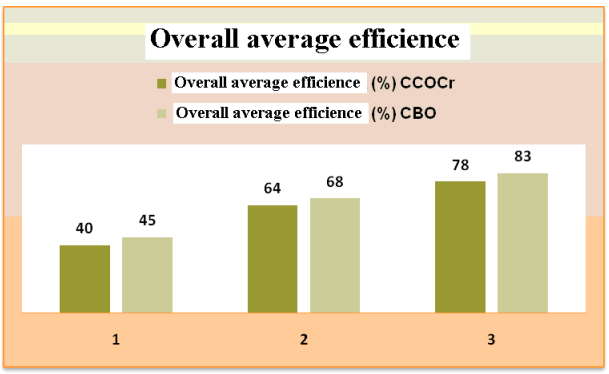

Fig. 7. *The dynamics of the average reduction efficiency of CCOCr and CBO_5 at the Galati treatment station in 2017 and 2018; 1 = mechanical step; 2 = (%) biological Step: 3 = Total installation (%)*

It is observed a superiority of the efficiency of reducing the CBO_5 to the efficiency of CCOCr reduction at both mechanical and biological treatment stages throughout the period studied, which means that the assimilated organic matter has been removed to a greater extent than unassimilated matter.

Figure 8 presents the dynamics of the Symons treatability ratio and its average value in 2017 and January-May 2018

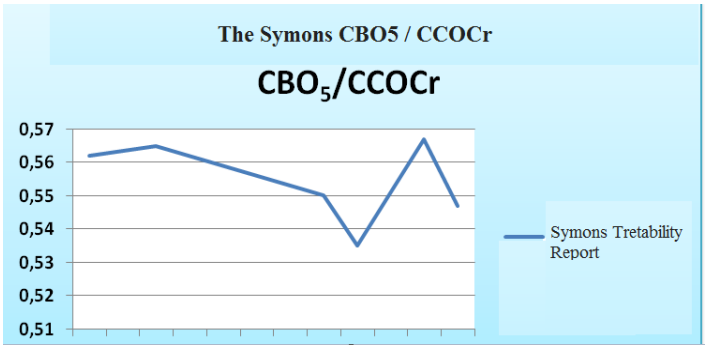

Fig. 8. *The dynamics of the Symons treatability ratio and its average value in 2017 and 2018*

The treatability ratio ranges from 0.535 to 0.567, with an average of 0.554 homogeneously depending on the loading and nature of pollutants. The reduction of Symons treatability ratio from 0.567 in the summer period to 0.535 in winter indicates that the wastewater was harder to treat during the winter period.

3. Conclusions

The reduction of CCOCr and CBO_5 from wastewater after passing through the installation of the Galati treatment station is an estimate of the quantity of organic substances removed in the treatment process.

The Symons environmental treatment ratio achieved for influence was 0.554, which framed the influence in S.E. Galati in the category of wastewater readily treatable by biological methods, in the presence of naturally occurring microorganisms in these waters. So, from the point of view of the Symons criterion, water is slightly biodegradable.

The average of the overall reduction efficiency of CCOCr is 81% and at CBO_5 is 84%, which means that also from this point of view, wastewater purified can be considered as biological treatable waters. The overall efficiency of CBO_5 reduction is a percentage value of the removal of equivalent organic matter and represents the slightly biodegradable component of global organic matter.

The efficiency of reduction of CCOCr (81%) and CBO_5 (84%) allow wastewater characterisation as biological treatable in S.E. Galati and alongside the operation at optimum parameters of treatment plants in 2017 and 2018, determines the achievement of technological performances Imposed by the legislation in force.

References

[1]. M. Negulescu, s.a., *Protectia mediului inconjurator (manual general)*, Ed. Tehnica, Bucuresti 1995.
[2]. Gabrian C. F., *Ghid de mediu*, Ed. Monitorul Oficial, 2008.
[3]. Vişan S., Angelescu A., Alpopi C., *Mediul înconjurător. Poluare şi protecţie*, Bucureşti, Editura Economică, 2000.
[4]. ***, *Poluarea atmosferică*, www.eea.europa.eu, accesat la data de 20.02.2017.
[5]. Cîrţînă Daniela, *Poluarea apelor*. Ed. SITECH, Craiova, 2005.
[6]. Gligor Delia Maria, Roşu Cristina, *Elemente fundamentale de chimia mediului*, Ed. Galaxia Gutenberg, Cluj-Napoca, 2012.