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Abstract. Wastewater and atmospheric treatment are of particular importance for agriculture and for the well-being of citizens so that after treatment they can be placed in a healthy way in nature. In this paper, we have analyzed some basic physicochemical parameters of urban wastewater of Skenderaj, untreated atmospheric water before entering the plant and after treatment of these waters, which after reaching the degree of purity from 80 to 85%, the water flows into Klina River. In this paper, we have reflected detailed data on how wastewater undergoes changes in the parameters that we analyzed after its treatment and this was the purpose of our work.

Key words: DSS (Dissolved Suspensive Substances, COD (Chemical Oxygen Demand), BOD5 (Biochemical Oxygen Demand), Dissolved oxygen**.**

Introduction

Wastewater treatment is of particular importance, especially in developed and developing countries. As their dumping in the untreated environment poses a potential risk of damaging the flora and fauna that live in rivers or even plants that are irrigated with those waters. Water quality studies at different flows revealed that anthropogenic activities have a significant negative impact on water quality in the lower sections of major rivers. This is a result of the cumulative effects of upstream development, but also of inadequate wastewater treatment facilities (Chang H.2008). In the Republic of Kosovo, the first wastewater treatment plant was built in Skenderaj. Skënderai occupies a central place in Drenica and covers an area of 378 km2. The territory of the Municipality of Skenderaj has a hilly-mountainous configuration with an average altitude of 500-700m. It has a mild relief, is crossed by small river valleys, and mainly dominates the medium continental climate characterized by harsh winters, dry summers with high temperatures, and low rainfall, while it has a rich flora and fauna. In the Municipality of Skënderaj live over 72 thousand inhabitants where 99% are Albanians. The structure of the population is mainly dominated by young people: 47% up to the age of 20, 48% from 20-60 years, while only 5% elderly over 60 years.

Table 1. Annual temperature in Skenderaj

Annual temperature and precipitation in Skenderaj		
Average temperature January	°C	-13.4
Temp. average July, August	°C	20.4
The absolute minimum is reached in February	°C	- 25.24
The absolute maximum is reached in August	°C	36.4
Average annual temperature	°C	10
Maximum annual rainfall	mm	850.9
Minimum annual rainfall	mm	394.9
Average annual rainfall	mm	604.8

The hottest months are July and August at 20.4 ° C. The coldest month is January with -13.4 ° C

The treatment of water from this plant is of special importance, because it treats wastewater, with a capacity of 8 thousand inhabitants. Connected to the Plant are 10% of the inhabitants living in the municipality of Skenderaj. It was a pilot project and only the city without villages was included. The plant has a working capacity of 245 m3 / h; an Area of 1.3 ha; The length of the pipe from the main well in Skenderaj to the plant is 3.2 km; Water flows through the pipe (diameter) Φ = 500 mm.

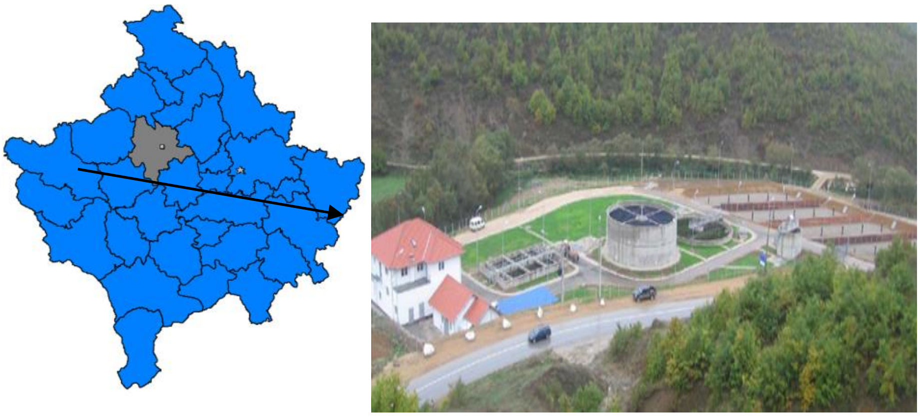

Fig.1. Geographical position on the map of Kosovo, of the wastewater plant in Skenderaj (Naylor 2009)

Material and methods

The analysis of Physic-chemical parameters was done at the Regional Water Company "MITROVICË" Laboratory of Physic-Chemical Analysis for Wastewater. To assess the water condition samples were taken at the plant's entrance and exit after wastewater treatment. The water sample for laboratory analysis is taken carefully. With the help of the Sampler device - the automatic sampling device at the entrance and exit of the plant can solve more every hour from a large amount of water.

Fig.2. Device “Sampler”

In figure 2 are presented samples were taken each month from 4 samples to calculate the average of the monthly values for the given parameters. We have compared the values for February, and March with the values of May July, and August 2022.

Methods of treatment: 1. Mechanical treatment, 2. Biological treatment, 3. Chemical treatment of lymph (disinfection of lime)

a) **Mechanical handling**: Motorized network; Suction pump station; Mesh protection in suction pumps; Removal of sand grains.

Fig.3. Primary sedimentation - Imhoff Reservoir

b) **Biological treatment:** Two automatic pumps with a capacity of 220 m3 / h: They work continuously and through the Fi 200 mm pipe, water is supplied allowing the sprayer to rotate. Drainage filters, where water and air-fed microorganisms (O2) are formed - aerobic process: it is a covered area and inside the drainage, filters are placed where water from the top falls down and then drains in secondary sedimentation.

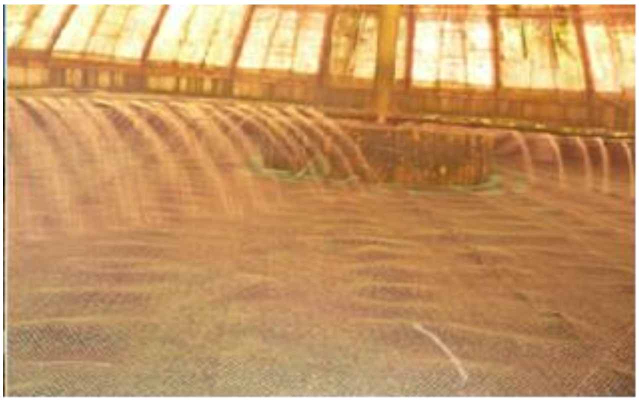

Fig.4. Biological treatment

c) **Secondary sedimentation:** After biological treatment, the water passes to secondary sedimentation, the amount of sludge through the pump is transferred to the sludge disposal and this is the final stage of water treatment before being discharged into the Klina River.

Fig.5. Chemical treatment of lymph (disinfection of lime)

Sludge treatment: Sludge treatment is done in a sludge tank with a capacity of 81 m3, rotating ring (separator) for mixing lime, and disposal of missing calcium Ca (OH) 2. Through the snail pumps sludge flows into the drying areas: In this factory has four drying zones, drying zones: 40x20m..

Results and discussions

During this research, we took samples of wastewater at the entrance and exit of the plant. In the following, we will discuss the results obtained from the analysis of wastewater samples at the above-mentioned plant.

Table 2. General physical and chemical parameters of wastewater at the inlet and outlet of the plant February 2022

Nr.	Parameters Average for February 2022	Unit	Entrance to the Plant	Exit from the Plant	Standard values
1	Water temp.	°C	18.1	18.3	30
2	pH - values	0-14	7.64	7.85	5.5-8.5
3	Electrical conductivity	µS/cm	206.66	194.66	600-1500
4	Total (TDS)	mg/l	103.46	97.2	
5	Total suspended solid (TSS)	mg/l	42.43	9.86	40
6	Sedimentary particles	ml/1h	1.13	0.08	2.5
7	Dissolved oxygen	mg/l	1.43	4.3	
8	BOD_5- biochemical expense of O_2	mg/l	36.2	6.1	40
9	COD-chemical consumption of O_2	mg/l	144	88	130
10	Phosphorus in phosphate ions (PO_4/P)	mg/l	2.2	1.8	1-2
11	N-total	mg/l	18.1	12.48	10-15

Table 3. General physical and chemical parameters of wastewater at the inlet and outlet of the plant March 2022.

Nr.	Parameters Average for March 2022	Unit	Entrance to the Plant	Exit from the Plant
1	Water temp.	°C	17.85	17.925
2	pH - values	0-14	7.735	8.0125
3	Electrical conductivity	µS/cm	215.75	209.75
4	Total (TDS)	mg/l	107.8	104.85
5	Total suspended solid (TSS)	mg/l	44.825	9.875
6	Sedimentary particles	ml/1h	1.15	0.075
7	Dissolved oxygen	mg/l	1.025	3.75
8	BOD_5- biochemical expense of O_2	mg/l	38	4.96
9	COD-chemical consumption of O_2	mg/l	120	73.6
10	Phosphorus in phosphate ions (PO_4/P)	mg/l	2.4	2
11	N-total	mg/l	16.2	9.8

Table 4. General physical and chemical parameters of wastewater at the inlet and outlet of the plant July 2022

Nr.	Parameters Average for Juli 2022	Unit	Entrance to the Plant	Exit from the Plant
1	Water temp.	°C	19.45	19.7
2	pH - values	0-14	7.835	8.015
3	Electrical conductivity	µS/cm	213.5	205.75
4	Total (TDS)	mg/l	106.75	102.5
5	Total suspended solid (TSS)	mg/l	45.45	10.775
6	Sedimentary particles	ml/1h	1.275	0.0875
7	Dissolved oxygen	mg/l	1.1375	3.85
8	BOD_5- biochemical expense of O_2	mg/l	37	3.66
9	COD-chemical consumption of O_2	mg/l	134	82
10	Phosphorus in phosphate ions (PO_4/P)	mg/l	2.2	1.9
11	N-total	mg/l	16.2	11.05

Table 5. General physical and chemical parameters of wastewater at the inlet and outlet of the plant August 2022.

Nr.	Parameters Average for August 2022	Unit	Entrance to the Plant	Exit from the Plant
1	Water temp.	ºC	18.92	19.1
2	pH - values	0-14	7.88	8.01
3	Electrical conductivity	µS/cm	213.25	204.5
4	Total (TDS)	mg/l	106.85	102.4
5	Total suspended solid (TSS)	mg/l	44.9	10.32
6	Sedimentary particles	ml/1h	1.22	0.08
7	Dissolved oxygen	mg/l	1.02	3.87
8	BOD_5- biochemical expense of O_2	mg/l	36.8	3.51
9	COD-chemical consumption of O_2	mg/l	112	82
10	Phosphorus in phosphate ions (PO_4/P)	mg/l	1.8	1.6
11	N-total	mg/l	12.2	8.8

Water temperature: depends on climatic conditions, geographical position, and altitude and ambient temperature dictate the water temperature. The water temperature values in our samples range from 18.1 ºC to 19.45 ºC with an average of 18.58 ºC. According to (Eckenfelder, W. Wesley, Jr.2000). the maximum temperature of the wastewater entering a biological reactor should be < 35 ° C. Changes in temperature affect all biological processes. There are three temperature regimes: the mesophilic one in the temperature range from 4 to 39 ° C, the thermophilic one which peaks at a temperature of 55 ° C, and the psychrophilic one which operates at temperatures below 4 ° C. (Eckenfelder, W. Wesley, and Jr.2000). PH-Values: are listed ranging from 0 to 14, and are divided into acidic, neutral, and basic values. From all the samples we have obtained slightly basic values, which are above 7.64 and up to 8.01. So that the pH values are within the accepted range. In general, the wastewater collected at the monitored sites is slightly alkaline. The pH for the Danube River varies between 6.8 and 8.3 — the average value is 7.82 under Romanian law (Paula Popa, et all. 2012), which is between 6.5 and 9.0. The electrical conductivity from the results presented in (Table 2,3,4,5) we have the values from 2006.66 µS / cm to 215.75 µS / cm. In many cases, conductivity is directly related to total dissolved solids (TDS). High-quality deionized water has a conductivity of about 0.05 µS / cm at 25 ° C, typical drinking water is in the range of 200–800 µS / cm, while seawater is about 50 mS/cm (Lenntech. 2013), (or 50,000 µS / cm). Conductivity measurements are routinely used in many industrial and environmental applications as a rapid, inexpensive, and reliable way to measure ionic content in a solution. (Gray, James R. 2004). For example, measuring product conductivity is a typical way to monitor and continuously monitor the performance of water purification systems. The concentration of DO in all samples taken is between 1.02 mg O2 / L in August and 1.43 mg O2 / L in February, with an average value of 1.15 mg O2 / L. While the values after leaving the plant are: the highest in February at 4.3 mg O2 / L and the lowest in March at 3.75 mg O2 / L where the annual average was 3.94 mg O2 / L According to research done in Romania by Paula Popa et all. (Paula Popa, et all.2012). DO concentration varies across all sampling sites and is between 0.96 (in S2) and 11.33 (in S4) mg O2 / L with an average value of 6.39 mg O2 / L. These are much higher than the DO values measured, for example, in natural surface waters in China, the Taihu Basin had the lowest DO level (2.70 mg / L), while in other rivers the DO varied from 3.14 to 3.36 mg O2 / L (Wang XL,2007). Concentration of P-PO4 - Another nutrient that was analyzed for our study was phosphorus-expressed orthophosphate. The concentration of P-PO4 before entering the plant varies, on average, between 1.8 and 2.4 mg / L. For this component, the concentrations are highest in March and lowest in August. The increase in the concentration of P-PO4 in domestic wastewater is due to food, and meat processing. Unlike most of the other compounds analyzed, for which concentrations were within acceptable limits, the maximum level of P-PO4 does not exceed the values under European law (European Commission Directive,1998), and (IHK 2011) which is set at 2.0 mg / L of total phosphorus per 10000–100000 inhabitants and for more than 100000 inhabitants (as in the case of Galati city) 1.0 mg / L total phosphorus. Before entering the plant and leaving the plant the values were according to the allowed standard.

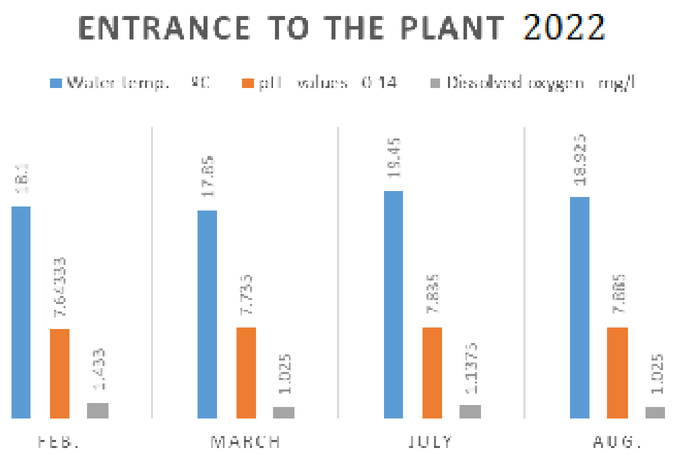

Fig. 6 Values for Temp. of water, pH, and Dissolved Oxygen for months, (2,3-7,8) 2022 at the plant input.

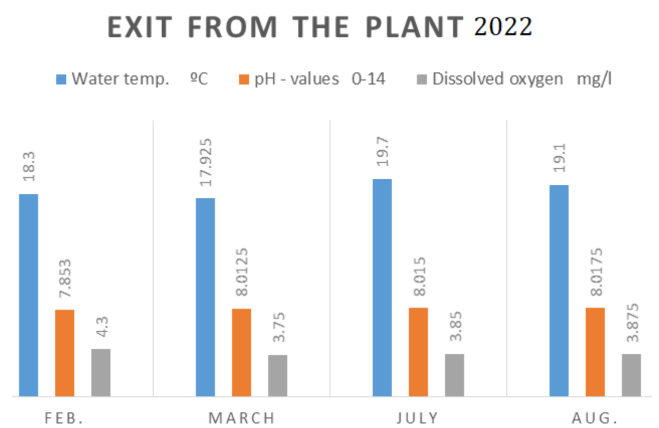

Fig. 7. Value for Temperature water, pH, and Dissolved oxygen for the months, (2,3-7,8) 2021 exit from the plant

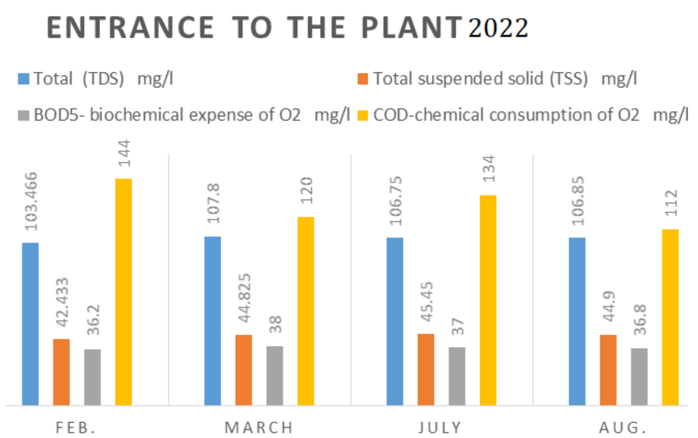

Figure 8. Values for TDS, TSS, BOD5, and COD for months, (2,3-7,8) 2021 at the plant input.

Referring to the results in tables (2,3,4,5) and figures (6,7,8,9) the values of physicochemical parameters of wastewater at the inlet of the plant are greater than those at the outlet so there decrease in these values and at the same time prevents the pollution of the Klina River.
Biodegradable dissolved organic carbon (BDOC) may have an impact on the bacteriological quality of water as it can be a source of carbon and energy for microorganisms. It is important to consider this parameter in the case of the distribution of drinking water. **(Sobczak, P.; Rosińska, A. 2020).**

Conclusion

The plant has a working capacity of 8000 inhabitants and the wastewater treatment process goes through three stages: mechanical process, biological process, and chemical process.

Through these three phases the wastewater treatment process starts from the entry of untreated water to the discharge process of treated water into the river.

The construction of the plant in Skenderaj has given good results so other plants are being built throughout the Republic of Kosovo, which is of particular importance for the life and well-being of citizens, agriculture, and other sectors because it helps the waters of blacks to be treated and plowed healthy in nature

The plant is treating not only the wastewater of the population, but will also treat industrial water, and atmospheric water as there is no separation between them.

Extension of plants in all cities and villages of Kosovo, in the future we will have a clean and sustainable ecological environment.The Skenderaj plant is used as a model for government and other stakeholders in the planning of costs and capacities for the extension of similar services in the future.

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