DETERMINATION OF THE TOTAL SUSPENDED SOLIDS CONTENT AND THE AMOUNT OF WASTE RETAINED BY THE SCREENING INSTALLATIONS

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Abstract: The calculations were done for a wastewater treatment plant that had mechanical, biological, and sludge processing stages and served a population of about 11,100 people. Domestic wastewater, storm water, and industrial water collected from businesses that release into the sewage system are all treated at the treatment plant. The STAS 6953-81 method was used in this research to determine the total suspended solids content. The purification plant's efficiency in removing these substances was assessed using measurements taken from both the influent and effluent. The quantities of coarse material (by weighing) retained from the sewage treatment plant using the two types of screens were also determined. It was observed that the efficiency of the treatment plant was over 98%.

Keywords: wastewater, treatment plant, total suspended solids, screening

1. INTRODUCTION

It is getting harder to guarantee that everyone has access to safe and sufficient water sources as populations rise and natural habitats deteriorate. Reduced pollution production and improved wastewater management are two key components of the approach [1].

To meet our demands for food and other (physical, social, and psychological) items, we need both cutting-edge technology and some traditional industrial facilities. These businesses frequently discharge enormous amounts of wastewater that are sent straight into rivers, streams, and oceans, whether they are food processing operations or other kinds of industrial facilities. This has a negative effect since there is little attempt being made to preserve water at a time when many people fear that the effects of global water shortages are about to become apparent. This harms fisheries and the marine environment in addition to destroying them [2].

Having access to water is crucial for human survival. Freshwater use has grown roughly 1% year since the 1980s and has climbed sixfold in the last 100 years, according to the UNESCO-published 2021 World Water Development Report. Water quality is suffering greatly because of excessive water use. The environment has been degraded and polluted because of industrialization, agricultural production, and urban life. The oceans and rivers are negatively impacted, which has a negative impact on long-term societal development and human health. In the world, it is estimated that 80% of industrial and municipal wastewater that is released into the environment has not been previously treated, which is bad for ecosystems and people's health [3].

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The Environmental Protection Act emphasizes that maintaining and enhancing the natural quality and productivity of surface and groundwater as well as aquatic ecosystems is the primary goal of protection to prevent negative effects on the environment, human health, and material goods [4].

In addition to the United Nations (UN), which oversees global health issues, there is also the World Health Organization (WHO), which has specific divisions dealing with drinking water. The "Guidelines for Drinking Water Quality" [5] are produced by the WHO, whose main objectives are to protect human health and provide a set of criteria that may be used at the national level. According to this manual, every country has the right to impose its own values, subject to regional regulations and environmental considerations.

Industrial wastewater discharge in Europe is governed both directly by environmental laws that apply to industry and indirectly by laws that deal with water-related issues. The Industrial Emissions Directive (IED, 2010/75 / EU), [6] regulates several important issues, including direct or indirect emissions of environmental pollutants from industry.

The main objective of EU water policy is to ensure that there is sufficient access to high-quality water across the EU to meet both environmental and human needs. Water contamination is one of the main environmental concerns brought up by EU citizens. The major strategy of battling water pollution and one approach to improve the quality of wastewater is the treatment procedure, which is now the most extensively utilized, are both continually being sought after at the European level.

Wastewater treatment is an essential method for the preservation and redistribution of water resources, as evidenced by the results of its use in several countries across the world. The understanding of the complex and interdisciplinary elements of the relevant biological, biochemical, chemical, and mechanical processes has advanced significantly during the preceding few decades [7-9]. Figure 1 shows the typical scheme of a wastewater treatment plant.

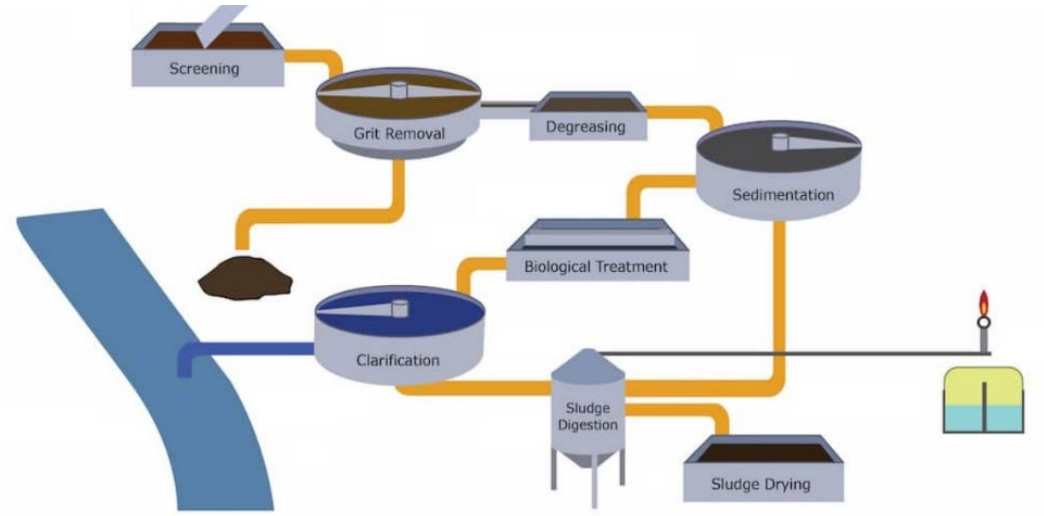

Fig. 1. Wastewater treatment process [10].

Water quality is improved by a treatment process that depends on the type and state of the mineral or organic substance collected to meet the requirements for use. The specification of the method used to improve water quality is decided in accordance with the condition of the raw water as determined by laboratory studies and the acceptable limit of the user's quality standard [11].

Wastewater treatment processes frequently employ physical settling procedures. Primary settling tanks are an essential component of the sludge treatment process and have been utilized widely for the removal of suspended solids (SS) by gravitational settling that are not eliminated by preparatory treatment [12]. The separation of the solid and liquid phases is probably the purifying process's most frequent separation requirement, with gravity-based settling being the most widely used method. Creating a decant with the least amount of liquid in the sediment and the least amount of solid phase in the shortest amount of time and for the least amount of money possible is the aim of efficient decantation.

Large particles and grit found in wastewater can obstruct treatment procedures, increase mechanical wear and maintenance requirements for wastewater treatment equipment, or both. These materials need to be handled separately to reduce any potential issues. These components are taken out of the influent wastewater during preliminary treatment [13].

The paper presents some determination that were performed for a wastewater treatment plant that had mechanical, biological, and sludge stages. The total suspended matter content was calculated in this study using the STAS 6953-81 technique. Measurements from the influent and effluent were used to determine how well the purification plant removed the total suspended solids. The weighted amounts of coarse material retained by the two different types of screens from the sewage treatment facility were also calculated.

2. EXPERIMENTAL SETUP

Determinations were made for a treatment plant with a capacity to treat an average daily flow of 2,550 m^3/day (107 m^3/h), with a maximum dry weather flow capacity of 195 m^3/h and 343 m^3/h maximum wet weather flow capacity.

The treatment plant's removal efficiency was assessed by measuring the total suspended solids (TSS) in the influent and effluent. The TSS was calculated using the STAS 6953-81 technique [14]. Filter paper was used to filter water samples that were collected in specific containers (100 mL), rinsed with hot distilled water, dried in an oven, and then weighed to estimate its initial mass. Following an hour at 103.5 °C in the oven, the precipitate and filter paper were cooled in the desiccator before being weighed. These procedures were followed for both influent and sewage treatment plant effluent. The following ratio was used to calculate the suspended matter content:

$$MTS = \frac{m_2 - m_1}{V} \cdot 1000 \quad (1)$$

where MTS represents total suspended solids content, m_1 represents mass of filter paper, m_2 - mass of filter paper with solid particles, V- volume of wastewater analyzed.

Regarding the amount of waste retained by the screening installations in the sewage treatment plants, the quantities of were determined by weighing.

The sewage treatment plant is equipped with two rare screens (40 mm bar spacing) and two dense screens (6 mm bar spacing) mounted in two reinforced concrete channels. Both grating types are 0.7 m wide and set at a 70-degree angle (Figure 2). Textiles, plastics, plant waste, and paper are among the waste materials preserved by the screening facilities. A toothed rake powered by two chains is used to automatically remove coarse contaminants from the grate surface. After a predetermined period of rotation, the rakes stop, at which point brushes positioned on their edges collect the coarse impurities and transfer them to a ram compactor, where they are compressed before being released into a container.

The waste retained by the screening installations from the treatment plant is transported to the landfill to which the plant is connected. The operation of the screens is intermittent, with the compaction equipment operating at approximately the same time as the screens.

The determination of the total suspended solids content and the amount of waste retained by the screening installations were carried out for the same period, specifically for five months of the current year (November - March).

3. RESULTS AND DISCUSSION

The hours of operation of the screening installations for the months in which the determinations were made were also recorded as part of this study, the results are presented in Table 1. The treated wastewater flow rate in January and February was higher due to snowmelt, and the amount of precipitation in November was lower than in

December and March. Based on these determinations, the variation in the amount of coarse waste retained with the sparse and dense grates at the city wastewater treatment plant was plotted for the months analyzed, Figure 3.

Fig. 2. Rare screens (a) and dense screens (b) of the municipal wastewater treatment plant.

Table 1. The hours of operation the screening installations.

Equipment type	Month determinations	Debit influent, (m^3/mounth)	Total operating hours, (h)
Rare dense screens	November	17,955	7.5
	December	19,250	6.5
	January	22,785	7.25
	February	22,080	5.5
	March	19,679	5.5

According to the graph in Figure 3 it can be seen that the highest amount of waste was generated in January, one reason being probably due to the winter holidays, and the lowest amount was generated in February and due to the lower number of calendar days than the others.

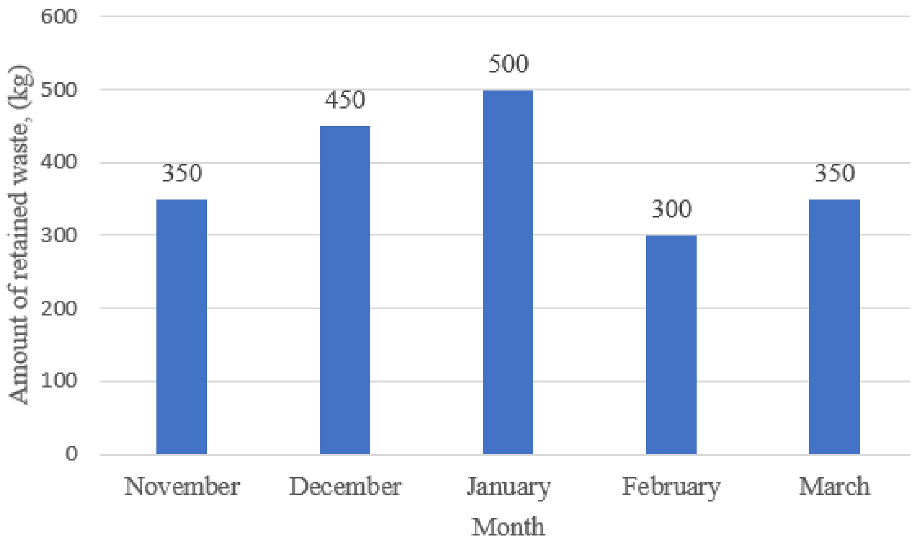

Fig. 3. The amount of retained waste retained from the wastewater treatment plant for the months analyzed.

The treatment plant ability to remove these substances was assessed by measuring the total suspended solids (TSS) in the influent and effluent as well.

Based on these results, variation curves of the total suspended matter content were plotted for the influent and effluent of the city wastewater treatment plant, Figure 4.

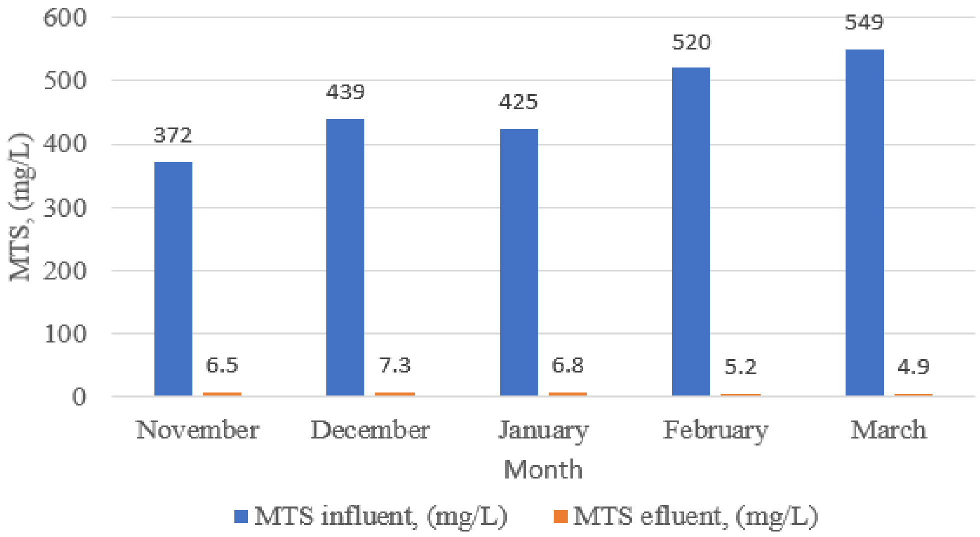

Fig. 4. Total suspended solids content for influent and effluent of the municipal wastewater treatment plant for months analysed.

The amount of suspended matter was greatly reduced in each of the five months that were examined, and each month fell within the permitted ranges for the parameter that was examined. This means that the treatment plant's efficiency was above 98% for each of the five months (Figure 5), this reflects the fact that the treatment plant has a high yield.

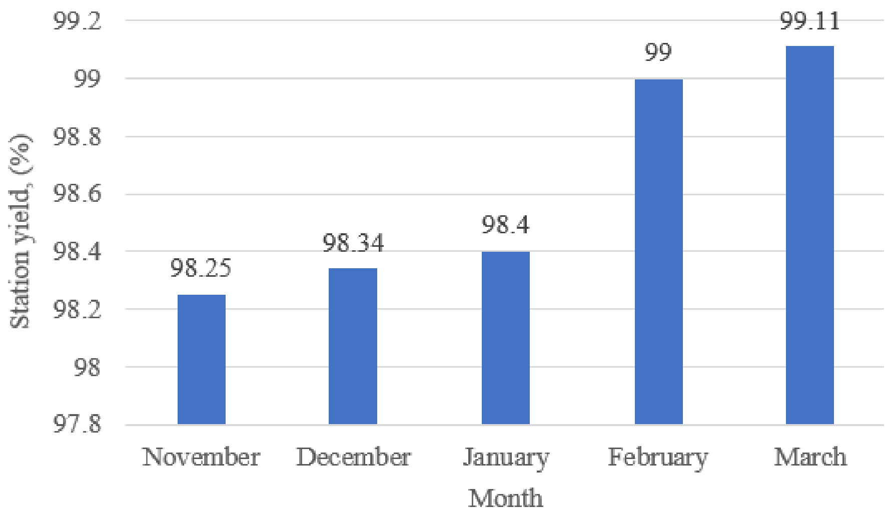

Fig. 4. Treatment plant yield for total suspended solids content.

The efficiency of the treatment plant is over 98 % in all the months analyzed, which attests that the treatment plant shows a high efficiency in terms of removal of total solid particles. The results obtained in this study are in close agreement with the literature.

4. CONCLUSIONS

The main objective of EU water policy is to ensure that there is sufficient access to high-quality water across the EU to meet both environmental and human needs. Wastewater treatment is an essential method for the preservation and redistribution of water resources, as evidenced by the results of its use in several countries across the world.

Large particles and grit found in wastewater can obstruct treatment procedures, increase mechanical wear and maintenance requirements for wastewater treatment equipment, or both. These materials need to be handled separately to reduce any potential issues.

The results showed that waste output peaked in January, maybe due to the winter holidays, and peaked at its lowest point in February, probably due to February's shorter number of calendar days. The amount of suspended elements significantly decreased each of the five months, and each month was within the allowed ranges for the criterion being taken into account. The treatment plant's efficiency was higher than 98% for each of the five months.

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