TO WORK ON THE WASTE WATER TREATMENT FACILITY IN HAYATABAD INDUSTRIAL ESTATES, PESHAWAR

RESEARCH THEISIS

GIS MINI PROJECT

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Introduction

Industrial wastewater treatment describes the processes used for treating water that is produced by industries as an undesirable by-product. After treatment, the treated industrial wastewater (or effluent) may be reused or released to a sanitary sewer or to a surface water in the environment.

Most industries produce some wastewater. Recent trends have been to minimize such production or to recycle treated wastewater within the production process.

Industrial pollutants have been the focal areas of research since last decades (Bui et al, 2016). These pollutants substances have huge potential of harming the aquatic environment (Lio et al, 2014). High levels of pollutants in river water causes an increase in BOD (biological oxygen demand), COD (chemical oxygen demand), TDS (total dissolved solids), and TSS (total suspended solids), hence make such water unsafe for drinking, irrigation and natural waters (Ajayi and Osibanjo, 1981). In Pakistan more than 6,000 industries are registered, out of which around 1,200 are highly toxic to environment (Sial et al, 2006). Pakistan is a highly pollutant country. In Pakistan <1% of industrial wastewater is treated before release into the rivers (MOE-Pak, 2005). Maximum industries are located in major Pakistani cities, which discard their wastewater into rivers, lakes, ditches, ponds, drains and streams (Ullah et al, 2009). Approximately, 40 G liters of per day wastewater discharge is estimated by industrial sector in Pakistan (Saleemi, 1993). These wastewaters not only pollute surface water but also infiltrate through the soil into the groundwater aquifer (Azizullah et al, 2011). Further, in industrial estate there is problem of bad smells, color and turbidity in storage tanks.

Problem Statement

The untreated wastes from Hayatabad Industrial Estate are causing environmental problem as well as disturb the natural water table and produced bad smell, color and destroy turbidity in the area as the industrial waste is being drained out in the water bodies without any treatment. In KPK Pakistan, no industrial wastewater treatment plant is available. The effluents discharged from the industries are passing through urban and rural parts of Peshawar and makes its way to BudniNallah and finally disposes off in river Kabul. The residents living in the vicinity

of these streams complain of nuisance created by the toxic pollution originating and other departments from the Peshawar Industrial Estate. The emission of toxic gases and effluent has compromised clean atmosphere, water table, bed smell affecting adversely the human life. Downstream the water is highly colored, turbid and vegetation along the Nallah appears scorched despite the facts that that water from this Nallah is used for irrigation of vegetables, drunk by animals and birds, and children use it for recreation. Therefore, wastewater treatment plant plays a vital role in industrial water pollution control.

Objective

The objective of this study is to conduct detailed analysis of local treatment facility of Hayatabad industrial estate Fig. 1. This facility is in the form of small treatment plant. This wastewater treatment plant requires surveillance and monitoring for maintenance and operations. The performance of this treatment plant is not studied yet. This is therefore the scope of this study to analyze the performance of the treatment plant in compliance with national environmental quality standards (NEQs)

Description of the treatment facility

Hayatabad Industrial estate is established in western Peshawar near suburban town of Hayatabad Peshawar, on the main Jamrud Road. The current treatment plant is established by PDA (Peshawar Development Authority) over the main drain of the industrial estate in Hayatabad Phase (V). The major contributors of pollution load to the industrial estate are paper mill, ghee, marble, food, iron and steel units. These industries constitute around 190 units, which are operational in the industrial estate (Tariq et al, 2006)

Fig. 1. GIS map of the study area

The industrial effluent are passing through the main channel; drained downstream to Nullah Malkandher and ultimately to River Kabul. Commonly, in a treatment plant through sedimentation, disinfection, coagulation, and filtration the water is treated (Dong et al, 2011). However, understudy treatment plant serves all industrial effluent through only physical treatment process. The treatment plant comprised of two doors for water flow control; screening zone, and a settling chamber for sedimentation of suspended load. The demonstration of the treatment plant could be seen in the model Fig. 2.

G.I.S Mapping of Project

A Detailed GIS Base Map shown in fig 1.1 was prepared to know the ground realities, the waste water network, services available and the ultimate disposal point of waste within the industrial estate. It ascertains and gives the topographic features of the industrial area.

Figure 1. Mapping of Project

Methodology

Twelve composite samples were collected and analyzed from the treatment plant during the study. Each day two composite samples were collected from treatment plant; each from inlet and outlet. Each sample was the result of three grab samples with 30 minutes interval. The samples were collected manually 15 m before and after the treatment plant. For collection of the samples two, three liter plastic containers were used. Less stable parameters like pH is measured on the spot. Using standard method the samples were analyzed and studied for various Physico-chemical parameters (Gupta, 2000). The samples were brought to the laboratory and analyzed. The physicochemical parameters analyzed were pH, BOD5 (Biological Oxygen Demand), COD (Chemical Oxygen Demand), TSS (Total Suspended Solids), and TDS (Total Dissolved Solids). The lab apparatus, pipits, burettes and remaining glassware were gently washed and cleaned with tap water and then with deionized water. The parameters analyzed were shown in the Tab.1 with methodology. The area of the treatment plant, flow rate and flow discharge were also determined by standard method.

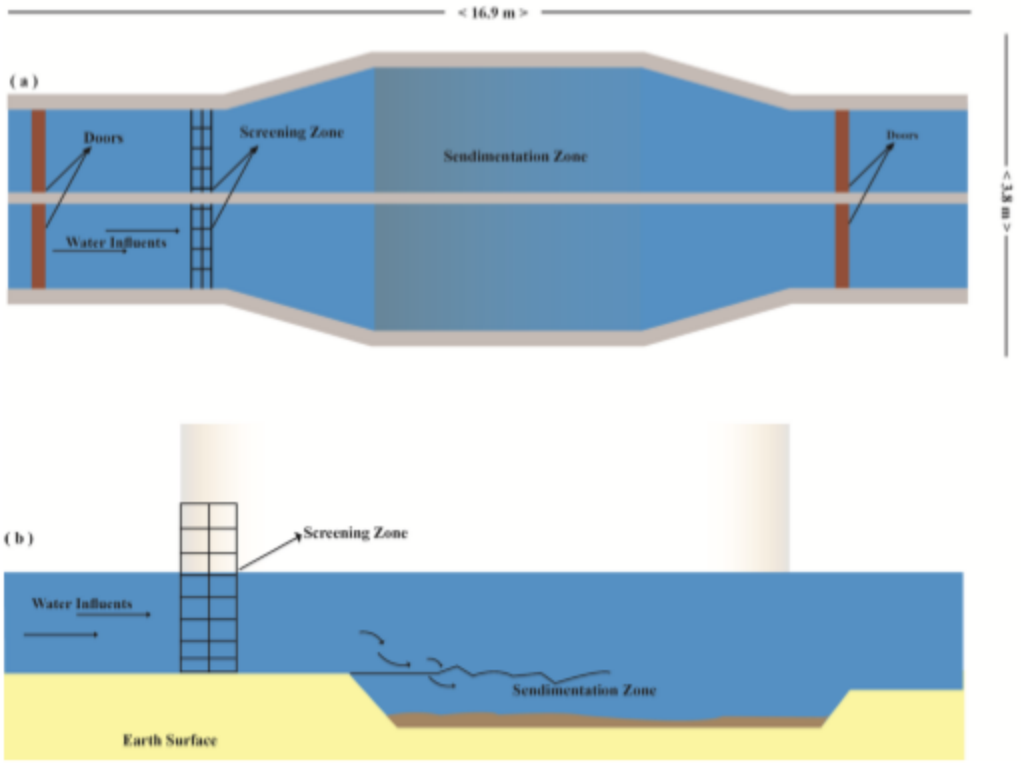

Fig. 2. Model of the treatment plant (a) Top view, (b) Side view

Table 1 Parameters and standard method used

S. No	Water Quality Parameters	Method of Determination
1	Hydrogen Ion Concentration (pH)	pH meter
2	Total Suspended Solids (TSS)	Filtration
3	Total Dissolved Solids (TDS)	Filtrate Evaporation
6	Biological Oxygen Demand (BOD_5)	Incubation at 20 °C, Titrimetry
7	Chemical Oxygen Demand	Titrimetry (Reflux Unit)

Results and Discussions

Area of the treatment plant

The calculated length and averaged breadth of the plant was 16.9 m and 3.8 m respectively with 64.4 m2 of total area. The calculated width of treatment plant in middle
is 5.7 m, which not only reduces the water velocity but also provides a large surface area to ease sedimentation process (Fig. 2).

Flow velocity of treatment plant

Flow is actually the speed at which a particular volume of water flows through a specific point. Along the length of the treatment plant a continuous variation has been observed in the flow rate of wastewater in day time. In the peak hours the highest flow velocity of wastewater was 1.32 m/sec. This speed reduced to 0.88 m/sec in dip hours. The detail of flow velocity is given in Fig. 3. The flow velocity of the treatment plant is calculated by float method with following equation. S = V × t V = S/t Where S distance covered by floating object over channel surface, t is time taken by floating object to reach to a known point.

Discharge rate of treatment plant

The maximum average discharge rate of wastewater through the treatment plant was 1.39 m3/sec, which reduced to 0.68 m3/sec in off time. The discharge rate for wastewater is shown in Fig. 4. The discharge of the main drain was calculated as: Discharge = A × V

Where A shows area of the water in specific cross section of the drain, and V shows the velocity of water in the drain.

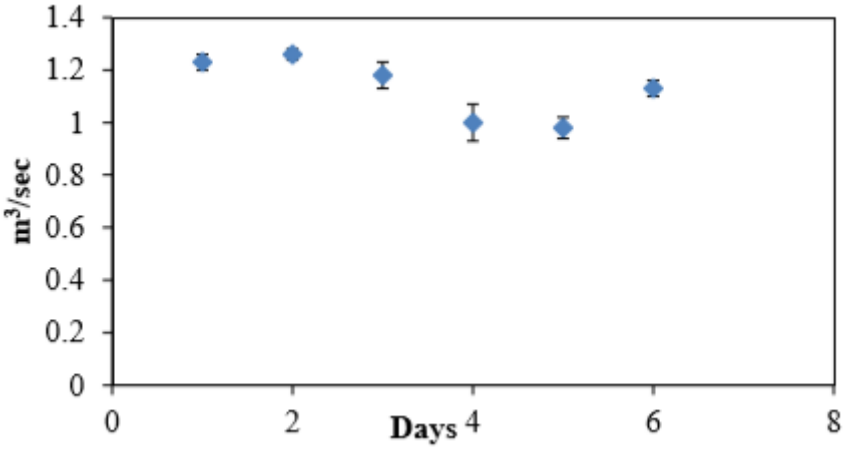

Fig. 3. Average flow rate of main drain

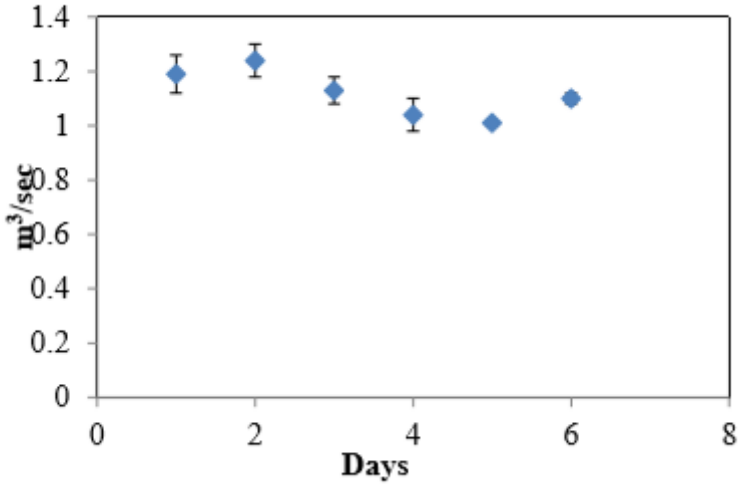

Fig. 4. Average discharge of main drain

Efficiency of the treatment plant

The treatment motivation

Organic load removal is the indicator for performance of wastewater treatment plant (CPHEEO, 1993). Similarly, Colmenarejo et al concluded that the overall performance of the treatment plant is measured by analyzing treatment potential of BOD, COD, Ammonia, and TSS) (Colmenarejoet al, 2006). Further, the efficiency of primary treatment is measured with total solid removal (Anonymous, 1998). Further, the reuse of
wastewater for irrigational purposes is related with dissolved solids, as it exceeds 480 mg/L it decrease hydraulic conductivity of irrigated farm lands (Bouwer, 1978). More, primary treatment is capable for 35% of BOD removal from wastewater. Based on above findings in the current study the competency of the treatment plant is estimated by considering study of BOD, COD, TDS, and TSS from influent in comparison with effluent of wastewater treatment plant. The details of seven days performance study conducted for the mentioned parameters are described below

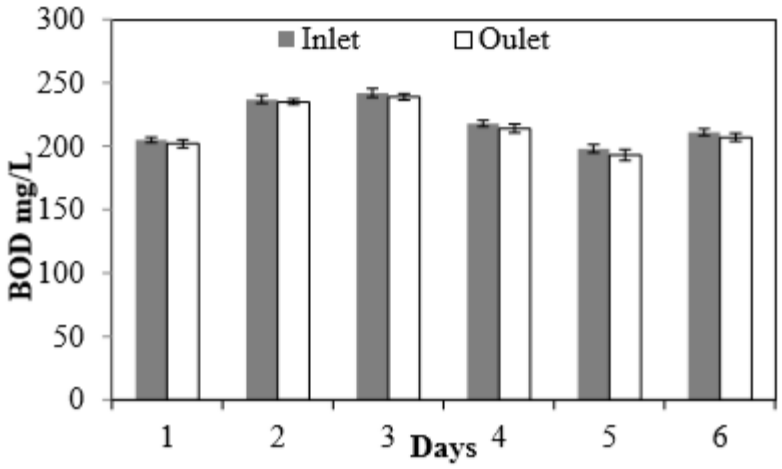

Fig.5. Inlet/outlet BOD value

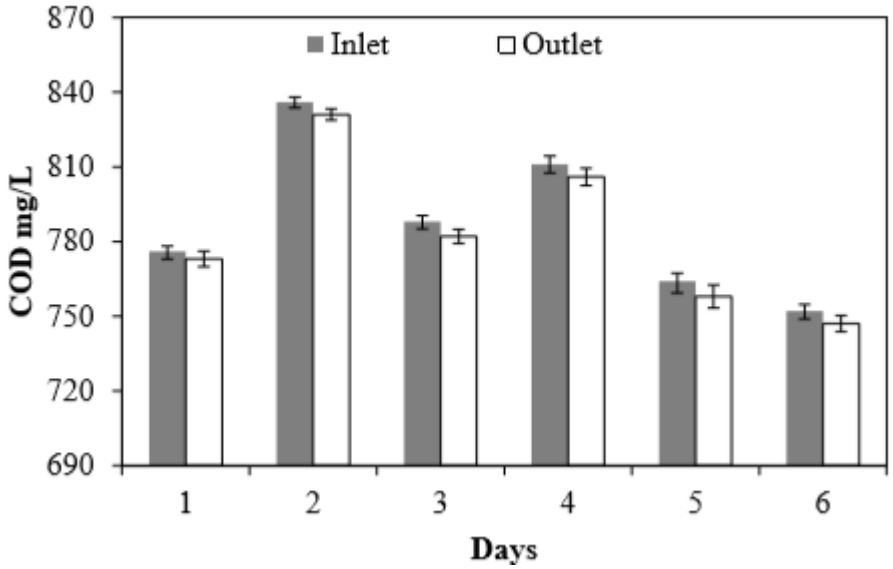

Fig. 6. Inlet/outlet COD value

Wastewater effluents entering the inlet of the treatment plant

In the influent of the treatment plant, the average concentration of the BOD, COD, TSS, and TDS of the influent were 218 mg/L, 787 mg/L, 958 mg/L, and 1520 mg/L respectively. The pH varied from 7.21-7.42 in
the influent. Same way, the effluents of the treatment plant was also analyzed for comparison with the influents. The average concentration of BOD and COD was 214 mg/L and 782 mg/Lin the effluents respectively. The average TSS was 958 mg/L while TDS was 1517mg/L in the effluents.

Slight variations in the pH of effluent were observed, which was 7.07 to 7.37.

Wastewater treatment efficiency of treatment plant

During six days study of the treatment plant the maximum value of BOD in the influents was 242mg/L, which is reduced by 1.29 % to 239mg/L as shown in Fig. 5. Similarly, Fig. 6 shows the value for COD (836mg/L) is reduced by 0.59% (831mg/L). High COD and BOD indicate high quantity of organic and chemical load in water. This reduces the amount of dissolved oxygen for aquatic life and agricultural farmlands (Wallace, 2000). The value of TSS (990mg/L) is reduced by 0.3% to 987 mg/L (Fig. 7), while the value of TDS (1552mg/L) could be seen in Fig 8. It is reduced by 0.19% to 1549
mg/L after passing through the sedimentation system of installed treatment plant. Such high TSS increases the rate of turbidity and lowers the clarity of water, hence affecting aesthetic behavior of water (Peavy, 1985). Elevated TDS may decrease the dispersion of light in water reducing the rate of photosynthesis. Such water is not feasible for drinking, irrigation, and even for release to natural water bodies purposes (Lokhande et al, 2011).

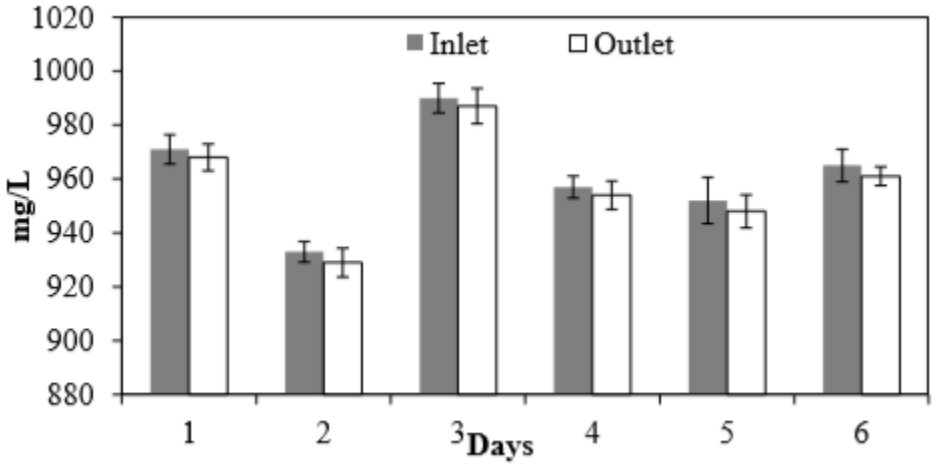

Fig.7. Inlet/outlet TSS value

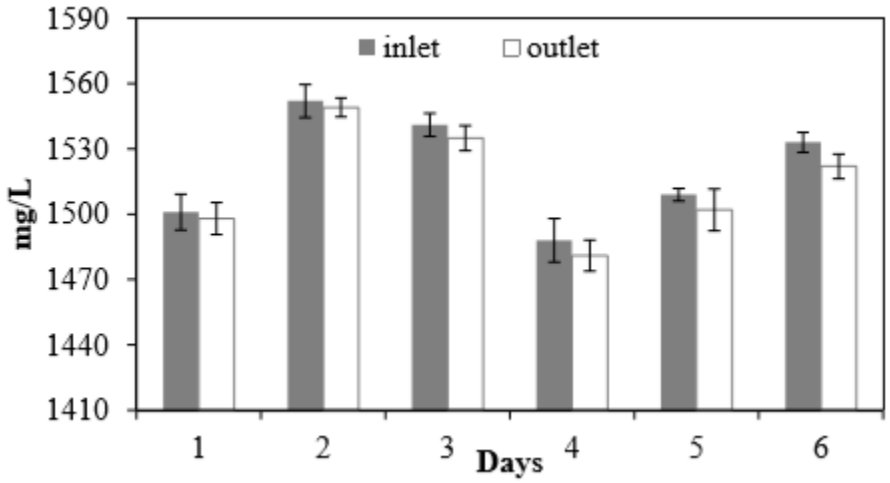

Fig.8. Inlet/outlet TDS value

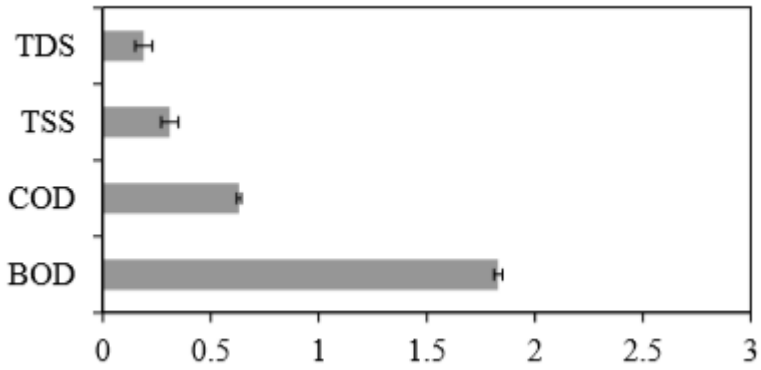

Fig.9. Efficiency of the wastewater treatment plant

Tab. 2 summarizes the Pakistan national environmental quality standards (NEQs) for comparison with the findings of the current study. The present study reveals that the performance of the treatment plant is not adequate. Fig. 9 shows the percent efficiency of the treatment plant. As there is continuous
flow of water and no retention time is given to sedimentation process so this is way the suspended load does not settle efficiently. In authors understanding, consistent flow fed up the sedimentation zone so incoming suspended load will have less chances of settling.

Tab 2 NEQs for considered parameters

S. No	Parameters	Standards (mg/L)
1	BOD (5 days at 20 °C)	80
2	COD	150
3	TSS	150
4	TDS	3500

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Conclusion

The six days performance study of the treatment plant showed poor efficiency of the treatment system. Overall, the plant reduced the TDS by 0.12- 0.30%, the TSS by 0.31% to 0.41%, the COD by 0.44% to 0.71%, and the BOD by 1.69% to 1.83%. Due to the installation of only screening and sedimentation process in the treatment plant, the present study reveals that the plant do not treat the BOD, COD, TSS, and TDS of the industrial effluents.. So it is concluded that in this condition the plant is not matching with the needs of wastewater of the industrial estate. In order to make its feasibility for the proposed wastewater treatment, further study should be conducted about addition of advance treatment facilities, which will be cost effective and economical for reuse and recycling of wastewater

Comments

Due to short of Time and COVD-19 Does not perform physically the mini Project. But Try out Best to make a good Thesis Statement with the help of Internet and Senior Expert and also the lectures which is Provide You (Sir).

THANKS