Performance Evaluation of Sewage Treatment Plant (STP) – A Review

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Abstract

The efficiency of individual units of Sewage Treatment Plant (STP) determines the overall performance of plant and final treated effluent quality. The paper aims to review on past work carried out which decides the various treatment techniques, material used for the treatment, methodology selected for the treatment and by means of that improving the performance of STP. The industry has been exercising for conserving water by recycle and reuse of treated sewage which reduces the requirement of water. For this the pollution load on each unit is analyzed and also evaluated the percentage removal to meet the standard effluent quality.
Keywords: Performance evaluation, Efficiency, STP, Industry

I. INTRODUCTION

Conversion of Civil Engineering into Environmental Engineering branch has taken place because conventional topics like water supply, sewerage had to include subjects like industrial waste treatment. Shortage of water resources led to efforts beyond conventional secondary treatment and a separate branch viz. tertiary treatment and reuse of waste water has developed. Most of sub-Saharan Africa is without wastewater treatment. In a relatively developed Middle Eastern country totally untreated sewage has been injected into the Tehran city's groundwater. As such urban drainage system should also be considered as an important in removing both wastewater and rainwater from city to prevent unhygienic conditions and to avoid damage from flooding.
Wastewater or sewage treatment is one such alternative, wherein many processes are designed and operated in order to mimic the natural treatment processes to reduce pollutant load to a level that nature can handle. In this regard, special attention is necessary to assess the environmental impacts of existing wastewater treatment facilities (Jamrah, 1999). Objective of sewage treatment is the removal of pollutants and to protect and preserve our natural water resources. Protecting the human health from the pathogenic organisms present in sewage before the treated effluent being discharged to the water bodies are of specific concern. The present study has been undertaken to review the evaluated performance of STP. For increasing the efficiency and performance of STP the various treatment techniques, materials as well as required methodology must be introduced.

II. REVIEW ON PAST WORK DONE

Sharma H. et. al. (2014) revealed the comparative study of 15 UASB reactors and polishing ponds under Indian climatic conditions installed along the Yamuna river bank in 1999 to 2002. The main objective of giving post-treatment by using a polishing pond for anaerobically pre-treated sewage is improving the quality of the final effluent for meeting the standards for protection of public health and environmental consideration. The samples were collected from the different 15 STPs located on the bank of Yamuna River from Tajewala to Agra. Keeping in view the similar climate and conditions. The parameters which were measured to assess the treatment efficiency of STPs are DO, pH, COD, BOD, SS, and fecal coliforms for the influents and effluents. Results showed that the effluent from the sewage treatment plants (STPs) investigated failed to comply with discharge standards in terms of ssuspenced solids, BOD, and fecal coliform removal. Therefore, it was proposed that such proper maintenance and operation while removing excess sludge and scum be conducted in order to increase treatment efficiency.

Dr. Bader Jarallah S AlBuraidi (2013) compared the efficiencies of effluent quality two pilot plants which were operated on extended aeration (ASEA) and Membrane Bioreactor (MBR). The plants were operated for thirty-six weeks in Al Gassim region from January 2010 till end of September 2011. The extended aeration and Membrane bioreactor (MBR) pilot plant operated for 36 weeks starting from January 2010 to the end of September 2010. The samples were collected 5 days in a week. The total number of samples analyse was 180 samples. The COD removal efficiency in MBR pilot plant ranges between 93% and 98% while in case

of ASEA pilot plant removal efficiency ranges from 89% to 91%. The SS removal efficiency ranges from 95% from 98% in case of MBR pilot plant and ranges from 93% to 97% in case of ASEA pilot plant. The ammonia removal efficiency ranges from 44% from 98% in case of MBR pilot plant and ranges from 19% to 97% in case of ASEA pilot plant. The high removal efficiency of organic matter could be achieved in both MBR and ASEA pilot plants. Membrane Bioreactor Technology provides a good alternative to the conventional treatment of municipal wastewater at small wastewater treatment capacities. The quality of the effluent from both membrane and activated sludge (extended aeration) is complying with Saudi regulations.

Mansi Tripathi et. al. (2013) conducted study for evaluation of two STPs which were operating on Upflow Anaerobic Sludge Blanket (UASB) and Fluidised Aerobic Bioreactor (FAB) technologies using two approaches, evaluating the treatability performance and Life-Cycle Assessment (LCA). Composite samples were collected and refrigerated. BOD removal efficiency of Daulatganj STP is better while COD removal efficiency of Bharwara STP is good. TSS removal is better in Daulatganj STP. For more appropriate comparison of the performance of the two STPs, the Life Cycle Cost for different technologies used in these STPs had been carried out for selecting best technology. For Life Cycle Cost estimation, the life of the STPs is assumed to be 20 years (n) and interest rate (i) to be 10% as prevailing. Life Cycle Costs have been calculated by keeping the capacity of the plant fixed and varying the rate of land. Then Life Cycle Costs have been calculated by altering the size of the plant but keeping the cost of the land constant. In both the cases, the rate of increase of the LCC is greater for the Bharwara plant.

E. C. Ukpong (2013) conducted research to find out the performance of Activated Sludge Wastewater Treatment Plant (ASWTP) at QIT, Ibeno Local Government Area of Akwa Ibom State. The objective of the study was to investigate the level of effectiveness of the activated sludge process. Samples were collected at monthly interval between February, 2011 and May, 2011 and at the following three points to analyse influent line, aeration tank and the outlet of plant. The parameters for which the samples are analysed were BOD, COD, TDS, pH, DO, Odour, Colour, temperature, TSS, Total Alkalinity, Oil and grease and total coliform per 100ml. After study it is concluded that the wastewater in the aeration tank has foul smell and black colour due to insufficient aeration. Some of the effluent sample results meet the WHO standard.

Jacklin J. Nilling et. al. (2013) attempt in this paper was to design a laboratory scale Rotating Biological Contactor (RBC) to treat sewage water before disposed of into the water bodies. By considering the important parameters like hydraulic loading, organic loading, sewage discharge, and detention time, RBC was designed. RBCs are capable of handling wide range of flows, lower power requirements, operating costs are low as no skill supervisor is required for plant's operation. But RBC could be influenced by the presence of different parameters such as nitrates, nitrites, sulphates, BOD, etc. in wastewater. Some parameter content increased after treatment, however other parameter content decrease. The nitrates content increases according to the test results. The nitrates remain in the wastewater until it is consumed by plants as plant's protein. Not much modification in components and its design may improve the efficiency considerably.

S. S. Fatima et. al. (2012) investigated the treatment performance of full scale wastewater treatment plant using ASP at Islamabad, Pakistan. The parameters which were observed regularly including total suspended solids (TSS), mixed liquor suspended solids (MLSS), mixed liquor volatile suspended solids (MLVSS), biological oxygen demand (BOD), and chemical oxygen demand (COD). The samples were collected on daily basis and sampling was done from the inlet, after primary clarifier, the aeration tank and outlet. Total Suspended Solids (TSS) and MLSS & MLVSS determined by filtration-evaporation, COD by closed reflux titrimetric method, BOD by dilution method and Sludge Volume Index (SVI) by sludge setteleability. This study disclosed that the desired MLSS in the range of 3,000–3,500 mg/L could be maintained by optimizing the SRT. For the desirable range of MLSS optimise the SRT of 7 days.

Ravi Kumar et. al. (2010) did the comparative study of Urban Waste Water Treatment Plants (UWTPs) towards the periphery of Vrishabhavathi valley, located in Nellakedaranahalli village of Nagasandra and Mailasandra Village, Karnataka, India. The composite samples were collected in clean plastic containers of 5 litre capacity at three different units of the treatment plant, namely, a) Influent to the plant, b) Effluent of aeration tank and c) final effluent from secondary clarifiers for seven days. The primary parameters included pH, TDS, TSS, DO, BOD (5), COD, chlorides and sulphates, the ratio of COD to BOD (5); while secondary parameters are MLSS and SVI, covering physical, chemical, and biochemical properties of the wastewater. It is found that the reduction in COD, BOD, total suspended solids was significant in both plants poor efficiency in terms of total dissolved solids removal.

III. CONCLUSION

It is concluded that many problems with regards to STP can be minimised by providing correct methodology, treatment process and the necessary design parameters for maximum efficiency of STP. The modified method should be adopting such as extended aeration activated sludge treatment, Upflow Anaerobic Sludge Blanket (UASB), Fludized Aerobic Bioreactor (FAB). For further treatment of wastewater tertiary treatment should be adopt. Due to that the reuse and recycle of water can be achieved.

IV. REFERENCE

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