International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 05 Issue: 02 | Feb-2018 www.irjet.net p-ISSN: 2395-0072

WASTEWATER TREATMENT USING FLY ASH

C.Ganapathy[1], K. Nivetha[2], E. Ohm Kumar[3], T. Pratheep[4]

[1] *Assistant Professor, Department of Civil Engineering, Sona College of Technology.*
[2] *UG Students, Department of Civil Engineering, Sona College of Technology.*

Abstract - *In the treatment of waste water to remove toxic effluents, highly porous power plant waste ashes can be utilized. An indigenous bed is made which could replace expensive treatment facilities such as reverse osmosis (RO), granulated activated carbon (GAC) bed etc. A lot of work has been reported on fly ash for adsorption and other construction related uses. But a little or no work so far has been reported for the use of fly ash for the treatment of wastewater. The use of fly ash resolved the environmental issues and disposal by treating wastewater. The treatment bed comprised of three layers of sand, fly ash, pebbles. Each layer has equal thickness. Alow-cost filter media was prepared and used for the removal of impurities such as Chemical oxygen demand(COD), total suspended solids(TSS), total dissolved solids (TDS) and pHof the effluent. It is found that COD is reduced from 300ppm to 80ppm. TDS is reduced from 2000ppm to 700ppm. TSS reduced from 3500ppm to 70-80 ppm and pH dropped from 7.58 to 5.6.the dissolved oxygen(DO) is increased to 2.75 to 12mg/l It is also reported here that for efficient treatment of wastewater filter bed thickness 10mm-20mm is recommended*

Key Words: fly ash bed, low-cost filter media, chemical oxygen demand, total suspended solids, total dissolved solids, dissolved oxygen.

1. INTRODUCTION

Wastewater pollution is one of the critical problems that the world is facing in this era. Water quality is extremely important because constant access to good quality water is necessary for life as well as the economy. Water is the major abundant natural resources of the ecosystem. The planet earth is having 79% of water. In India, major problem leading to waste pollution is increasing population, industrialization and urbanization. All the living organism in the environment require water for their growth and development. Water pollution occurs when the pollutants are discharged directly or indirectly into water bodies without adequate treatment. Collection, treatment and disposal of domestic and industrial wastewater are the serious issues to be handled for preventing damage to the environment. Water is mainly polluted by discharging effluents from domestic, industrial waste.

Fly ash is a pulverized fuel ash. It is a coal combustion product that is composed of the particulates that are driven out of coal-fired boilers together with the flue gases. Ash that falls to the bottom of the boiler is called bottom ash. Fly ash contains high carbon content with specific surface area between 2000 to 6800 cm2. It is examined that the fly ash in wastewater treatment is used to remove COD, reduce TSS, TDS and pH level.

In this research work, fly ash filter is used for wastewater treatment.

2. LITERATURE STUDY

Syed Farman Ali Shah et al (2015) had conducted experiment in wastewater treatment using bed of coal fly ash for dyes and pigment industry. The treatment bed comprises of briquettes of coal fly ash coupled with commercial coagulant ferrous sulfate -lime reduced COD, colour, turbidity and TSS of effluent remarkably. In coagulation treatment, coagulant $FeSO_4$-lime influenced reduction of COD, colour, turbidity and TSS by 32%, 48%, 50% and 51% respectively. the CFAB coupled with coagulant, resulted an excessive removal of colour, TSS, COD and turbidity by 88%, 92%, 67%, and 89%.

Dr. Pankaj Singh et al (2014) studied domestic wash water treatment using fly ash alone and in combined form. This study reports the use of fly ash alone and in combined state in different ratios with wood ash for the treatment of domestic laundry wastewater. Effect of various parameters such combination ratio of fly ash and wood ash, contact time, adsorbent dosage and particle size of adsorbent have been studied. It is found that TSS reduced from 350ppm to 15-20 ppm, BOD from 250pm to 10-20ppm and pH dropped from highly alkaline range to 8.5-9.5 range

3. EFFLUENT AND MATERIAL COLLECTION

3.1. Effluent collection

Waste water generally grey water collected from sewage treatment plant, generated in Sona campus, Sona college of technology, Salem. It is polluted and has high concentration of COD, TSS, TDS, pH and the dissolved oxygen level would be very low.

3.2 Material collection

3.2.1 Fly ash

Fly ash is collected from thermal power plant by electrostatic precipitator method.

3.2.2 Pebbles

Pebbles are generally considered larger than granules and smaller than cobbles. Here we used small size pebble to make the filter media slighter effective.

3.2.3 Sand

Sand is a naturally occurring granular material composed of finely divided rock and mineral particles. A layer of sand is also used in the filter media to make it effective. Here River sand is used which was sieved with 2.45mm sieve.

4. PREPARATION OF FLY ASH FILTER BED

The CFAB is designed for the effluent effective treatment and removal results. The filter bed has inlet and outlet. Initially the filter bed consist of three layers. The first and the bottom layer is pebbles. The second layer is fly ash and the third layer is sand.The filter bed comprises sand, pebbles, and fly ash. The sand, pebbles will make the filter bed more effective.The COD, DO, TSS, TDS, and pH will be reduced by increasing the layer of fly ash. The fly ash medium is sanwiched between the layers of pebles and sand to get beneficial results. Fly ash was made as a filter bed of 10mm, 20mm, 30mm, and 40mm thick.The thickness of the each layers is similar. Fly ash act as adsorbent as it contains high carbon content.

5. DESIGN OF FILTER BED

The specifications of the bed structures are as follows:

Length of bed = 0.3m

Width of bed = 0.3m

Height of bed = 0.3m

6. PROCEDURAL TREATMENT OF WASTEWATER WITH FLY ASH AS FILTER BED:

Initially, the filter bed cleaned well. Fly ash is seived in micrometer sieve and taken up. The pebbles which is laying in the bottom layer should be wasted with distilled water and dried in the sunlight for few minitues. The river sand taken is seived in 2.45 micrometer. The untreated effluent should be tested to get initial readings of COD, DO, TSS, TDS and pH. First the bed of 40 mm is made. Laying bottom layer with pebbles then layer of fly ash and top layer is of sand each layer has 40mm thick. Then the effluent is poured into the bed. After 24 hrs left, it has been tested. The tests are determination of COD, DO, TSS, TDS and pH. The same procedure is followed for the consecutive layers (30mm, 20mm, 10mm). Finally the effective thickness in which the fly ash will give better results should be determined.

7. RESULT AND DISSCUSSION

7.1 Removal of COD from the Waste Water

Chemical oxygen demand is a measurement of the oxygen required to oxidize soluble and particulate organic matter in water. Before treatment the level of COD is above than permissible limit 300mg/l. After treatment, the COD value decreased to a 80 mg/l in the thickness of 10 mm. It is clear that the effective thickness is 10-20 mm.

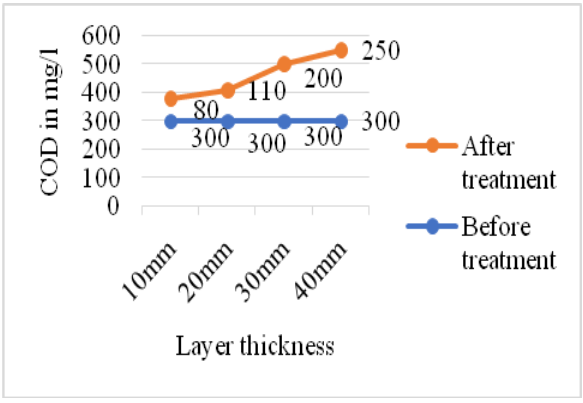

Figure 7.1 Amount of COD before and after treatment

7.2 Removal of TDS from the Waste Water

The term total dissolved solids refers to materials that are completely dissolved in water. These solids are filterable in nature. estimation of total dissolved solids is useful to determine whether water is suitable for drinking purpose , agriculture and industrial purpose. Before treatment the level of TDS is above than permissible limit 2000mg/l. After treatment, the TDS value decreased to a 700 mg/l in the thickness of 10 mm. It is clear that the effective thickness is 10-20 mm.

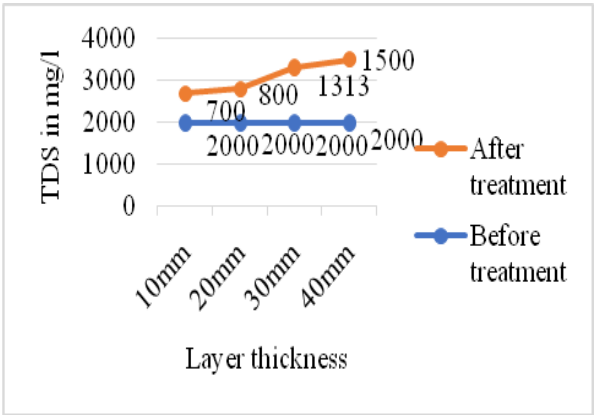

Figure 7.2 Amount of TDS before and after treatment

7.3 Removal of TSS from the Waste Water

The term total suspended solids refers to materials which are not dissolved in water and are non filterable in nature. It is defined as residue upon evaporation of non-filterable sample on a filter paper. In industries, use of water with high amount of dissolved solids may lead to scaling in boilers, corrosion and degraded quality of product. Before treatment the level of TSS is above than permissible limit 3500mg/l. After treatment, the TSS value decreased to a 80 mg/l in the thickness of 10 mm. It is clear that the effective thickness is 10-20 mm.

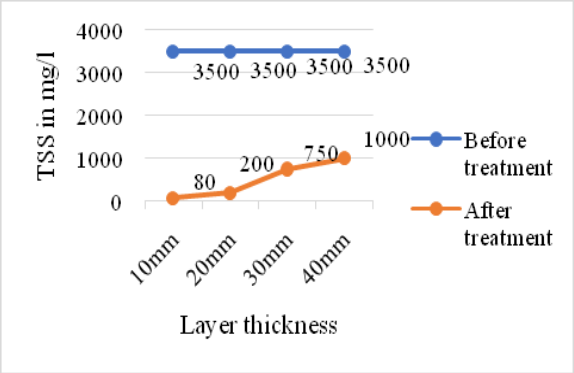

Figure 7.3 Amount of TSS before and after treatment

7.4 Increase in DO level of the Waste Water

Dissolved oxygen determination is used to describe the amount of oxygen dissolved in a unit volume of water. Dissolved oxygen is essential for the maintanance of healthy lakes and rivers. Analysis of dissolved oxygen is an important step in water polution control and wastewater treatment process control. Drinking water should be rich in dissolved oxygen for good taste. Before treatment the level of DO is below than ermissible limit 2.75mg/l. After treatment, the DO value increased to a 12 mg/l in the thickness of 10 mm. It is clear that the effective thickness is 10-20 mm.

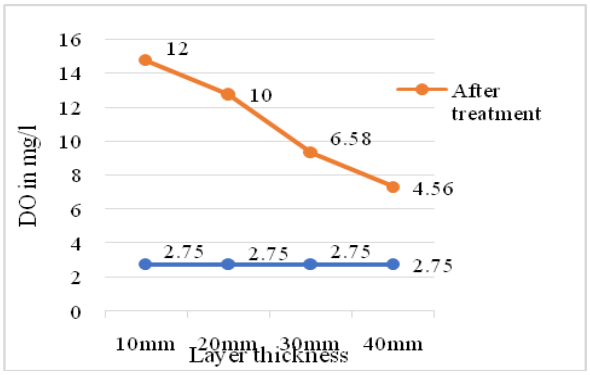

Figure 7.4 Amount of DO before and after treatment

7.5 Reduction of pH Content of the Sample

Reduction of ph level in the consecutive layers are tabled below.

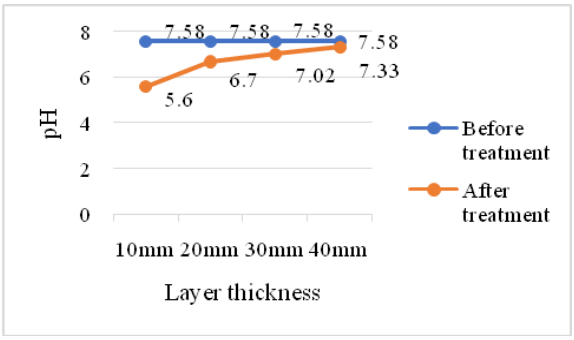

Figure 7.5 pH content before and after treatment

8. CONCLUSION

Coal fly ash bed is an inexpensive and effective for removal of COD, TSS, TDS and pHreduction due to its high porosity and adsorption capacity. Fly ash is available in abundance at coal fed electric power plants can be effectively used for treatment of wastewater. When fly ash is used as filter bed of 10mm, 20mm, 30mm, and 40 mm thickness, the parameter value is reduced to great extent from initial value in 10-20 mm thick. It is concluded that the fly ash is better option for the treatment of waste water treatment. The obtained result values are within the permissible limits. Environmental pollution issues can also be minimized by using coal fly ash bed in waste water treatment.

REFERENCES

[1] Indian fly-ash: production and consumption scenario, Md Emamul Haque Department of Mechanical Engineering, Faculty of Engineering and technology Jamia Millia Islamia (Central University), New Delhi 110025 INDIA

[2] Low-cost adsorbants for waste wastewater treatment: A review, S.J.T. Pollard*, G.D. Fowler, C.J. Sollars and R. Perry.

[3] Use of fly ash in reducing toxicity of and heavy metals in wastewater effluent Gian Gupta, Norca Torres.

[4] Application of fly ash -based Coagulant in Tanning Wastewater Treatment Zhihui Sui 1, ChengliQiao 1, Xin Zhao 1, Xihuai Qiang 2.

[5] Ash utilization in water quality management, T. Viraghavan

[6] Kadam, A.; Ozha, G; Nemade, P.; Dutta, S.; Shankar, H.S. (2008). Municipal waste water treatment using novel constructed soil filter system. Chemosphere (elesevier) 71(5) 975-981.

[7] Abid Shakeel, Nusrat Ali, (2015). Treatment of Grey Water by Low Cost Natural Adsorbent, International Journal of Scientific Research and Civil Engineering (Zealsci), Vol-7, Issue 1.

[8] Mukhopadhey B., Majumder M., Barman R., Roy P., Mazumder A. (2009) "Verification of filter efficiency of horizontal roughing filter by Weglin's design criteria and Artificial Neural Network", Drinking Water Engineering and Science, Volume 2, pp. 21-27.

[9] Patil V., B., Kulkarni G., S. and Kore V., S., Performance of Horizontal Roughing Filters for Wastewater: A review, International Research Journal of Environment Sciences, 1 (2), 53-55, (2012).

[10] Woodlard, C.D.; Petrus, K and M van der Horst (2000). The use of a modified fly ash as an adsorbent for lead. Water SA 26(4) 531-536.

[11] Li Yijin, Zou Shiqiong, Yin Jian and Yingli (2002). The effect of fly ash on the fluidity of cement paste, mortar and concrete. International workshop on sustainable development and concrete technology. 339-345.

[12] Indrek kulatos, Yu Ming Gao, Robert H Hurt and Eric M Suuberg(2001). Adsorption of ammonia on coal fly ash International ash utilization symposium, center for applied research, University of Kentucky Paper 59.