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Research Article

Green and Ecofriendly environment by treating pharmaceutical waste water from pharmaceutical lab

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Abstract

Background: Pharmaceutical compounds are typically produced in batch processes leading to the presence of a wide variety of products in wastewaters which are generated in different operations, wherein copious quantities of water are used for washing of solid cake, or extraction, or washing of equipment. The presence of pharmaceutical compounds in drinking water comes from two different sources: production processes of the pharmaceutical industry and common use of pharmaceutical compounds resulting in their presence in urban and farm wastewaters.

Objectives: Wastewater treatment is important for protecting the environment and the health of humans and animals. The main goal of wastewater treatment is to remove as much suspended solids as possible before discharging the remaining water back into the environment

Methods: In this project there used a three-stage treatment filtration process for removal of waste from the water which is collected from pharmaceutical lab. At first stage treatment tank were used natural stone, sand and chemical. In the second stage treatment where used polypropylene filter and finally, In the third stage treatment where used carbon filter.

Result: In pH, most of the obtained reading are in standard range which is (4.74-6.45). In Temperature, all of the reading are within the standard range. In Turbidity, most of the value shows good result which range is (9-21.1). In Emf, the values show good result most of the time which range is (34-126) etc.

Conclusion: Pharmaceutical waste water must be treated before drain in the nature. An effective treatment is essential for protecting the environment, public health and regulatory compliance.

Key words: wastewaters; treatment; environment; public health

Introduction

Environmental pollution is one of the major challenges of today's civilization. It is found that one-third of total water pollution comes in the form of industrial effluent discharge, solid wastes and other hazardous wastes. Industrial wastewater presents a potential hazard to the natural water system (1). This wastewater contains many inorganic and organic matters, which are toxic to the various life forms of the ecosystem. Several research investigations have shown the widespread occurrence of these pollutants in wastewater, surface water and ground water (2). The development of a water treatment plant to treat wastewater from a university laboratory is a critical and innovative undertaking that addresses one of the most pressing environmental challenges facing educational institutions and communities today. In this research study will be assessed current status of the waste water quality and it will hope that the results of study will assist the relevant pharmaceutical lab and authorities in designing suitable preventive steps to ensure that effluent and also emitted quality in streams will be improved (3). By this plant laboratory waste water of Department of pharmacy, USTC can be purified according to Standard value of Dept. of Environment, Bangladesh. Student can be learned about how to develop complex and expensive water plant by simple, easier and affordable way (4). To safeguard the environment and public health, this type of plant plays a significant role to treat laboratory wastewater. Treated water can be reused in various laboratory works during practical. Laboratories at universities are hubs of scientific research and experimentation, but they also generate a significant amount of wastewater that can contain a variety of pollutants and contaminants (5). So, this pollution problem can be minimized by this lab scale Effluent Treatment Plan. From many years in Bangladesh, institutions and also industries are establishing haphazardly here and there in very much unplanned way. That is why, many institutions and industries do not set up Effluent Treatment Plan for the treatment of their institutional and industrial discharges and pollutes our society. It has become imperative for universities to take responsibility for the proper treatment of their laboratory wastewater (6). Due to rapid Urbanization and growth of world population, the municipal bodies are problems of

collection, treatment and disposal of waste water. Scientists around the world are working on new strategy for water conservation. It is an opportune time, to refocus on one of the techniques to recycle water through the reuse of waste water by economical way (7). So, this project will beneficial to whole society.

Aim of the work:

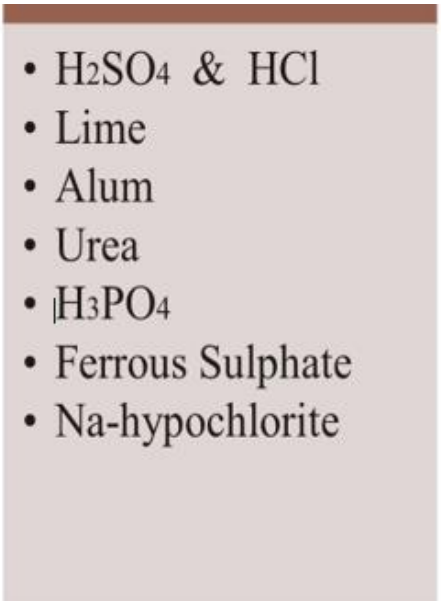
The aim of this project was to develop an Effluent treatment plant in the pharmacy department laboratory to treat the laboratory waste water. So other objectives were-

i. To analyze different parameters like EMF, TDS, TSS, pH, EC, of waste water after treatment.

ii. To reuse the treated water in the laboratory washing and other purposes.

iii. To recycle, reuse and reduce of water and also evaluation of students, environment and social significances of this project.

Chemical and Apparatus: -



Methodology:

First Stage Treatment:

The waste water is collected and treated in the equalization tank. This waste water is alkaline in nature. Solution of HCL is dosed here to neutralize the waste water from alkaline condition. In this tank, polyelectrolyte & alum is used so that the smaller particle of the effluent agglomerated. Thus, sludge is produced in this tank. In this tank, the sludge is separated also the measure the amount of sludge to monitor performance of the flocculation clarifier. The sludge is taken outside and buried down (8).

Second Stage Treatment:

Primary clarifier cannot separate sludge alone from the effluent. The remaining sludge is separated in this tank as well as the TDS value of the effluent is reduced. In this tank, polypropylene filter is used. PP filter cartridge works by holding dirt and preventing it from passing the filtration medium with clean water or process fluids. Also, it has a high dirt holding capacity and efficiency as it has a high surface area. Besides, it also operates well under low pressure which other filter cartridges find hard to work in (9).

Determination of pH:

pH is a determined value based on a defined scale, similar to temperature. This means that pH of water is not a physical parameter that can be measured as a concentration or in a quantity. Instead, it is a figure between 0 and 14 defining how acidic or basic a body of water is along a logarithmic scale [1]. The lower the number, the more acidic the water is. The higher the number, the more basic it is. A pH of 7 is considered neutral. The logarithmic scale means that each number below 7 is 10 times more acidic than the previous number when counting down. Likewise, when counting up above 7, each number is 10 times more basic than the previous number.

Determination of Turbidity:

The sample water was taken in the small tube of the turbidity meter. The switched was on and then the reading was taken from the portable turbidity meter

Determination of Electric Conductivity (EC):

The conductivity meter and cell were calibrated using 0.005 M KCl solution. Water samples were used directly for measurement of specific conductance within 5 – 10 minutes of sample collection by using Combo meter.

Determination of Electro Magnetic Field (EMF)

EMF was recorded immediately after collection of each sample within 5- 10 minutes at the sampling spot by using Combo meter (10).

Determination of Total Dissolved Solid (TDS):

TDS in water can be measured using a digital meter. Bottled mineral water usually contains higher TDS levels than tap water. Generally, the operational definition is that the solids must be small enough to survive filtration through a filter with 2-micrometer (nominal size, or smaller) pores (11).

Results:

pH:

Chemicals used	Appearance
Ferrous Sulphate	Granular solid, greenish color
Lime	White bulk form
Sulphuric acid	Clear liquid
Alum	White bulk form
Na-hypochlorite	Clear liquid
Hydrochloric acid	Clear liquid

Day	Value	Standard Value
1	4.96	8
2	4.74	
3	5.75	
4	5.55	
5	6.45	
6	3.33	
7	3.59	

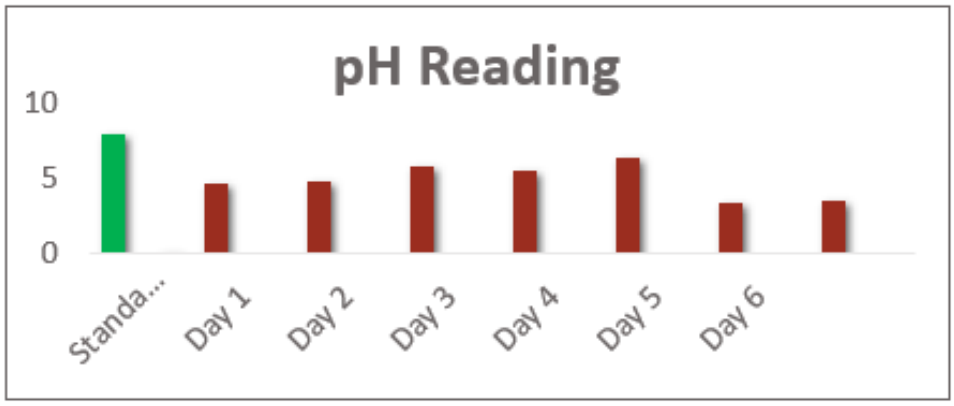


Figure 1: Comparison of pH value with standard range at different days after treatment

Discussion:

The pH values of effluent samples collected from the different industries have been presented in Table 1. From the results it was observed that pH value significantly varied. The pH values fluctuated between 3.33 to 6.45, indicating that the sample water after treatment at different days are in the standard range. But some days the waste water show acidity because of high concentration of chemicals.

If there could be maintained constant ratio of chemicals in the first tank then there will get optimum value at different days.

Result of Temperature:

Day	Value	Standard Value
1	25	20-30°C
2	25	
3	25	
4	24.9	
5	24	
6	24	
7	25	

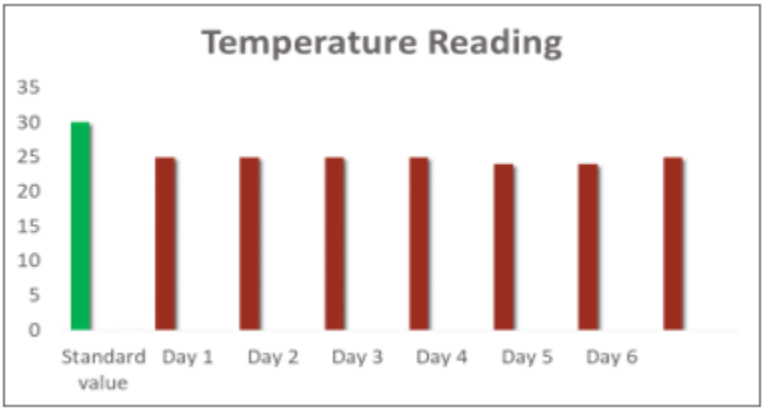


Figure 2: Comparison of Temperature value with standard range at different days after treatment

Discussion:

From the table 2, the temperature of waste water in different days are in standard range.

The room temperature is directly related to the sample water temperature that's why all the temperature reading at different days are within the standard range.

Result of Turbidity:

Day	Value	Standard Value
1	20.86	10 NTU
2	47.97	
3	49.58	
4	48.9	
5	21.1	
6	17.98	
7	9	

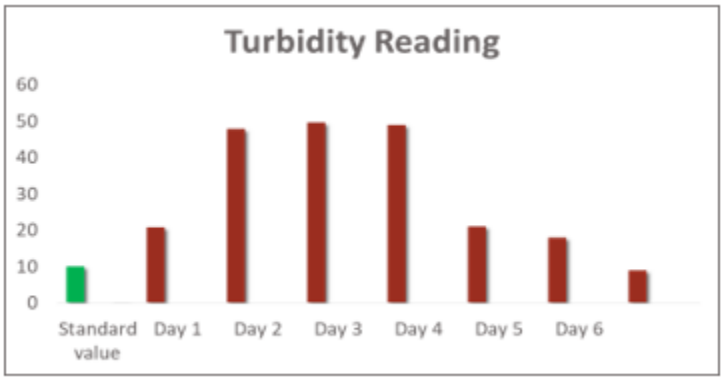


Figure 3: Comparison of Turbidity value with standard range at different days after treatment

Discussion:

From the table 3, most of the turbidity values are in standard range which is (9-21.1). But some days it shows higher turbidity.

Color and Turbidity are associated with each other. The present study showed the higher value of color and turbidity concentration in Pharmaceutical Lab was 49.58 NTU.If there could be maintained constant ratio of chemicals in the first tank then there will get optimum value at different days.

Result of Electric Conductivity:

Day	Value	Standard Value
1	763	1200 µs/cm
2	6435	
3	6867	

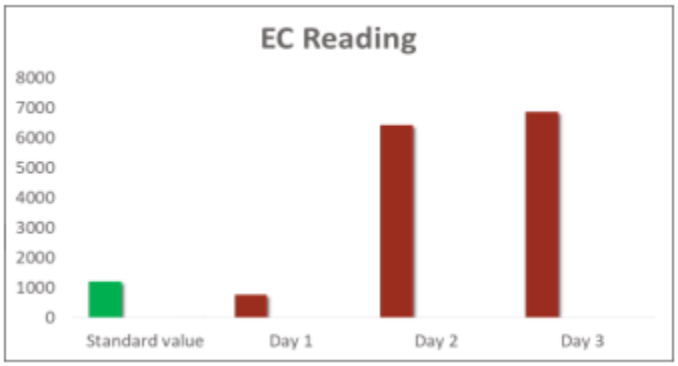


Figure 4: - Comparison of EC value with standard range at different days after treatment

Discussion:

From the table 4, most of the EC value show higher than the standard value. The higher value is 6867 µs/cm.

Result of Electromagnetic Field (EMF):

Day	Value	Standard Value
1	121	70 mv
2	126	
3	63	
4	74	
5	34	
6	196	
7	183	

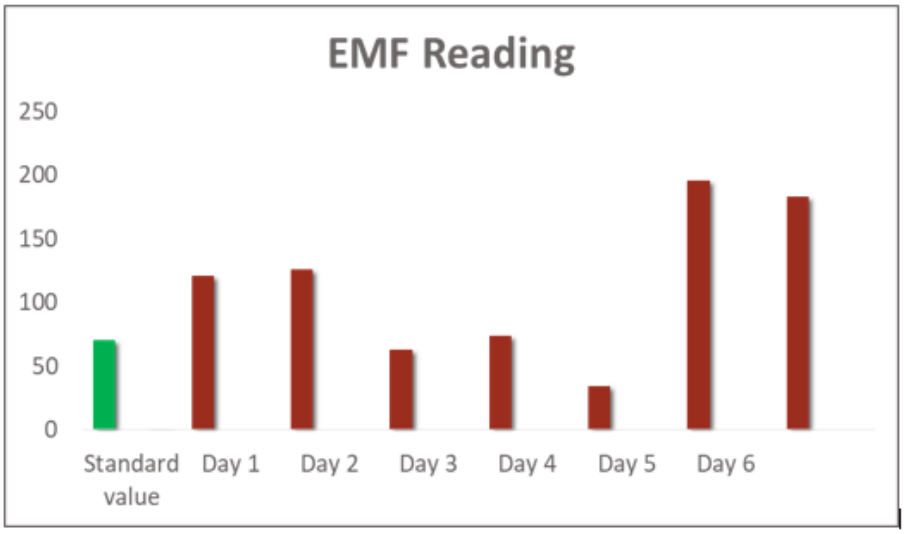


Figure 5: - Comparison of EMF value with standard range at different days after treatment

Discussion:

From the table 5, most of the EMF values are near to the standard range which is (34-121). But some time it shows higher value.

To get the optimum value there needs to maintain the constant ratio of chemicals continuously according the ratio of waste water.

Result of Total Dissolved Solid (TDS):

Day	Value	Standard Value
1	387.53	2100 mg/L
2	3497	
3	3433	

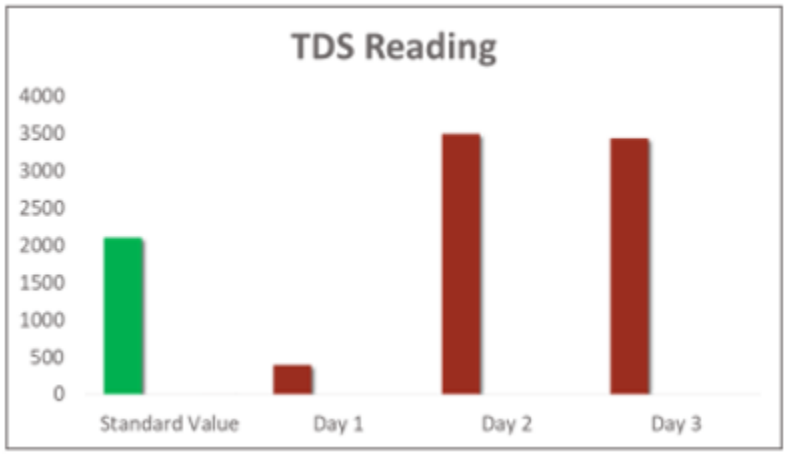


Figure 6: - Comparison of TDS value with standard range at different days after treatment

Discussion:

From the table 6, all of the TDS value of waste water in different days shows good value. To maintain the optimum value there needs to maintain the constant ratio of chemicals continuously in the first tank.

TDS is the measure of extent of solid materials dissolved in water. Total dissolved solids (TDS) usually affect the refractive capacity of the water body. If the TDS level is high, especially due to dissolved salts or solid many forms of aquatic life are affected. TDS values of the different sampling points were ranged from 387.53 to 3497 mg/L (Table6).

Result of Total Solid:

Day	Value	Standard Value
1	573	140 mg/L
2	88	
3	226	
4	27	
5	190	
6	500	
7	75	

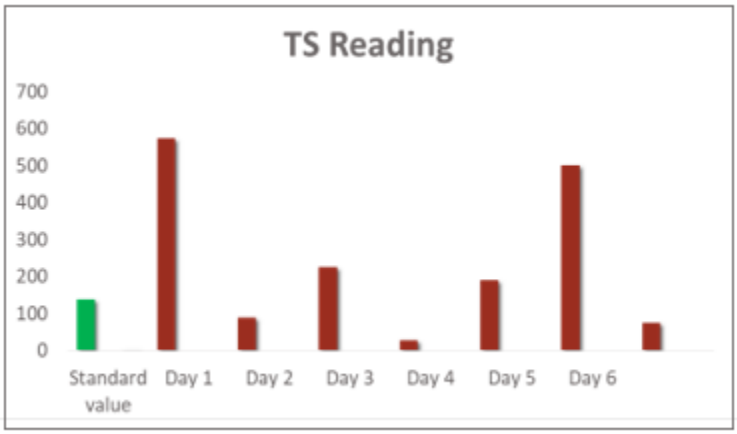


Figure 7: Comparison of TS value with standard range at different days after treatment

Discussion:

From the table 7, most of the TS value show a little bit high than the standard value at different days.

To get the optimum value there should be increased the concentration of chemicals which is responsible for reducing the total solid in the waste water.

Conclusion:

Pharmaceutical waste water must be treated before drain in the nature. In this project there used a three-stage treatment filtration process for removal of waste from the water which is collected from pharmaceutical lab. At first stage treatment tank were used natural stone, sand and chemical. In the second stage treatment where used polypropylene filter and finally, In the third stage treatment where used carbon filter. In pH, most of the obtained reading are in standard range which is (4.74-6.45).

In Temperature, all of the reading are within the standard range. In Turbidity, most of the value shows good result which range is (9-21.1). In Emf, the values show good result most of the time which range is (34-126) etc.

Reference:

1. APHA, AWWA and WPCF (1999) "Standard Methods for the Examination of Water and Wastewater", 21st ed., Washington, D.C.
2. Cyr, P.J. Suri, R.P.S. and Helmig, E.D. (2002) "A Pilot Scale Evaluation of Removal of Mercury from Pharmaceutical Wastewater using Granular Activated Carbon", Water Res., 36 (19), 4725-4734.
3. El-Gohary, F.A., Abou-Elela, S.I. and Aly, H.I. (1995) "Evaluation of Biological Technologies for Wastewater Treatment in the Pharmaceutical Industry", Water Sci. Technol. 32(11), 13-20.
4. Farooq, S. and Nakhla, G.F. (1997) "Tertiary Treatment of Wastewater Effluents with Slow Sand Filtration for Removal of Viruses", King Abdulaziz City of Science and Technology (KACST).
5. Henery, M.P., Donlon, B.A., Lens, P.N. and Colleran, E.M. (1996) "Use of Anaerobic Hybrid Reactors for Treatment of Synthetic Pharmaceutical Wastewaters Containing Organic Solvents", J. Chem. Tech. Biotechnol. 66, 251-264.
6. Acharya BK, Mohana S, Madamwar D (2008) Anaerobic treatment of distillery spent wash: a study on up flow anaerobic fixed film bioreactor. Bioresour Technol 99:4621-4626
7. Adishkumar S, Sivajothi S, Banu JR (2012) Coupled solar photo-fenton process with aerobic sequential batch reactor for treatment of pharmaceutical wastewater. Desalin Water Treat 48:89-95
8. Altaf MS, Ali TA (2010) Wastewater treatment using sequential batch reactor and development of microbiological method for the analysis of relative toxicity. Pak J Nutr 9(6):574-576
9. Billore SK, Singh N, Ram HK, Sharma JK, Singh VP, Nelson RM, Dass P (2001) Treatment of a molasses-based distillery effluent in a constructed wetland in central India. Water Sci Technol 44(11-12):441-448
10. Fang HHP, Chui HK, Li YY (1994) Microbial structure and activity of UASB granules treating different wastewaters. Water Sci Technol 30:87-96
11. Qian Wang, Shi-Peng Sun, Qigang Wu, Taoli Huhe, Zhengzhong Zhou. Energy Consumption of Nanofiltration Diafiltration Process: Identifying the Optimal Conditions of Continuous and Intermittent Feed Diafiltration. Industrial & Engineering Chemistry Research 2022, 61 (22), 7645-7653.

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