Carcinogenic Waste Management in A Pharmaceutical Industry - A Case Study

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Abstract- *Cancer occurrence rate has increased worldwide and is the second leading cause of death. Pharmaceutical industry produces hazardous waste which includes huge range of chemical compounds and they all have different effects on humans and environment. Some of the hazardous waste are carcinogenic which cause serious problem to human life. International Agency for the Research on Cancer has confirmed many of the pharmaceutical chemicals and drugs to be carcinogenic in nature.*

This report presents the way of analyzing performance of effluent treatment plant by using SPSS (Statistical Package for Social Sciences).

Keywords- Carcinogenic, Pharmaceutical waste, Hazardous waste, SPSS

I. INTRODUCTION

Cancer is a large group of diseases that can start in almost any organ or tissue of the body when abnormal cells grow uncontrollably, and go on spreading to the other parts of the body as well. Cancer is the second leading cause of death and it is estimated that 9.6 million deaths or one in six deaths, occurred in 2018. Approximately, 3,00,000 children aged 0 to 19 years old are diagnosed with cancer each year. The cancer burden is continuously growing globally. Under developed and developing countries are affected much by this because, they lack proper treatment facilities. There is less work carried out on how the pharmaceutical hazardous waste is becoming the reason for carcinogenecity and affecting the humans and environment. Cancer deaths could be prevented by enhancing or avoiding key risk factors.

1.1 Pharmaceutical Industry waste

Wastes are the unwanted materials that can no longer be used and eventually turn into hazardous or non hazardous materials to humans or the environment. Pharmaceutical industry produces hazardous waste which includes huge range of chemical compounds and they all have different effects on humans and environment. Some of the hazardous waste are carcinogenic which cause serious problem to human life

Pharmaceutical waste is divided into 3 categories (1) Hazardous waste (2) Non-hazardous waste (3) Chemo waste

1.1.1 Hazardous waste

Waste that is dangerous and harmful to human health or the environment is called as hazardous waste. It can be liquids, solids, gases, or sludges.

Pharmaceutical wastes come underneath listed wastes considering that they comprise commercial chemical products. Characteristic wastes are regulated because they show hazardous properties – ignitability, corrosivity, reactivity and toxicity.

Wastes that aren't listed and don't show a characteristic are considered solid waste. Solid wastes should be discarded according to state and/or local regulations, including regulated medical waste requirements.

1.2 Health impacts of discharged pharmaceuticals

Because of their intrinsic biological activity, APIs are of emerging concern which are leading to fatal consequences. The estimation tells that half of the pharmaceutical wastewater produced are discarded without treatment in the world. The endocrine disrupting compounds (EDCs) present in the aquatic system are known to cause damage to the human endocrine system. Pharmaceutical industries are releasing higher amount of pharmaceuticals than those sources where drugs are used.

1.3 Sources of pharmaceutical wastewater

Usually the wastewater from the pharmaceutical industry comes from synthesis and formulation of the drugs. Many products are manufactured in the industry where a single reactor is present. The reactor will be generally oversized and is not designed as per the capacity. So the quantity of wastewater produced increases. The primary sources are solvents, spills, spent raw material and wash water.

II. LITERATURE REVIEW

[1] Muhammed Jaseem, et al, "An overview of waste management in pharmaceutical industry" The Pharma Innovation Journal 2017

This paper presents the waste management strategies and the effective methods for the management and disposal of pharmaceutical waste. The types of pharmaceutical waste and the regulatory bodies which are involved in waste management is presented.

[2] Brambilla and Antonietta Martelli "Update on genotoxicity and carcinogenicity testing of 472 marketed pharmaceuticals" Mutation Research September 2008

A survey was conducted to know genotoxicity and carcinogenicity of 838 marketed drugs. Of these 366 (43.7%) do not have genotoxicity or carcinogenicity records and the remaining 472 (56.3%) have at least one genotoxicity or carcinogenicity test result.

[3] L. Marconato, C Leo, et al, "Association between Waste Management and Cancer in Companion Animals, J Vet Intern Med 2009

Study was carried out in Naples, Italy and the surrounding areas because cancer rates got increased in the area. 453 (353 dogs, 77.9%; 100 cats 22.1%) cases were diagnosed and of them, 256 tumors (56.5%) were diagnosed in animals coming from high-danger zone and 197 tumors (43.5%) in animals residing in low-danger zone. The analysis presented in this paper shows carcinogenic potential of hazardous environmental substances and risk of tumor development in people residing in areas with high degree of pollution.

[4] K. Pratyusha et al, "Waste material management in pharmaceutical industry" International Journal of Pharmaceutical Sciences Review and Research September 2012

This paper presents types of waste, regulatory bodies involved in management of waste material and waste management strategy. The study tells that some drugs contain heavy metals, endocrine disruptors, and other compounds that are dangerous for animals and the environment. In order to safely handle and dispose of waste it is necessary to recognize the specific hazards of the waste product, and the ability of a given disposal technique to manage them

[5] Shah Abhishek, et al, "Statistical analysis to identify the main parameters to the wastewater quality index of CETP: a case study at Vapi, Gujarat, India" Journal of Environmental Research and Development 2013

The wastewater quality index was prepared for wastewater of common effluent treatment plant. First 23 parameters were analyzed. During the analysis some parameters were totally absent and some were very low with respect to prescribed limits. Hence only 16 parameters were analyzed excluding the other parameters. By using SPSS software correlation between waste water quality index and different parameters of wastewater was found out.

III. OBJECTIVES

- Analysis of pharmaceutical industry wastewater using SPSS a statistical analysis software.

IV. METHODOLOGY

Visit to the pharmaceutical industry was made. Data regarding Effluent Treatment Plant was collected for period of 12 months. The data consisted of values of raw wastewater and values after the treatment of wastewater. The data was analyzed using SPSS software to know the performance of effluent treatment plant.

The hazardous wastes produced at industry were

- Used oil
- Oil soaked cotton waste
- Residual waste
- Spent carbon
- Spent solvent
- Discarded containers or liners
- Flue gas cleaning residue
- Chemical sludge

V. RESULTS AND DISCUSSIONS

Total 9 parameters were analyzed using the SPSS software. They are, pH, TSS, BOD, TDS, COD, Phosphates, Sulphates, Ammonium Nitrogen and Sodium.

Descriptive statistics, paired sample statistics, paired sample correlation and paired sample test was conducted.

Before and after treatment data of pH, TSS, BOD, TDS, COD, Phosphates, Sulphates, Ammonium Nitrogen and percent Sodium are weakly correlated and pH was negatively

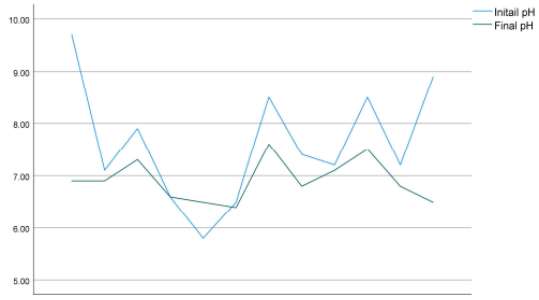
correlated because pH values before and after treatment were near to each other.

The hypothesis test gives the result as following

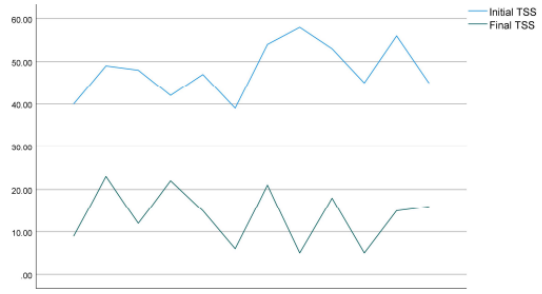
There is a significant difference between before and after treatment data, except pH value and comparatively, the mean values of the initial TSS, BOD, TDS, COD, Phophates, Sulphates, Ammonium nitrogen and percent Sodium are 34.883, 195.883, 1057.5, 474.825, 43.34417, 20.42250, 61.80 and 53.05 times higher than the final values

There was no significant difference between the before and after treatment data of pH (t=2.429, p>0.001).There was a significant difference between the before and after treatment data of TSS (t=14.290, p<0.001), BOD (t=27.800, p<0.001), TDS (t=44.251, p<0.001), COD (t=18.530, p<0.001), Phospahtes (t=20.255, p<0.001), Sulphates (t=8.804, p<0.001), Ammonium Nitrogen (t=20.293, p<0.001) and percent Sodium (t=17.360, p<0.001)

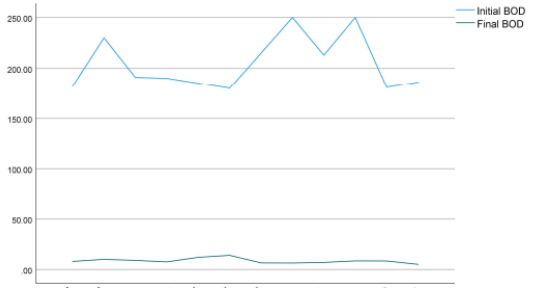
These are the graphs obtained by using the SPSS software for the collected data. By observing graphs we come to know that there is huge difference in the initial and treated parameters.



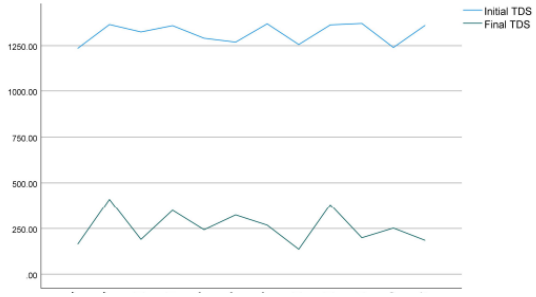
5.1Graph showing variation in pH values



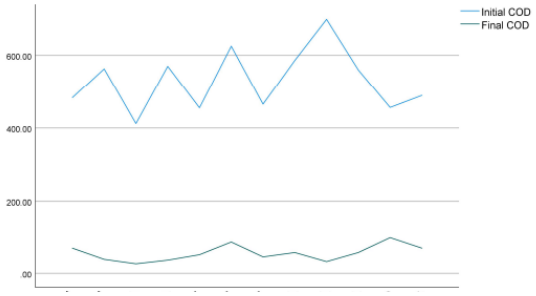
5.2 Graph showing variation in TSS



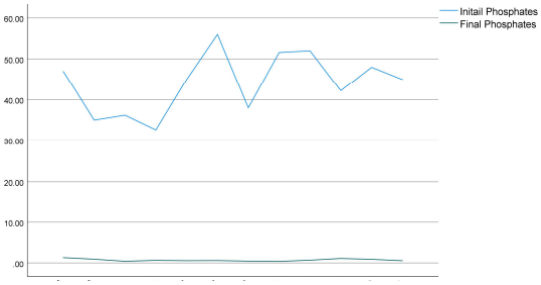
5.3 Graph showing variation in BOD values



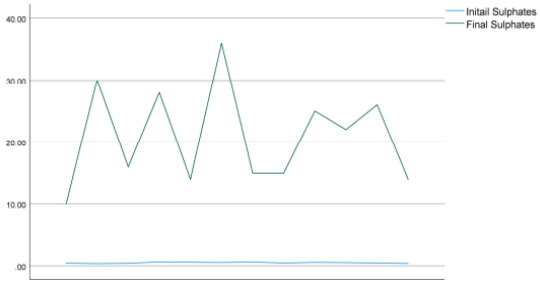
5.4 Graph showing variation in TDS values



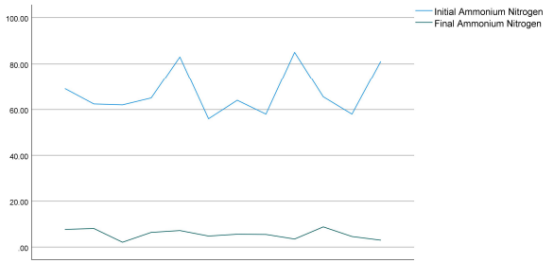
5.5 Graph showing variation in COD values



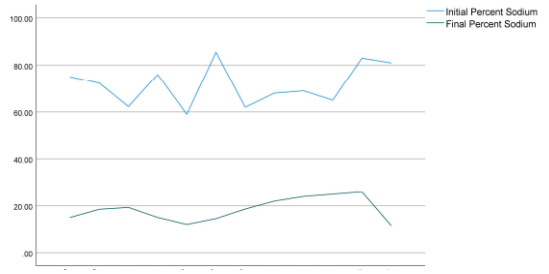
5.6 Graph showing variation in Phosphate values



5.7 Graph showing variation in Sulphate values



5.8 Graph showing variation in Ammonium Nitrogen values



5.9 Graph showing variation in percent Sodium values

V. CONCLUSION

By the results, we come to know that the effluent treatment plant is working efficiently. Pharmaceuticals within the environment and their potential toxic effects are emerging research areas. This study presents the effective way of managing pharmaceutical hazardous waste in order to prevent the risk of cancer from the wastes produced. It is very important to treat the pharmaceutical wastewater to a great extent so that pollutants getting in to the environment can be prevented.

REFERENCES

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