A REVIEW ON THE STUDY OF BIO-MEDICAL WASTE TREATMENT

[1]Dr. Sindhu J. Nair, [2]Sunil Kumar Singh,

[1]Professor, [2]PG Scholar

[1,2]Department of Environment Science and Engineering, BIT Durg, India

Abstract-

Hospitals and other healthcare facilities are responsible for providing patient care services, which generates waste in the form of swabs, discarded syringes and plastics, unused specimens, and so on, which is referred to as biomedical waste. This paper deals with the brief discussion on Various factor responsible for harmful effect of bio-medical waste flowing out from the district hospital, Civil hospital and Community health centre. The second phase of work highlights the case study of waste water from the inlet and outlet region of the Hospital. The work concludes that there is need for general routine testing of the waste water in order to maintain the acceptable criteria of the parameter.

Keywords: Bio-Medical Waste, Hospital , Health Centre

1. Introduction

When improperly handled and disposed of, liquid wastes pose a serious threat to human health and the environment because of their ability to enter watersheds, pollute ground water, and drinking water. At the same time, the illegal and unethical reuse of this untreated waste can be extremely dangerous and even fatal in causing diseases such as cholera, plague, tuberculosis, hepatitis B, diphtheria, and others, which can pose grave public health risks and consequences and thus is a major problem for healthcare facilities, their employees, and the community at large (Blenkharn 2006). Wastewater is not the same as sewage because the former is any water that has been adversely affected in quality by anthropogenic influence and consists of liquid waste discharged from health care facilities (HCF) or from domestic residences, commercial properties, industry, and or agriculture and includes a wide range of potential contaminants and microbial concentrations, whereas sewage is a subset of wastewater that is contaminated with faeces or urine.

2. Discussion on work done on Bio-medical Waste treatment

The following below are the past work from the reputed indexed journals discussed about the treatment of medical waste water treatment are as follows-

2.1 Reviews based on Bio-medical Waste Treatment

(Biswal 2013) stated that the existing techniques are failing to deal with the problem of liquid biomedical waste, as this area of waste management is becoming grossly neglected. The hospitals and bio medical facilities though meant to ensure improved care have unfortunately become a potential health risk due to mismanagement of the infectious waste. The safe handling of BMW remains a major concern for health authorities in India, as waste generated from medical activities can be hazardous, toxic, and even lethal due to the high potential for disease transmission. In the community centre of health care due to lack of awareness at different levels, it becomes very effective strategy and specific group detected, to aware the people of hospital to make proper management.

BMW management, according to (Datta, Mohi, and Chander 2018) should be a collaborative effort with committed government support, good BMW practises followed by both healthcare workers and HCFs, continuous monitoring of BMW practises, and strong legislation. It is a basic human right to live in a clean and safe environment. The pillar of BMWM is segregation of waste at source and WR. The current BMWM 2016 rules are an improvement over previous rules in terms of improved segregation, transportation, and disposal methods, with the goal of reducing environmental pollution and ensuring the safety of staff, patients, and the general public. Furthermore, more non-PVC medical devices should be used, and the development of newer, novel, eco-friendly BMW disposal systems should be encouraged. All participants in BMWM should pledge to guarantee a cleaner and greener environment.

According to (Shashikant, Mohammed, and Khan 2017) biomedical wastewater is highly organic in nature, which allows for biological decomposition. The BOD/COD ratio should be 60 percent but whereas our ratio is 55.6 percent which cannot be easily degraded. The value of COD, BOD, Chlorides and Total Alkalinity for Biomedical waste water exceeds the discharge standards of sewer, streams and Onland standards.

According to (Khan et al. 2019) is common in field hospitals used in extreme situations. It is high risk because, in comparison to domestic sewage, hospital effluent contains a wide range of toxic substances such as antibiotics, radionuclides, and disinfectants. Furthermore, based on the currently used HWW treatment scenarios, the optimal field hospital wastewater treatment scenario includes a combination of MBR and FP technologies. It will reduce the cost, reactor size, and reagents required for HWW treatment.

Hospitals are important point sources contributing to the release of both PhCs and antibiotic resistant bacteria into surface waters, according to (Al Aukidy, Al Chalabi, and Verlicchi 2017) especially if hospital wastewaters are discharged into receiving ambient waters without treatment. This problem is exacerbated in developing countries because most of the time no wastewater treatment facility is available. In the countries studied, hospital wastewaters are subjected to various treatment scenarios (specific treatment, co-treatment, and direct disposal into the environment). Due to limited availability of municipal wastewater treatment plants, onsite treatment of hospital wastewater prior to discharge into municipal sewers should be considered and implemented. Discharge of HWWs into municipal wastewater collection systems is an option for wastewater management in hospitals where applicable. The use of experienced operators to upgrade existing WWTPs and improve operation and maintenance practises is recommended.

According to (Singh, Sharma, and Malviya 2021) industrial wastewater has a significant impact on human health. The manuscript also describes various methods for wastewater treatment. According to recent research, biological therapies are a more environmentally friendly and cost-effective method of metal removal. Toxic sludge, which does not settle easily, is treated using physical and chemical methods. The treated water can be easily dumped into streams. Wastewater treatment has no negative environmental, aquatic, or human health consequences. As a result, wastewater treatment before disposal into the environment is required.

(Amouei et al. 2012) concluded that the effluent of all hospital wastewater treatment plants is suitable for reuse, but further treatment is required for efficient removal of TSS, BOD5, and COD, and rehabilitation of the chlorination system is also recommended.

According to (Azar et al. 2010) removal efficiency in biological treatment by the biological oxidation method is greater than 90% for the main parameters of hospital wastewater. The biological oxidation method for hospital wastewater is advantageous and can be used for all hospital wastewater treatment that includes similar pollution. The removal of all important parameters in hospital wastewater, such as BOD, COD, detergent, and microbial parameters, was accomplished with high efficiency using this method.

According to (Babitha 2018) the absence of bacteria is identified as the COD in the effluent is higher than in the influent. MLVSS values of 0 also indicate the same thing. Even in this state, the plant does not stink because it is in an aerobic state. Because no microorganisms survive in the plant, the oxygen supply in the aeration tank is simply wasted. As a result, the blowers or diffusers consume more power, resulting in an 80 percent loss of electric power. Some recommendations are made to address all of these issues.

According to (Asfaw 2018) the widespread emergence of drug resistance among pathogens has become one of the world's most serious challenges. Hospital wastewater contains a diverse group of disease-causing organisms and plays an important role in the spread of drug-resistant pathogens in the environment, causing them to become emerging pollutants by amplifying, spreading, and persisting in the environment. These conditions have become a major public health issue, particularly in developing countries, because they can infect humans and animals through contaminated food and drinking water, as well as directly from the environment. As a result, reducing selective pressure by regulating antibiotic use is a critical step in halting the spread of resistance in hospital wastewater in order to avoid favoured resistant strains in the environment. In order to reduce the problem, proper hospital wastewater management should be practised in all health institutions.

According to (Thomas et al. 2021) the treatment with anaerobic process is more effective for sludge digestion. Impurities are removed, and after treatment with a trickling filter, sludge is obtained. They can also be treated with a digestion tank, and after treatment, biogas is obtained. The efficiency of the components was greatly influenced by factors such as the age of the treatment plant, maintenance, economic and political situations, technical problems, and so on.

In some countries (for example, Japan, China, Greece, and the United States), large hospital wastewater is pretreated on-site (Kosma et al. 2010; Liu et al. 2010; Pauwels and Verstraete 2006), whereas in the majority of low- and middle-income developing countries, including India, it is connected directly to a municipal sewer and treated at the municipal WWTP (Gupta et al. 2009). Thus, the purpose of this study was to assess the potential genotoxic effects of final effluents from three major hospitals in Jaipur, Rajasthan (one of which has an on-site effluent treatment plant) (biggest state of India, in terms of area). In addition, the efficacy of the effluent treatment plant was investigated for its role in reducing waste effluent genotoxicity.

The genotoxicity of these effluents was investigated using two bioassays: the Salmonella fluctuation assay and the SOS chromotest. The Salmonella fluctuation test detects at least two distinct molecular mechanisms: base-pair substitution mutation (TA 100 positive) and frameshift mutation caused by nucleotide insertion or deletion (TA 98 positive). Because of its higher sensitivity than the traditional Ames test/Salmonella microsome experiment, this assay is particularly well suited to detecting mutagenicity in water samples (Monarca et al. 1985). On Escherichia coli, the SOS chromotest detects primary DNA-damaging agents. These two tests are not equivalent, but they may complement one another to increase mutagen detection capacity (Rosenkranz et al. 1999).

2.2 Review on Hospitals with Effluent Treatment Plant

Himalayan Institute of Hospital Trust is a charitable organisation. This 750-bed hospital near Dehradun serves the medical needs of 700 villages. The ETP here was built in January 2004 for Rs 2,000,000, with a treatment capacity of 100 m3 per day. It operates on the aerobic activated sludge process and regulates BOD, COD, pH, and total suspended solids. It was established with the goal of preventing groundwater pollution, conserving energy, meeting water needs, and maintaining the ground water table. Some of the treated effluent is recycled as fertiliser for gardens on the hospital's 300-acre campus. Some of this is also sold for use in nearby fields. The savings in both costs and ground water have encouraged the institute to build another STP that will recycle 200,000 litres of water per day. This water will be distributed throughout the campus and hostels.

Sir Ganga Ram Hospital is a 625-bed multi-specialty hospital in New Delhi. The hospital's ETP was installed in the hospital's basement and is monitored by the hospital's maintenance and sanitation department. This system employs an Extended Aeration, Suspended Growth Process with a Fine Bubble Diffused Aeration System. The raw wastewater from the old and new buildings is collected by gravity in the collection tank outside the E.T.P, and the raw influent from the laundry goes directly into the flocculation tank. It passes through a tube settler for sedimentation before collecting in an equalisation tank for further aerobic treatment in an aeration tank via a suspended growth process using a diffused membrane aeration system. The secondary clarification of aerated mixed liquor occurs in the Hopper Bottom Secondary clarifier and is followed by disinfection chlorination. Excess chlorine is filtered and de-chlorinated using a multi-grade filter and an activated carbon filter. The treated water is then collected and stored in a tank. The treated water is reused for flushing and gardening, and the treated sludge is thickened using a filter press and used as plant manure. The effluent testing results before and after the ETP.

Choithram Hospital and Research Centre is an Indore-based 350-bed tertiary care centre with a daily OPD attendance of 475 patients. The hospital's total water requirement is 5,00,000 litres. The ETP plant was established in November 2001. The analysis of the hospital effluent before and after treatment; all of the physicochemical parameters are within the specified limits. The chlorination process completely inactivates the Multiple Drug Resistant bacteria, rendering the effluent water safe. The daily effluent input is approximately 3,39,000 litres, with a recovery of approximately 3,00,000 litres of treated water. Water from treated effluent is used for irrigation and sanitary cleaning. The hospital no longer has a water shortage. Furthermore, more than 5,000 kg of dried sludge is available every month as garden manure.

Sawai Man Singh Hospital (SMS) is Rajasthan's largest government hospital. There are 43 wards totaling 1563 beds. Because the hospital lacks a wastewater treatment plant to treat its wastewater before releasing it into the municipal sewerage system, samples were collected from the main sewer.

Soni Hospital S. K. Soni Hospital is Rajasthan's most visited private critical care hospital, with over 300 ICU beds to handle all types of trauma and emergency cases. Although S.K. Soni Hospital lacks an effluent treatment plant, all liquid waste is disinfected with a sodium hypochlorite solution before being discharged into the municipal sewer. Different hyposolution concentrations are used to disinfect various wastes. For example, the microbiology laboratory prefers a 1 percent sodium hypochlorite solution, whereas cytotoxic waste requires a 5 percent hyposolution. Chlorination is used to clean the floors and washrooms. Samples were taken from the main sewer from this hospital.

Santokba Durlabhji Memorial Hospital (SDMH) is also known as the Medical Research Institute. The SDMH is Rajasthan's most modern hospital of its kind. It has a bed capacity of 310, including 31 ICC/CCU beds and 161 neonatal care beds. This hospital has a functional effluent treatment plant that includes filtration and proper chlorination of effluent. The samples were taken before and after treatment. An untreated sample was taken from the hospital's sewer, where all of the hospital's water is collected before being treated. Treated wastewater was collected from the outlet where it exited the treatment plant and used to irrigate the hospital's gardens.

Conclusion

This review will have Proper collection and segregation of biomedical waste are important. At the same time, the quantity of waste generated is equally important. A lesser amount of biomedical waste means a lesser burden on waste disposal work, cost-saving and a more efficient waste disposal system. Hence, health care providers should always try to reduce the waste generation in day-to-day work in the clinic or at the hospital.

References

- Amouei, A., H. A. Asgharnia, A. A. Mohammadi, H. Fallah, R. Dehghani, and M. B. Miranzadeh. 2012. "Investigation of Hospital Wastewater Treatment Plant Efficiency in North of Iran during 2010-2011." *International Journal of Physical Sciences* 7(31):5213–17.
- Asfaw, Tsegahun. 2018. "Review on Hospital Wastewater as a Source of Emerging Drug Resistance Pathogens." *J Res Environ Sci Toxicol* 7(2):47–52.
- Al Aukidy, Mustafa, Saeb Al Chalabi, and Paola Verlicchi. 2017. "Hospital Wastewater Treatments Adopted in Asia, Africa, and Australia." *Hospital Wastewaters* 171–88.
- Azar, Akbar Mokhtari, Ali Ghadirpour Jelogir, Golamreza Nabi Bidhendi, Naser Mehrdadi, Narges Zaredar, and Maryam Khalilzadeh Poshtegal. 2010. "Investigation of Optimal Method for Hospital Wastewater Treatment." *J. Food Agric. Environ* 8:1199–1202.
- Babitha, M. 2018. "PERFORMANCE EVALUATION OF STP FOR THE TREATMENT OF HOSPITAL WASTEWATER AT RRMCH."
- Biswal, Sasmita. 2013. "Liquid Biomedical Waste Management: An Emerging Concern for Physicians." *Muller Journal of Medical Sciences and Research* 4(2):99.
- Blenkharn, J. I. 2006. "Standards of Clinical Waste Management in UK Hospitals." *Journal of Hospital Infection* 62(3):300–303.
- Datta, Priya, Gursimran Mohi, and Jagdish Chander. 2018. "Biomedical Waste Management in India: Critical Appraisal." *Journal of Laboratory Physicians* 10(01):6–14.
- Khan, Nadeem Ahmad, Sirajuddin Ahmed, Sergij Vambol, Viola Vambol, and Izharul Haq Farooqi. 2019. "Field Hospital Wastewater Treatment Scenario." *Ecological Questions* 30(3):57–69.
- Shashikant, Prof, R. Mise Mohammed, and Yawar Khan. 2017. "General Characteristics of Biomedical Wastewater." 5(06):824–25.
- Singh, Shubhi, Akanksha Sharma, and Rishabha Malviya. 2021. "Industrial Wastewater: Health

Concern and Treatment Strategies." *The Open Biology Journal* 9(1).

- Thomas, Anju, V. M. Gayathri, Sabareesan P. Pillai, M. Sankeerthana, and Seena Mani. 2021. "Treatment of Pharmaceutical Waste Water Treatment." *International Journal of Engineering Research & Technology (IJERT)* 10(6):733–36.
- Effluent Treatment Plant: Why and How" Ravikant, Vikrant Chitnis, S P Jaiswal, D S Chitnis, Kamlakar Vaidya-Journal of the Academy of Hospital Ind Medica Administration Vol. 14, No. 1 (2002).
- Personal interview with Dr Sudhakar Vira, medical superintendent, Sir Ganga Ram Hospital.