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BIO-MEDICAL WASTE MANAGEMENT IN CHOITHRAM HOSPITAL, INDORE: A CASE STUDY

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The proposed work focuses on understanding the biomedical waste management system in Choithram Hospital and its potential to become a model system of waste management among other hospitals in Indore. The choice of Choithram hospital seemed better to any other hospital in Indore as it has been running the system of biomedical waste management for more than a decade, being one of the oldest hospitals where such practice is operational at a considerably bigger level. This would help the policy makers in identifying certain parameters to draft a suitable policy according to the current need of the organizations as well as the city.

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Executive Summary

The proposed work focuses on understanding the biomedical waste management system in Choithram Hospital and its potential to become a model system of waste management among other hospitals in Indore. The choice of Choithram hospital seemed better to any other hospital in Indore as it has been running the system of biomedical waste management for more than a decade, being one of the oldest hospitals where such practice is operational at a considerably bigger level. This would help the policy makers in identifying certain parameters to draft a suitable policy according to the current need of the organizations as well as the city.

Introduction

Environmental degradation has globally become a very serious matter of concern, because with rising population, higher standards of living, modern ways of production and many other reasons, has disturbed the ecological balance. At the present time a major issue is increasing quantum of waste of different types and its proper disposal. Among these, biomedical waste management has recently emerged as an issue of major concern not only to hospitals, nursing home authorities but also to the environment. The proper management of biomedical waste has become a worldwide humanitarian topic today. Although hazards of poor management of biomedical waste have aroused the concern world over, especially in the light of its far-reaching effects on human, health and the environment. The biomedical wastes generated from health care units depend upon a number of factors such as waste management methods, type of health care units, occupancy of healthcare units, specialization of healthcare units, ratio of reusable items in use, availability of infrastructure and resources etc. Modern hospitals are complex, multidisciplinary systems which consist of

different facets of medical care as well as research facilities. In the course of functioning of hospitals, there is a considerable amount of hospital wastes generated. It is now a well-established fact that there are many adverse and harmful effects to the environment including human beings which are caused by the “Hospital waste” generated during the patient care. Hospital waste is a potential health hazard to the health care workers, public and flora and fauna of the area. The problems of the waste disposal in the hospitals and other health-care institutions have become issues of increasing concern. Hospitals generate a wide range of waste and solid waste is one of them. According to western figures, approximately 15-20% of their hospital waste is hazardous and infectious, and this proportion may be much higher in our country as proper waste segregation does not exist. Hospital solid waste includes anatomical, pathological, infectious, non-infectious, sharps, kitchen waste and general waste (paper, cardboard, plastic etc.). In light of these facts the proposed work focuses on understanding the biomedical waste management system in Choithram Hospital and its potential to become a model system of waste management among other hospitals in Indore. The choice of Choithram hospital seems

better to any other hospital in Indore as it has been running the system of biomedical waste management for more than a decade, being one of the oldest hospitals where such practice is operational at a considerably bigger level. This would help the policy makers in identifying certain parameters to draft a suitable policy according to the current need of the organizations as well as the city.

System of Bio-Medical Waste Management in Choithram Hospital, Indore

This hospital in Indore has done lot of work in the field of proper management of biomedical waste and now has proudly implement it for more than two decades. It is 350 bed hospital with around 16 departments. For biomedical waste it has a separate department called infection control department.

After conducting a waste audit they determined the type and quantity of waste generated in various units. These units are the sources of waste generation. The waste is segregated at source by placing various colored dustbins at different sources. The color of the dustbins is pre-decided according to the Bio-Medical Waste Management Rules, 2016. Their method of biomedical waste management can be understood by analyzing the different categories of waste:

1. Human anatomical waste – In this category human tissues, organs, body parts are collected. This waste is collected in yellow plastic bins

and transferred in yellow colored bags. This waste is collected from Operation Theaters (OTs), burn units and labor room and some of the OPDs (outpatient departments). These bags are then transported to secondary storage area where all waste is collected.

2. Microbiology waste – In this category cultures, stocks or specimen of microorganisms, wastes from production of biological toxin, dishes and devices used for transfer of cultures are collected. They are then sent for autoclaving. This hospital has a separate autoclaving machine for treating such biomedical waste. After autoclaving i.e. making it free from infection it is collected in yellow bag and then transported to the waste storage unit.

3. Waste sharps – This category of waste should be collected in puncture proof containers, as directed by the Bio-Medical Waste Management Rules, 2016. Needles, syringes, scalpels, blades, glass etc. used and unused are collected in a white translucent puncture proof disposable container. This is a very safe and full proof method by which chances

of spreading infection are negligible. This category of waste is stored in the same containers.

4. Discarded medicine/ cytotoxic drugs – Cytotoxic drugs are used in treatment of cancer patients. The action of these drugs is to slow down cell formation which increases in cancer patients. So such drugs if disposed carelessly in municipal corporations waste will go to landfills, where the persons coming for collecting plastic and garbage can come in contact of these drugs and may have certain skin disease or other medical problems. Here in Choithram hospital this type of waste is collected in yellow plastic bins and then are transferred to the waste storage facility.

5. Soiled waste – Items contaminated with blood and body fluids including cotton, dressing, and solid plaster casts. This category of waste is collected in yellow bags and sent to storage facility.

6. Solid waste (Recyclable Plastic) – Plastic Waste generated from disposable items other than waste sharps, such as tubing, bottles, gloves (even soiled), syringes, urine bags, vaccutainers etc. this

category of waste is collected in red bins. Then this is taken to secondary storage area where they have a tank of hypochlorite solution. All this collected waste is dipped in it and then sent to Hoswin.

7. Solid waste (Recyclable Glass) – Glass Waste generated from disposable items other than waste sharps, such as broken glass, contaminated glass, medicine vials, ampoules, metallic body implants etc. this category of waste is collected in blue bins. Then this is taken to secondary storage area where they have a tank of hypochlorite solution. All this collected waste is dipped in it and then sent to Hoswin.

8. Chemical waste – Chemicals used in production of biological products, chemicals used in disinfection and insecticides, etc. All these are treated chemically.

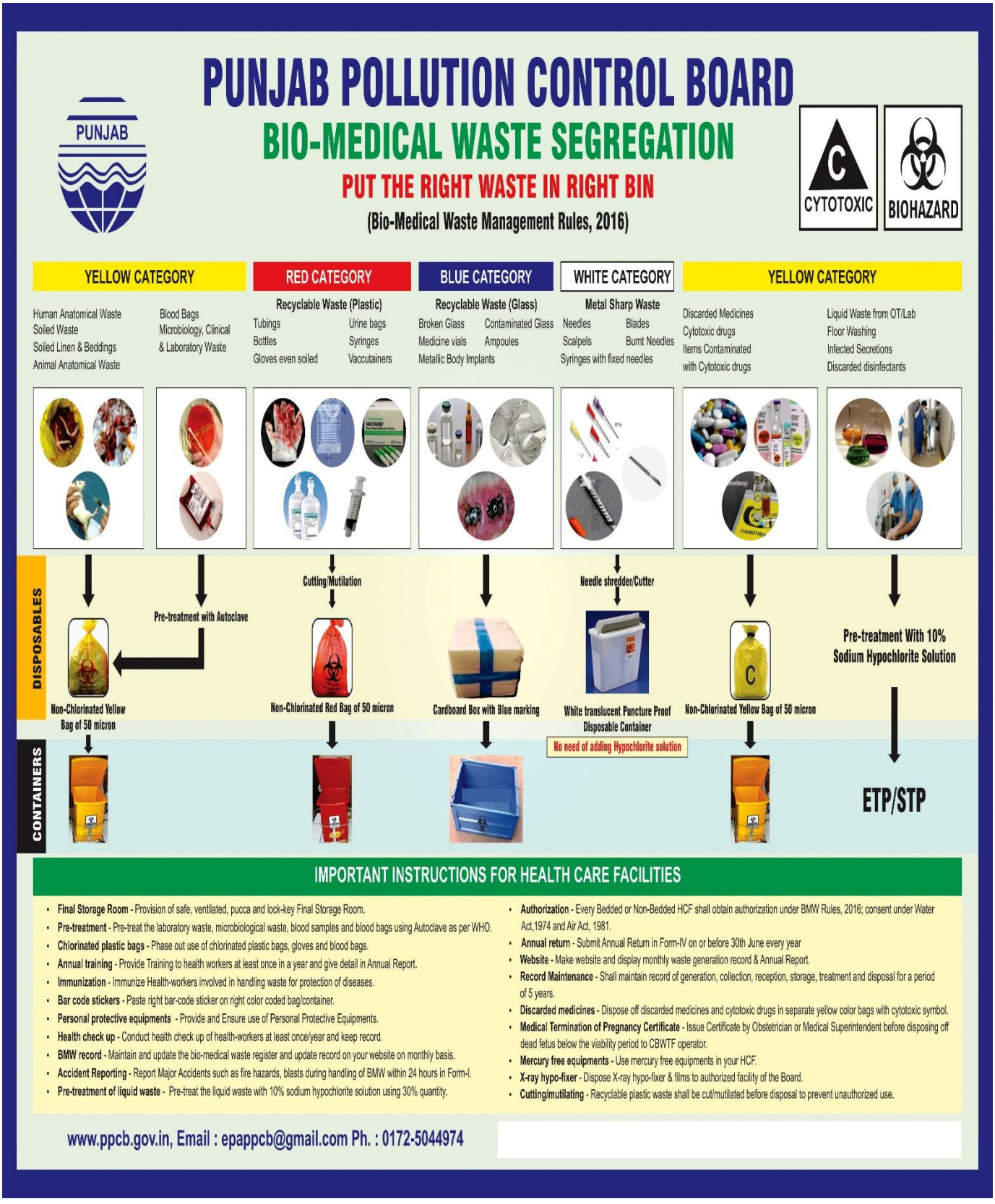
9. Liquid waste (see Figure 3) – Waste generated from laboratory and washing, cleaning, housekeeping and disinfecting activities. All this is sent to effluent treatment plant which yields about 05 lakh liters of

safe treated water. Over 06 lakh liters of liquid waste is generated in the whole premises including hospital, school, residential area, nursing college, etc. This water is checked in laboratory every month. It is used for irrigation of green belt and for sanitary cleaning purpose. In addition to this it yields 5000 Kg/month of sludge, which is disinfected with hypochlorite dried by sunlight and used as manure.

Figure 1 shows the mandated Waste Segregation Methods.

Figure 1: Waste Segregation Methods (according to Bio-Medical Waste Management Rules, 2016)

Source: Punjab Pollution Control Board's website



Choithram hospital had its own incinerator also but as the hospital is in vicinity of residential area, the incinerator cannot be used. Now it is send to a common incineration facility i.e. Hoswin incinerators. In this manner each type of waste is collected and segregated at the generation point itself. The waste is then transferred to a common storage facility through trolleys where it is weighed and kept until the Hoswin's transport services take the waste for disposal (see figure 2). All the weighed bags are labelled with a barcoded strip in which the information about the quantum of waste (in Kilos) stored in that particular bag is secure. In this way, the management of waste is easier and the record keeping is also automated. All the records of past 6 months are collected through the same technique.

Figure 2: Process of Bio-Medical Waste Management in Choithram Hospital, Indore

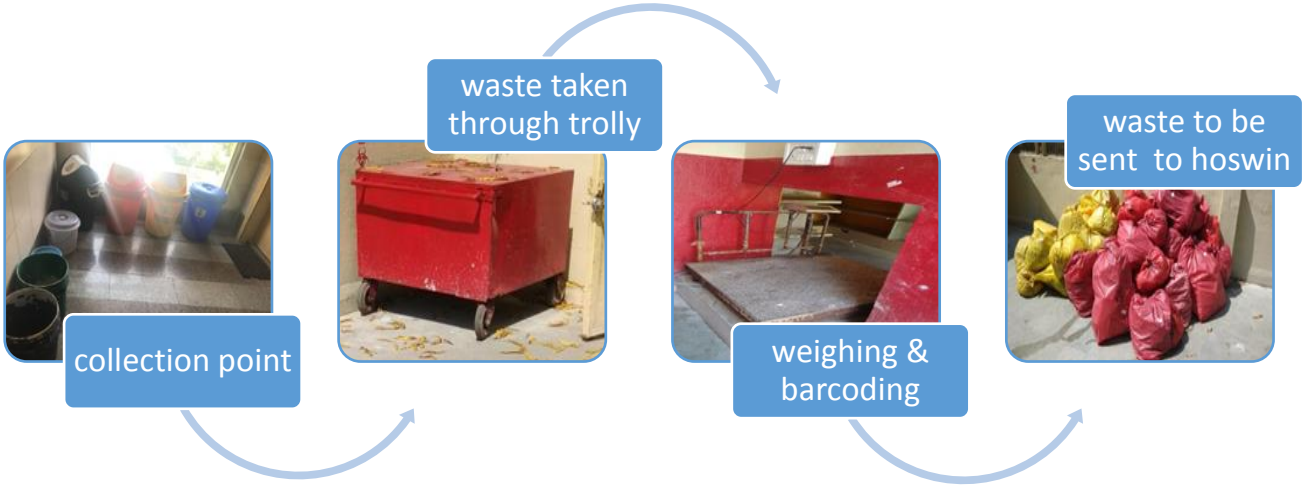
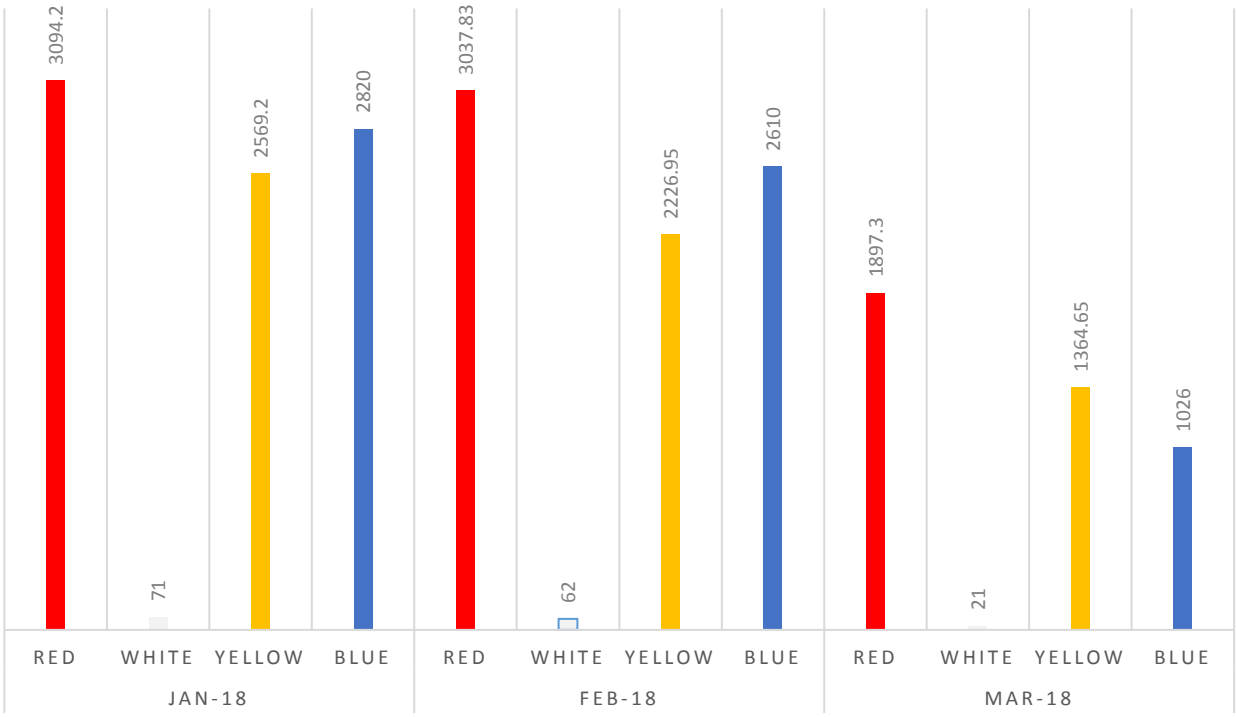


Image Source: Infection Control Department, Choithram Hospital, Indore

The hospital generates around 500 Kg/day organic waste as it has huge green belt, which is decomposed and used as manure. The amount of bio-medical solid waste generated is 4308 Kg/day (for the month of March, 2018).

Figure 3 shows the quantum of waste generated from January, 2018 to March 2018. As can be seen, the quantity of waste generated is more or less same for January and February but has decreased drastically for the month of March.

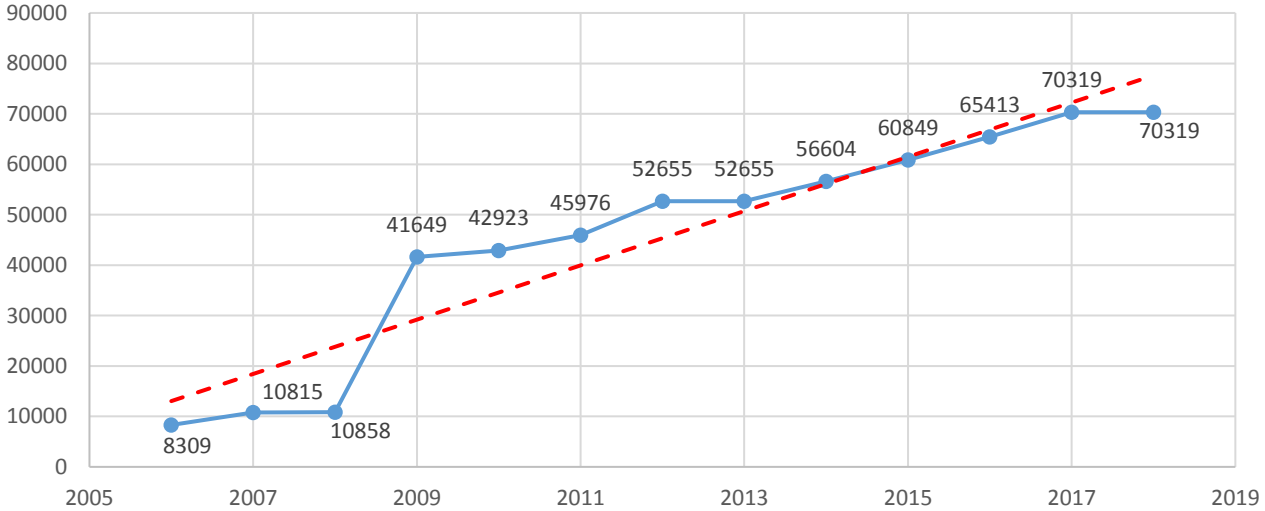
Figure 3: Quantum of Bio-medical Waste Generated (in Kgs)



This hospital gives training to all its staff right from doctors to '*safai karmacharis*' about the biomedical waste program. They have formed a committee for the same purpose which is headed by their Director Medical Services and its secretary is Infection Control Nurse. If there is any new recruitment in the staff then first they are given training about biomedical waste management. In this manner they are trying to implement this program with no loopholes so that everybody in the hospital has safe and infection free environment.

The maintenance such facility is not easy as it incurs much costs. The bio-medical waste management is the mandatory legal obligation for the hospital. The bio-medical waste disposal cost is a recurring expense for the hospital which includes the charges paid to Hoswin Incinerators. Hoswin's charges for bio-medical waste disposal are according to the number of beds in the hospital, which is 350 in case of Choithram. The cost charged by Hoswin has increased over the years that is from the year 2006 till date at a compounded annual growth rate of 18.68% which is an expensive affair for the hospital. As can be seen from figure 4, the charges have drastically increased from Rupees 8309 in 2006 to Rupees 73,309 in 2018. Other costs aren't included because of insufficiency of data.

Figure 4: Monthy Cost (paid to Hoswin) (in Rupees)



This bio-medical waste management expense is a tax deductible expense under The Income Tax Act, 1961.

Moving forward to the liquid waste management, the hospital has an Effluent Treatment Plant (ETP) installed in the premises. The construction work was completed in 6 months at the cost of Rupees 14 lakhs and commissioned in November 2001. In the year 2014 an additional plant was set up to enhance its capacity, costing around 08 lakhs. The schematic flow sheet of ETP is depicted in Figure 5.

Principle and Functioning of ETP:

1. Bar screens: For screening and removal of coarse suspended solids from the effluent while it passes through the bar scanner.
2. Oil and grease Trap: Removes the floating oil and grease from the effluent.
3. Equalization tank: Collects and equalizes the raw effluent.
4. Aeration tank: Mixes the effluent and provides excess of air (oxygen). The aerobic bacteria in the biomass oxidize the suspended and dissolved organic matter. The organic matter is biodegraded by the

bacterial mass. Complex carbon compounds are degraded and CO_2 generated. Complex organic nitrogen compounds are degraded to form ammonia, nitrite and nitrates.

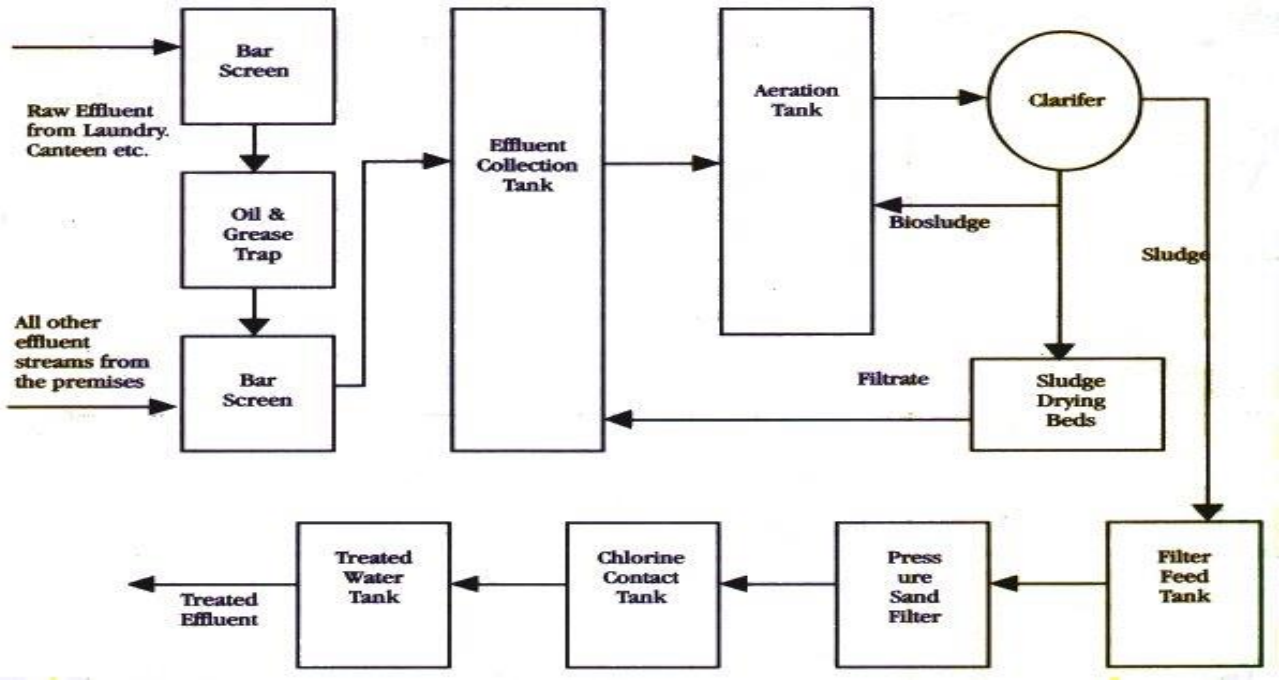
5. Clarifier tank: Separates suspended biological material. Part of the sludge is returned to aeration tank to provide biomass for the treatment and excess is flown to sludge drying bed.
6. Filter feed tank: The treated effluent is stored before passing to pressure sand filter.
7. Pressure sand Filter: Removes the fine suspended mater from the treated effluent.
8. Chlorine contact tank: Chlorine is added continuously to inactivate the microbial population.
9. Clean treated effluent water tank: Holds water before lifting to high-level storage tanks.

Further, table 1 shows the capacity of the old and new ETP. As can be seen the capacity has been doubled since 2014. This plant efficiently generates around 4.5 to 5 lakh liters per day. The treated water is used solely for gardening purpose.

Table 1: Size and Capacity of the ETPs

Tank Name	(Existing ETP) Dimension in meter/capacity in litre	(Expanded Plant) Dimension in meter/capacity in litre	Total capacity (in litre)
Bar Screen		1.0*1.0*1.0 m/1000	1000
Oil & grease trap	2.0*0.8*1.0 m/ 1600	2.5*1.25*1.0 m/3125	4725
Effluent collection cum equalization tank	6.5*3.1 m/102815	Existing	102815
Aeration tank	4.25*8.5*2.55m/92118	6.25*6.25*2.7m/105468	197586
Clarifier tank	5.0*2.5 m/49062	4.5*3.1 m/49278	98340
Intermittent holding tank or feed sump	5.0*2.5 m/49062	Existing	49062
Chlorine contact tank	1.8*1.8*1.6 m/5184	Existing	5184
Treated water collection tank	6.5*3.1 m/102815	existing	102815
Sludge Draying beds	2.5*2.5*1.7 /10.625 m square	2.5*2.5*1.7 /10.625 m square	21.250 m square
Capacity of ETP	**300 kl/day**	**300 kl/day**	**600 kl/day**

Figure 5: Schematic Flow Sheet of Effluent Treatment Plant



Source: Ravikant et al. (2002). *Effluent Treatment Plant: Why and How*. Journal of the Academy of Hospital Administration, Vol. 14, No. 1 (2002-01 – 2002-06).

Operating expenditure of ETP (inclusive of both old and new plants) includes the maintenance expenses of Rupees 60,000 per month, electricity charges (see table 2) amounting to Rupees 133,380 per month and depreciation of the plant (which is a non-cash expense) amounts to Rupees 6085.57 (for the month of March 2018). Thus the total operating expense per month amounts to Rupees 199,465.57 (for March 2018).

Table 2: Plant-Wise Electricity Charges of the ETPs

***Rupees**	**Old Plant**	**New Plant**
Units consumed per day	276	218
Rate per unit*	9	9
Per month charges*	74520 (276*9*30)	58860 (218*9*30)

Note: The calculation is done for a month and hence the final charges are multiplied by 30.

The depreciation for the ETP is calculated using WDV method. ETP has an estimated useful life of 50[1] years and the rate of depreciation applicable shall be 15% (rate prescribed for plant and machinery by the Income Tax Act).

[1] Raghuvanshi S et al. (2017). *Waste Water Treatment Plant Life Cycle Assessment: Treatment Process to reuse water*. Procedia CIRP 61. Pp. 761-766

As per revised Accounting Standard- 10, Property, Plant and Equipment (which is now Ind AS- 16), depreciation is to be charged on the basis of useful life of asset. Schedule II of the Companies Act, 2013 prescribes that the useful life of an asset shall not ordinarily be different from the useful life specified in the schedule and the residual value of an asset shall not be more than 5% of the original cost of the asset[2], i.e., for old plant it shall be Rupees 30,000 (600000*5%) and for new plant it shall be Rupees 40,000 (800000*5%).

[2] Rawat, D. S. (2017). *Student's Guide to Accounting Standards*. New Delhi: Taxmann Publications (P) Ltd.

Concluding Remarks

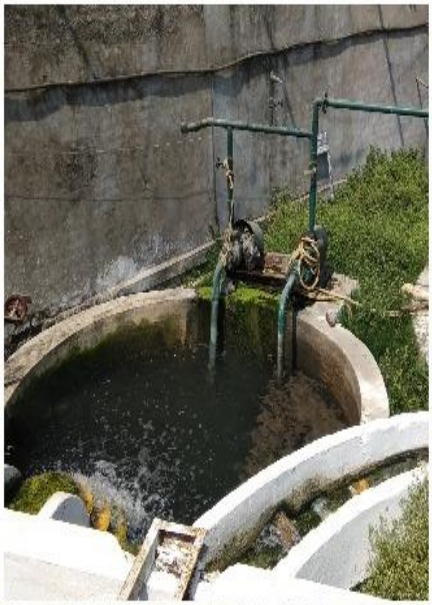
This study was undertaken to understand the system of Bio-Medical Waste Management in Choithram Hospital. Being a case study approach, this work was focused only on building the know-how of the bio-medical waste management system. At the preliminary stage, it was found that hospitals have to mandatorily follow biomedical waste rules in India, which Choithram hospital is prudently been doing even before the effective implementation of rules. They tried to dispose waste through their own incinerator, which had practical limitation so had to stop that practice and transfer all the bio-medical waste to Hoswin Incinerators. Thereafter, it was also found that the Hospital administration had also installed an ETP for treating the in-house waste water and reusing it for various purposes. This method of harvesting the waste water was very successful and looking at this successful implementation of their first ETP they installed new ETP in the year 2014. Now, around 4.5 to 5 lakh liters of water is treated daily in both the ETPs and is used solely for gardening purposes. It was very satisfying to see that every employee, right from doctor to fourth class

employee, is given training of bio medical waste generation, its segregation and method of disposal and the administration is very strict about following the safety protocols. Also, the hospital is making all the waste generated infection free through the autoclaving process which should be made mandatory in every hospital. The administration is keen on maintaining good gardens and lawns for better environment near hospitals and also making it convenient for the relatives and care takers of the patient a better feel through the greenery of the campus. The sludge generated through ETP provides for the manure as byproduct. This is again used for maintaining green campus. Thus, it can be concluded that Choithram Hospital has been very effectively and efficiently managing the bio-medical waste generated in its premises and the system of bio-medical waste management followed in the Hospital can be developed as a 'model' system to be used by other similar institutions.

Glimpses of Our Visit


HYPOCHLORITE TANK
हायपोक्लोराइट टैंक


EFFLUENT
COLLECTION TANK



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