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Integrated Waste Management at Pharmaceutical Industry

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Abstract – *Waste is a complex mixture of different substances that are discarded by household, individual or organizations that are harmful to the environments and health. Waste management consists of collection, processing, transport and disposal of solid waste [14]. Waste management also includes the treatment of waste water from the production and the domestic places at the industry. All the waste water are treated under domestic sewage treatment process and effluent treatment process depending upon the characteristics of the waste water produced. This study is done to know about the overall waste management at the pharmaceutical industry.*

***Key Words*: waste management, hazardous waste, biomedical waste, domestic wastewater treatment, effluent treatment.**

1. INTRODUCTION

Integrated Waste Management (IWM) is a comprehensive waste prevention, recycling, composting, and disposal program. Any effective integrated waste management system considers how to prevent, recycle, and manage waste in ways that most effectively protect human health and the environment. Wastes are the unwanted or unusable materials that people will no longer use for, which are either intended to get rid of or have already been discarded. Moreover, wastes can be hazardous to human or the environment as such, which has to be discarded immediately, else may cause serious health related problems in human. There are a number of different options available for the treatment and management of wastes including prevention, minimization, re-use, recycling, energy recovery and disposal. Pharmaceutical wastes are of different types mainly hazardous wastes and non-hazardous wastes.

Waste is produced by human activities for example, the extraction and processing of the raw materials. Waste management is intended to reduce adverse effects of waste on human health, the environment or aesthetics. All kinds of wastes, right from the municipal waste to agricultural waste to hazardous residues and special wastes such as sludge, health care wastes come under one umbrella. Though all of them are certain waste products, their management practices are not the same.

Here, Industrial waste is further classified in 3 categories:

1. Hazardous waste.
2. Biomedical waste.
3. Water and Waste water treatment.

1.1 Objective of Study

a) To study the solid waste management practices adopted in the plant.
b) To analyse the characteristics of wastewater generated in the plant.
c) To study the performance of existing ETP.

2. Waste Management:

Waste management are the activities and actions required to manage waste from its inception to its final disposal. This includes the collection, transport, treatment and disposal of waste, together with monitoring and regulation of the waste management process. Waste can be solid, liquid, or gas and each type have different methods of disposal and management. Waste management deals with all types of waste, including industrial, biological and other. In some cases, waste can pose a threat to human health.

a) Hazardous wastes: Hazardous waste is waste that is dangerous or potentially harmful to our health or the environment. Hazardous wastes can be liquids, solids, gases, or sludges. They can be discarded commercial products, like cleaning fluids or pesticides, or the by-products of manufacturing processes. The responsibilities of the occupier for management of hazardous and other wastes are to follow the following steps, namely- Prevention, Minimization, Reuse, Recycling, Recovery, Utilization including co-processing, Safe Disposal. The State Government, occupier, operator of a facility or any association of occupiers shall individually or jointly or severally be responsible for identification of sites for establishing the facility for treatment, storage and disposal of the hazardous and other waste in the State.

Table -1: types of hazardous wastes and their disposal process.

Sl. No	Waste Category No as per Schedule-I	Details of Hazardous waste	Treatment & Mode of Disposal
1	20.3	Solvent Distillation Residue	Shall be stored in secured manner and handed over to Authorised Incinerator/ disposed to authorised cement kilns for Co-processing/Co-incineration
2	37.3	MEE Salt from Evaporator	Shall be stored in secured manner and handed over to KSPCB authorised TSDF
3	28.3	Spent Carbon	Shall be stored in secured manner and handed over to KSPCB authorised TSDF/ disposed to authorised cement kilns for Co-processing/Co-incineration/Common Incinerators
4	33.1	Discarded Containers, Used barrels (MS Drums/HDPE barrels/Carbouys)	Shall be stored in secured manner and disposed to KSPCB authorised recyclers (After wash – original Authorisation)
5	33.1	Discarded Liners (pp Bags)	Shall be stored in secured manner and disposed to KSPCB authorised recyclers
6	33.1	Discarded Glass Bottle	Shall be stored in secured manner and disposed to KSPCB authorised recyclers
7	28.4	Off Specification Products	Shall be stored in secured manner and disposed to disposed to authorised cement kilns for Co-processing/Co-incineration/Common Incinerators
8	28.5	Dated expired and Off Specification medicines or drugs	Shall be stored in secured manner and disposed to authorised cement kilns for Co-processing/Co-incineration/Common Incinerators

b) Biomedical waste: Biomedical wastes can be briefly defined as any solid or liquid waste that is generated in the diagnosis, treatment of immunization of human beings or animals in research pertaining thereto, or in the production or testing of biological material. According to World Health Organization (WHO) estimates 85% of hospital waste is actually non-hazardous and around 10% is infectious while the remaining 5% is noninfectious but consists of hazardous chemicals like methyl chloride and formaldehyde.

Fig -1: Biomedical waste management rules 2016

Table -2: types of biomedical wastes and their disposal process.

Biomedical stes	Quantity of waste	Treatment/ disposal methods
Chemical liquid waste	300-400 kg	After resource recovery, the chemical liquid waste shall be pre-treated before mixing with another wastewater. The combined discharge shall conform to the discharge norms.
Waste sharps finishing metals	2.0-3.0kg	Autoclaving or Dry Heat Sterilization followed by shredding or mutilation or encapsulation in metal container or cement concrete; combination of shredding cum autoclaving; and sent for final disposal to iron foundries (having consent to operate from the State Pollution Control Boards or Pollution Control Committees) or sanitary landfill or designated concrete waste sharp pit.

Microbiology, biotechnology and other clinical laboratory waste	500-600kg	Pre-treat to sterilize with non-chlorinated chemicals on-site as per National AIDS Control Organization or World Health Organization guidelines thereafter for Incineration.

c) Water and Waste Water Treatment: Water is one of the major commodities used by the pharmaceutical industry. It may be present as an excipient or used for reconstitution of products, during synthesis, during production of the finished product or as a cleaning agent for rinsing vessels, equipment, primary packaging materials etc.

Water purification: Water purification system components that require water for pharmaceutical manufacturing processes are determined by need and by the feed water's quality. Testing of the feed water is required to accurately identify contaminants it may contain, including particulates, inorganics, organics and microorganisms. Water purification of the potable water is done by the following stages,

a. Reverse osmosis
b. Electro deionization
c. Ultraviolet disinfection
d. Multi column distillation plant

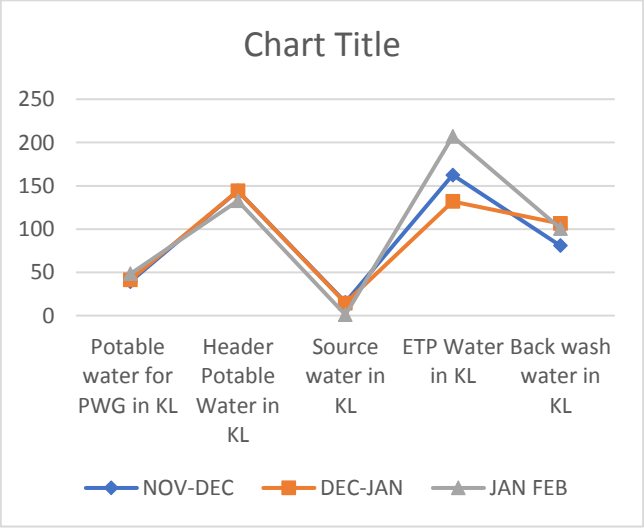

Chart -1- Graphical representation of the usage of the water in the production block B1 and B2 from Nov2019 to feb2020

Wastewater treatment: Wastewater treatment is a process used to remove contaminants from wastewater or sewage and convert it into an effluent that can be returned to the water cycle with minimum impact on the environment, or directly reused. The latter is called water reclamation because treated wastewater can be used for other purposes. The treatment process takes place in a wastewater treatment plant (WWTP), often referred to as a Water Resource Recovery Facility (WRRF) or a Sewage Treatment Plant (STP).

The entire waste stream is classified into 2 streams:

a. Domestic sewage treatment
b. Process effluent treatment

a. Domestic sewage treatment: Sewage treatment is the process of removing contaminants from wastewater, containing mainly domestic sewage plus some industrial wastewater. Physical, chemical, and biological processes are used to remove contaminants and produce treated wastewater (or treated effluent) that is safe enough for release into the environment. A by-product of sewage treatment is a semi-solid waste or slurry, called sewage sludge. The sludge has to undergo further treatment before being suitable for disposal or application to land.

Table -2: Readings of treated sewage water with standard values

Sl.No.	Parameter	Standard Values (mg/L)	Treated Water (mg/L)
1.	pH	6.5- 8.5	7.5
2.	Turbidity	1-5	6.5
3.	Total Hardness	200 mg/l	350
4.	Calcium	75-200 mg/l	195
5.	Magnesium	30-100 mg/l	115
6.	BOD	5-10 mg/l	16
7.	Alkalinity	200-600 mg/l	450

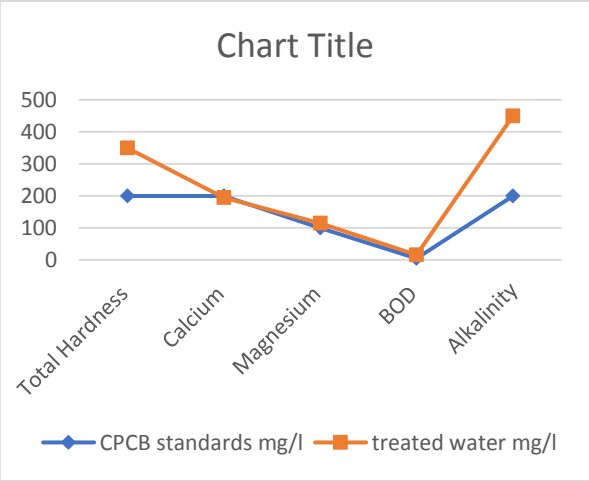

Chart -2: Graphical representation of sewage treated water with CPCB standards

b. Process effluent treatment: Effluent Treatment Plant (ETP) is used by leading companies in the chemical industry to purify water and remove any toxic and non-toxic materials or chemicals from it. These plants are used by all companies for environment protection.

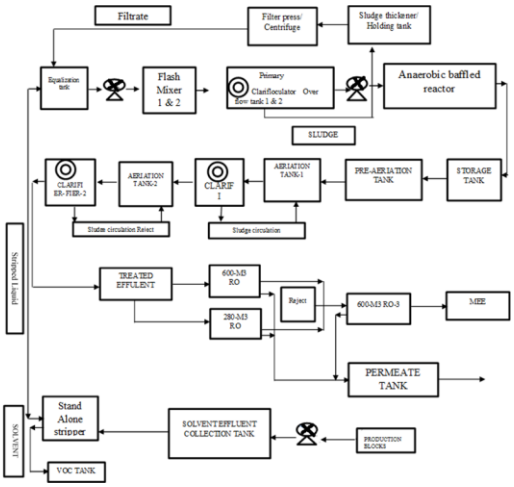

Fig- 4: Flow chart of effluent treatment plant

Table-3: Readings compared with treated water and CPCB

Sl.No.	Parameter	Standard Values (mg/L)	Average Treated Water readings (mg/L)
1.	pH	6.5-8.5	7.90
2.	Total dissolved solids	500-2000 mg/l	643.34
3.	Total Suspended solids	100-200 mg/l	139.67
4.	Electrical conductivity	400 µS/cm	308.67
5.	COD	250 mg/l	219.34
6.	Chloride	250-1000 mg/l	391

3. CONCLUSIONS

- Waste management in the location are followed according to the guidelines KSPCB. Segregation and proper storage of waste should be improved.
- Here, industry is achieving Zero liquid discharge (ZLD) system for some better Solutions for reject and salt management are achieved. This will better facilities for to reduce pollution load and reducing in quantity of effluent disposed.
- Waste water treatment technology is properly to recycle, recovery and reuse of treated waste water.

REFERENCES

1. A.J. Morrissey, J. Browne, Waste management models and their application to sustainable waste management, national college of Ireland, waste management 24 (2004) 297-308,17 September 2003.
2. Agamuthu Periathamby Fauziah Shahul Hamid Kahlil Khidzir, Evolution of solid waste management in Malaysia: impacts and implications of the solid waste bill, Institute of Biological Sciences, Faculty of Science, University of Malaya, November 23, 2008.
3. Aman Gandhi, Arti Pamnani, Integrated Solid Waste Management: Review for Better Solution, International Advanced Research Journal in Science, Engineering and Technology, Vol. 4, Issue 10, October 2017.
4. Arti Pamnani, Management of Municipal Solid Waste: A Study of Small-Scale Municipality, International Journal of Engineering Sciences & Research Technology, [Pamnani, 4(1): January, 2015].
5. Atiq Uz Zaman, Review A comprehensive review of the development of zero waste management: lessons learned and guidelines, Journal of Cleaner Production 91 (2015).
6. B B Bala Sreevatsan, Dr. Rajan Ramaswamy, A Study on Integrated Waste Management, International Research Journal of Engineering and Technology (IRJET) Volume: 05 Issue: 04, Apr-2018.

7. Dipam Saikia, Manash Jyoti Nath, Design of an Integrated Solid Waste Management Mechanism: A Model Design for Tezpur Municipal Area, Assam, IOSR Journal of Environmental Science, Toxicology and Food Technology, Volume 9, Issue 3 Ver. I (Mar. 2015).

8. Dipam Saikia, Manash Jyoti Nath, Integrated Solid Waste Management Model for Developing Country with Special Reference to Tezpur Municipal Area, India, international journal of innovative research & development, Vol 4 Issue 2, February, 2015.

9. Egun Nkonyeasua Kingsley, Iniaghe Okiroro Paschal, Evbayiro Osagie Jude, Assessment of landfill sites for solid waste management in Delta state, Nigeria, Journal of Environment and Waste Management Vol. 3(1), May, 2016, pp. 116-122.

10. G.H. Huang, G.F. Chi, and Y.P. Li, Long-Term Planning of an Integrated Solid Waste Management System under Uncertainty—I. Model Development, environmental engineering science Volume 22, Number 6, 2005.

11. Gaurav K. Singh, Kunal Gupta, and Shashank Chaudhary, Solid Waste Management: Its Sources, Collection, Transportation and Recycling, International Journal of Environmental Science and Development, Vol. 5, No. 4, August 20.

12. Mr. C. Balakrishnan, A Survey of household Solid waste Management in Chennai, ISBR Management Journal, Volume1, Issue2, Dec 2016.

13. Muzaffar Ahmad Wani, Zubair Ahmad Dada, Shamim Ahmad Shah, Sustainable Integrated Solid Waste Management in the Trans- Himalayan Accommodation Sector, African Journal of Hospitality, Tourism and Leisure, Volume 7 (2) - (2018).

14. Sylvia Adipah, Ofotsu Nana Kwame, A Novel Introduction of Municipal Solid Waste Management, Journal of Environmental Science and Public Health, Volume 3, Issue 2, 02 April 2019.

15. Vipin Gupta, Sarvesh Kumar, Rishabh Pandey, Chanda Rani, Smart Integrated Waste Management System, International Journal for Research in Applied Science & Engineering Technology.

16. Yeny Dhokhikah, Yulinah Trihadiningrum, Solid Waste Management in Asian Developing Countries: Challenges and Opportunities, Journal of Applied Environmental and Biological Sciences, J. Appl. Environ. Biol. Sci., 2(7)329-335, 2012.

17. Dr. Raveesh Agarwal, Mona Chaudhary, Jayveer Singh, Waste Management Initiatives in India For Human Well Being, European Scientific Journal /SPECIAL/ edition ISSN: 1857 – 7881 (Print) e - ISSN 1857- 7431, June 2015.

18. Rajkumar Joshi1 and Sirajuddin Ahmed, Status and challenges of municipal solid waste management in India: A review, Cogent Environmental Science, 2: 1139434, 2016.

19. Tomas Ekvall, Getachew Assefa, Anna Bjorklund, Ola Eriksson, Goran Finnveden, what life-cycle assessment does and does not do in assessments of waste management, Waste Management 27 (2007) 989–996, 16 February 2007.

20. Isabela Maria Simion, Cristina Ghinea, Sebastian George Maxineasa, Nicolae Taranu, Alessandra Bonoli, Maria Gavrilescu, Ecological Footprint Applied in The Assessment of Construction and Demolition Waste Integrated Management, Environmental Engineering and Management Journal, Vol.12, No. 4, 779-788, April 2013.