

A Review on Pharmaceutical Waste Management

Afshal Ahamed.A¹, Bowya.S², Eniyan.MR³, Hariharan.K⁴, Jaikumar.A⁵,
Kaviyarasu.V⁶, Surthi.A⁷, Veera kumar.S⁸, N.Rajesh kumar⁹,
Dr.P.Manikandan¹⁰, Dr.M.Surendra kumar¹¹.

^{1,2,3,4,5,6,7,8}B.Pharm Final Year, Sengundhar College of Pharmacy

⁶M.Pharm, Associate Professor, Dept. of Pharmaceutics Sengundhar College of pharmacy.

Submitted: 01-08-2023

Accepted: 10-08-2023

ABSTRACT:

Pharmaceutical wastes come in variety of forms, mostly as strips, expired drugs, production wastes, etc. The Pharmaceutical waste management is a crucial component of the pharmaceutical industries and healthcare system. It originates from a variety of stakeholders in the health care system, including pharmaceutical developers and manufacturers, hospitals, individual doctors, and everyone else.

KEYWORDS:

Waste Management, Pharmaceutical Wastes, Regulatory Bodies.

I. INTRODUCTION:

Waste is made up of undesired materials that can no longer be employed in production operations and may eventually become harmful or non-harmful to humans or the environment. Various regulatory organizations, including governmental organizations, law enforcement agencies, and environmental protection organizations, are taking part in the effort to prevent pharmaceutical pollution. As a result, anything that must be thrown away right away must be done so to prevent significant health issues in people. There are many various types of waste, including home garbage, sewage, manufacturing sludge waste, packaging materials, abandoned cars, obsolete televisions, garden debris, and empty paint cans. Daily operations might therefore result in a wide range of diverse wastes coming from various sources [Mohammed Jaseem.2017].

The identification of active pharmaceutical components and healthcare goods in aquatic Environments have grown over the past 20 years. These substances are released into the environment through a variety of channels, and because many of the APIs are resistant waste water treatment plants cannot successfully remove them.

[Kiranmayl.2019]. Currently being examined primarily on pharmaceutical waste, how it affects the environment, and treatment methods. Waste from the healthcare and pharmaceutical industries is produced in a variety of ways across the health care system, including spills, breakages, broken, infected syringes, wasted preparations, expired pharmaceuticals, etc. It might also build up in areas like patient rooms, surgical rooms, nursing stations, and emergency rooms, among others.2010: [Kummerer.2010]. For the treatment and management of wastes, a variety of solutions are available, including prevention, minimization, reusing, recycling, energy recovery, and disposal. Pharmaceutical wastes come in a variety of forms, primarily hazardous and non-hazardous wastes. [Pramod Kumar.2017]



FIGURE -1 TYPES OF WASTE MATERIAL

AIM:

The purpose of waste management is to lessen the harmful consequences that these wastes have on both the environment and people. The placement of used medication, cytotoxic pharmaceuticals, solid chemical wastes, and incinerator ash in landfills with security measures. Burying rubbish while disposing of it in landfills is still a standard practice in the majority of nations.

OBJECTIVES:

The destruction of the compounds or their recovery for reuse and conversion into harmless

forms that are appropriate for unrestricted disposal constitute the pharmaceutical waste management treatment.



FIGURE.2 WASTE MANAGEMENT STEPS

- ✓ To repair and lessen the harm that pollution does to the environment, as well as to safeguard it from contamination and pollution.
- ✓ It reduces the hazards and dangers to the neighbor hoods that may be at risk because of hospitals. Other diseases caused by infected medical equipment occur as a result of proper waste management. Reducing or eliminating waste dangers and, often, rendering the waste unrecognizably are the objectives of pharmaceutical waste treatment. Every healthcare facility must take all necessary precautions to ensure that pharmaceutical waste is handled safely and without harming the environment.
- ✓ Waste avoidance is given high priority in pharmaceutical waste management, followed by reuse, recycling, recovery, and final disposal.
- ✓ To reap the most beneficial practical effects
- ✓ To produce the least amount of trash while obtaining the greatest practical benefits from items. Making the most of waste simply refers to producing inventive and beautiful items from the stuff we no longer require.
- ✓ Waste management aims to lessen the negative consequences of waste on environmental resources, human health, and aesthetics.
- ✓ To identify the types and amounts of trash being produced, and the assess how well the current waste management system is working.
- ✓ To find ways to make waste management practice and methods better.
- ✓ To produce the least amount of trash while obtaining the greatest practical benefits from items. Making the most of waste simply refers to producing inventive and beautiful items from

the stuff we no longer require.

- ✓ Waste management aims to lessen the negative consequences of waste on environmental resources, human health, and aesthetics.
- ✓ To identify the types and amounts of trash being produced, and then assess how well the current waste management system is working.
- ✓ To find ways to make waste management practices and methods better.
- ✓ It's crucial for each of us to contribute in order to keep as much waste out of landfills as we can. One way we can play a part. Waste management is one approach to put the principle into practice.
- ✓ To stop or lessen the generation of waste, as well as the degree of its risk, and to reuse and recover trash.
- ✓ To stop the damage that waste causes.
- ✓ To reduce the volume.
- ✓ To obtain recyclable.
- ✓ To ensure efficient and safe disposal.

Background Study Of Pharmaceutical Waste Management:

- Sanitation and the proper disposal of medical waste were practically unknown in the nineteenth century. Serious transformation did not start until the middle to late 1800s. Edwin Chatwick, a well-known British reformer, studied the incredibly poor conditions that could be found in the hospitals and jails of Britain. His noteworthy efforts contributed to the 1848 passage of the Public Health Act. Others found inspiration in Chatwick's work. For instance, Colonel George Bewaring, an officer in the Union army during the American Civil War was instrumental in bringing about new changes in the United States. Sanitary engineering was established by Warring. Today, sanitary engineering is a crucial component of our daily life.
- ✓ The development of efficient medical waste disposal in the 20th century made it possible for Americans to live longer. With the passage of the Solid Waste Disposal Act in 1965 and the Medical Waste Tracking Act in 1988, new technologies and greater requirements entered the law. The need for stricter regulations on the disposal of medical waste increased, which benefited the environment and led to healthier and happier lives. [Aug, 2017].
- ✓ Prior to being regulated in the United States, medical waste was once dumped into the general waste stream. It makes me squirm to

- even consider it, but that was once the case. The term "Regulated Medical Waste" and the legislation governing it are relatively recent
- ✓ Inventions. In fact, it wasn't until the 1980s, when medical trash began washing up on several east coast beaches, that anyone began to pay attention to the potential health risks of medical waste. 1976 saw the passing of the Resource Conservation and Recovery Act (RCRA).
 - ✓ The primary federal statute in the United States regulating the disposal of hazardous and solid waste is this one. Although there have been hospitals, medical institutions, laboratories, and dentists for more than a century, it wasn't until the 1980s that congress was finally moved to act by the waste washing up on beaches. The Medical Waste Tracking Act of 1988 was approved by Congress and was initially intended as a two-year government program in which the Environmental Protection Agency (EPA) was tasked with establishing rules for the handling of medical waste. On June 24, 1989, this program's restrictions were implemented in just four states including Puerto Rico. The program's requirements applied to the following four states: New York, New Jersey.
 - ✓ Rhode Island and Connecticut. [Brown, Brooke.2022]. Unavoidable waste produced by human activity is solid waste. Any substance that is rejected as a result of home or industrial activity, which can be disposed of, and for which there is no market demand. The quantity and complexity of
 - ✓ General solid waste increases as a result of economic expansion, urbanization, and higher living standards in cities.[Nick Chukwuemeka.2016].
 - ✓ A minor portion of the total trash produced by hospitals is biomedical waste. However, this waste .Stream poses the biggest threat to the public's and employees' health. The need for more healthcare facilities (hospitals, nursing and retirement homes), utilized injections.
 - ✓ The public's and employees' health. The need for more healthcare facilities (hospitals, nursing and retirement homes), utilized injections at home, and medical research have all expanded in recent years, as has the production of biomedical waste. In addition to hospitals and other recognized healthcare facilities, private residences, workplaces, schools, nursing homes, and children's homes also produce biomedical waste. These smaller facilities, including houses, do not manage the waste they produce.
 - ✓ Based on rules with which hospitals are required to comply. Biomedical waste management in
 - ✓ developing countries faces many difficulties, including a lack of laws and regulations, weak operating standards and practices in the healthcare sector, insufficient financial resources, lower citizen
 - ✓ Education and a general lack of awareness of environmental health and safety. [Madhu Bala.2015]
- ✓ **CURRENT STATUS & FUTURE PROSPECTIVES :**
- ✓ In addition to financial costs, the improper disposal of medical waste has a negative impact on the general health of the community. Traditionally, the primary technique of handling medical waste has been incineration. It is the only system that can treat every part of medical waste, cutting waste
 - ✓ Volume and weight by 90% and 75%, respectively. In the US, 20-37% of medical waste is autoclaved, 49-60% is burned, and other technologies are used to treat 4-5%. The most environmentally friendly of the procedures described is autoclaving, which is already widely employed in academic
 - ✓ Laboratories. It is possible for autoclaving to spread throughout hospitals with the right protocols in place. Additionally, this would promote the use of reusable kits and supplies, limiting the usage of single-use kits that produce more general waste. [Betty Hui Yu Zhang.2020].
 - ✓ According to the Municipal Solid Garbage Management Handling Rules, 2000, all urban local bodies in India are in charge of collecting, transporting, disposing of, and segregating solid garbage. Each year, 62 million tones of trash are produced in India. A total of 43 million tones (70%) are
 - ✓ Collected; 12 million of them are processed and 31 million of those are disposed of in landfills.
 - ✓ Urban municipal solid waste generation is predicted to rise to 165 million tones in 2030 as a result of shifting consumption patterns and rapid economic expansion. The majority of Indian dumpsites are larger than their

permitted 20-meter height limit. These locations are thought to contain more than 10,000 hectares of urban land. [Sep, 2022].



FIGURE-4 EFFLUENT TREATMENT PLANT



FIGURE-5 WASTE MANAGEMENT AREA PHARMACO FABRICON INDUSTRY IN MADURAI

- ✓ Issues brought on by the volume of COVID 19 trash are also necessary. [Malini R. Capoor.2021]. HCWM is currently a global public health and environmental concern, especially in poorer nation.
- ✓ The future of trash management is currently one of the largest global challenges due to the
- ✓ Enormous amounts of smelly, bulky waste that is being produced worldwide. Most of it is disposed of in developed nations like Sweden and the U.S., and some of it is even recycled or made into compost. Contrarily, nations like India and China, which have long been overpopulated, lack the
- ✓ Resources and technologies necessary to efficiently handle all of the waste that has been produced there. In fact, the guardian reports that nearly 50 million tones of scrap steel, 28 million tones of
- ✓ Paper garbage and 7.4 million tones of used plastic were imported into China in 2010. [Aug , 2017]

SOLID WASTE MANAGEMENT

- ✓ Solid waste removal and management in India is a difficulty due to an expanding population, urbanization, and economic activity.

MEDICAL WASTE MANAGEMENT

The COVID 19 epidemic presents new problems that need to be solved every day. Waste produced while a person is quarantined at home is also potentially contagious. There must be a plan for their secure disposal. The dead COVID 19 patients must be safely buried or cremated because doing otherwise compromises both their safety and their feelings. Addressing potential environmental.

- According to India's Central Pollution Control Board, daily garbage production has climbed from 0.26 kg to 0.85 kg per person. 90% of waste is thrown without being properly treated, which pollutes the environment. Waste generation is anticipated to surpass 300 million tones annually by 2047, according to an MNRE assessment. With so many obligations and evolving rules, it might be difficult to accurately maintain track of a long list of waste-related Chores. Many healthcare organizations make the error of only training individuals who will play significant roles in the control of pharmaceutical waste.
- ✓ Many healthcare facilities, including hospitals, make the error of failing to train and educate the whole nursing team on correct drug disposal techniques. The unofficial hub of a hospital's drug disposal system is frequently the nursing staff. The failure to adopt a drug disposal system in
- ✓ Healthcare facilities results in noncompliance, which exposes the institution to substantial fines. Professional training is required for nursing staff regarding the different types of medications and the proper disposal container.
- ✓ This relates to nursing personnel that is

overworked, undertrained, and educated. You want me to collect those empty wrappers; for example, can come up from the nursing staff without the required training on container labeling. These are the pharmaceutical waste management prospects for the future. [Sep, 2017].

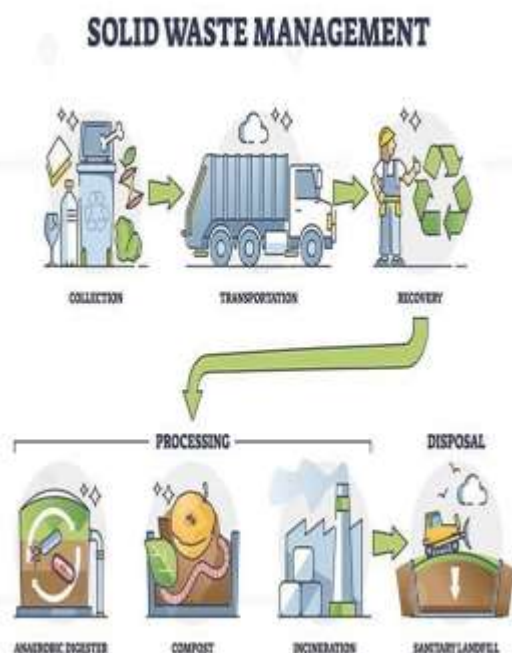


FIGURE-6 PROCESS OF SOLID WASTE MANAGEMENT

MEDICAL WASTE MANAGEMENT

The COVID 19 epidemic presents new problems that need to be solved every day. Waste produced while a person is quarantined at home is also potentially contagious. There must be a plan for their secure disposal. The dead COVID 19 patients must be safely buried or cremated because doing otherwise compromises both their safety and their feelings. Addressing potential environmental issues brought on by the volume of COVID 19 trash is also necessary. [Malini R. Capoor.2021]. HCWM is currently a global public health and environmental concern, especially in poorer nation. The future of trash management is currently one of the largest global challenges due to the enormous amounts of smelly, bulky waste that are being produced worldwide. Most of it is disposed of in developed nations like Sweden and the U.S., and some of it is even recycled or made into compost. Contrarily, nations like India and China, which have long been overpopulated, lack the resources

and technologies necessary to efficiently handle all of the waste that has been produced there. In fact, the guardian reports that nearly 50 million tones of scrap steel, 28 million tones of paper garbage, and 7.4 million tones of used plastic were imported into China in 2010. [Aug , 2017]

SOLID WASTE MANAGEMENT

Solid waste removal and management in India is a difficulty due to an expanding population, urbanization, and economic activity. According to India's Central Pollution Control Board, daily garbage production has climbed from 0.26 kg to 0.85 kg per person. 90% of waste is thrown without being properly treated, which pollutes the environment. Waste generation is anticipated to surpass 300 million tones annually by 2047, according to an MNRE assessment. With so many obligations and evolving rules, it might be difficult to accurately maintain track of a long list of waste-related chores. Many healthcare organizations make the error of only training individuals who will play significant roles in the control of pharmaceutical waste.

Many healthcare facilities, including hospitals, make the error of failing to train and educate the whole nursing team on correct drug disposal techniques. The unofficial hub of a hospital's drug disposal system is frequently the nursing staff. The failure to adopt a drug disposal system in healthcare facilities results in noncompliance, which exposes the institution to substantial fines. Professional training is required for nursing staff regarding the different types of medications and the proper disposal container.

This relates to nursing personnel that is overworked, undertrained, and educated. You want me to collect those empty wrappers, for example, can come up from the nursing staff without the required training on container labeling. These are the pharmaceutical waste management prospects for the future. [Sep, 2017].

II. CONCLUSION :

Concerned about this issue, the government and non-governmental organizations have put plans in place for the disposal of this trash. The cost of trash management must be decreased, so it is necessary to continuously develop new classifications for their simple removal and efficient techniques. Waste disposal is handled by all parties involved in the healthcare system, including doctors, pharmacists, and nurses.

REFERENCES:

- [1]. Swarupa Arvapalli, Joginpally B.R. Pharmacy College.
- [2]. Tripti Shukla, Rashi Bajaj, Shreya Khanna, Shrad Prakash Pandey, Rupal Dubey, Neeraj Upmanyu,2014.
- [3]. Asavari R. Shinde, Ankita P. Patil, Tejaswini M. Patil, Mr. Rohan R. Vakhariya, Dr.C.S. Magdum, Rajarambu College Of Pharmacy, Kasegaon, Dist. Sangli, Maharashtra, India,2020.
- [4]. Atul Kadam, Shithalkumar, Sachin Patil, Anil Tumkur, Ashokrao Mane College Of Pharmacy, Peth Vadgaon, Kolhapur, INDIA, Department Of Pharmacy Practice, Internstional Medical university, Kuala Lumpur, MALAYSIA,2016.
- [5]. P.S. Patil, S,R, Kumbhoje, S.S. Patil, Ashokrao Mane College Of Pharmacy, PethvdgON, Tal- Hatkanamgle, Dist- Kolhapur,2015.
- [6]. Muhamad Jaseem, Dept Of Pharmaceutics, Pramod Kumar, Dept Of Pharmaceutics and Remya Mariam John, Dept Of Pharmaceutics,2017.
- [7]. Shivangi Upadhyay & Alok Sinha,2022.
- [8]. Solomon Ahmed Mohammed, Mesfin Haile Kahissay, Abel Demerew Hailu,2021.Brooke Brown,2022
- [9]. Yu Fei Xia and Betty Hui Yu Zhang, McMaster University,2020.
- [10]. Priya Datta (Dept OF Microbiology), Gursimran Kaur Mohi, Jagdish Chander, 2018.
- [11]. Madhu Bala,(Dept Of Environmental Engineering),Delhi Technological University.
- [12]. Sunil Kumar, Stephen R. Smith, Geoff Fowler, Costas Velis, S. Jyoti Kumar, Shashi Arya, Rena, Rakesh Kumar and Christopher Cheeseman,2017.
- [13]. Malini R. Capoor, Annapurna Parida,(Dept Of Microbiology)Safdarjung Hospital and VMMC ,New Delhi,INDA,2021.
- [14]. Teshival Derwss Yazie, Mekonnen Girma Tebeje& Kasaw Adane Chufa,2019.
- [15]. Sucharita Bhattacharyya(Dept Of Applied Science and Humanities, Guru Nanak.
- [16]. Institute Of Technology, INDIA, and Anwesh Bhowmick(Dept Of Pharmaceutical Sciences and Technology,Birla Institute Of Technology, INDIA,2021.

REFERENCES :

- [1]. Swarupa Arvapalli, Joginpally B.R. Pharmacy College.
- [2]. Tripti Shukla, Rashi Bajaj, Shreya Khanna, Shrad Prakash Pandey, Rupal Dubey, Neeraj Upmanyu,2014.
- [3]. Asavari R. Shinde, Ankita P. Patil, Tejaswini M. Patil, Mr. Rohan R. Vakhariya, Dr.C.S. Magdum, Rajarambu College Of Pharmacy, Kasegaon, Dist. Sangli, Maharashtra, India,2020.
- [4]. Atul Kadam, Shithalkumar, Sachin Patil, Anil Tumkur, Ashokrao Mane College Of Pharmacy, Peth Vadgaon, Kolhapur, INDIA, Department Of Pharmacy Practice, Internstional Medical university, Kuala Lumpur, MALAYSIA,2016.
- [5]. P.S. Patil, S,R, Kumbhoje, S.S. Patil, Ashokrao Mane College Of Pharmacy, PethvdgON, Tal- Hatkanamgle, Dist- Kolhapur,2015.
- [6]. Muhamad Jaseem, Dept Of Pharmaceutics, Pramod Kumar, Dept Of Pharmaceutics and Remya Mariam John, Dept Of Pharmaceutics,2017.
- [7]. Shivangi Upadhyay & Alok Sinha,2022.
- [8]. Solomon Ahmed Mohammed, Mesfin Haile Kahissay, Abel Demerew Hailu,2021.
- [9]. Brooke Brown,2022
- [10]. Yu Fei Xia and Betty Hui Yu Zhang, McMaster University,2020.
- [11]. Priya Datta (Dept OF Microbiology), Gursimran Kaur Mohi, Jagdish Chander, 2018.
- [12]. Madhu Bala,(Dept Of Environmental Engineering),Delhi Technological University.
- [13]. Sunil Kumar, Stephen R. Smith, Geoff Fowler, Costas Velis, S. Jyoti Kumar, Shashi Arya, Rena, Rakesh Kumar and Christopher Cheeseman,2017.
- [14]. Malini R. Capoor, Annapurna Parida,(Dept Of Microbiology)Safdarjung Hospital and VMMC ,New Delhi,INDA,2021.
- [15]. Teshival Derwss Yazie, Mekonnen Girma Tebeje& Kasaw Adane Chufa,2019.
- [16]. Sucharita Bhattacharyya(Dept Of Applied Science and Humanities, Guru Nanak
- [17]. Institute Of Technology, INDIA, and Anwesh Bhowmick(Dept Of Pharmaceutical Sciences and

- Technology, Birla Institute Of Technology, INDIA, 2021.
- [18]. Samuel Sasu, Klaus Kummerer and Martin Kranert, 2012.
- [19]. Ndidi C. Ngwuluka, University Of Jos, Patricia O. Odumosu, University Of Jos, 2011.
- [20]. Mannen Anil Babu, Dept Of Biotechnology, Vignan
- Hospital and VMMC, New Delhi, INDIA, 2021.
- [15]. Teshival Derwss Yazie, Mekonnen Girma Tebeje & Kasaw Adane Chufa, 2019.
- [16]. Sucharita Bhattacharyya (Dept Of Applied Science and Humanities, Guru Nanak Institute Of Technology, INDIA, and Anwesh Bhowmick (Dept Of Pharmaceutical Sciences and Technology, Birla Institute Of Technology, INDIA, 2021.
- [17]. Samuel Sasu, Klaus Kummerer and Martin Kranert, 2012.
- [18]. Ndidi C. Ngwuluka, University Of Jos, Patricia O. Odumosu, University Of Jos, 2011.
- [19]. Mannen Anil Babu, Dept Of Biotechnology, Vignan University, Guntur, India, 2016.
- [20].
- REFERENCES :**
- [1]. Swarupa Arvapalli, Joginpally B.R. Pharmacy College.
- [2]. Tripti Shukla, Rashi Bajaj, Shreya Khanna, Shrad Prakash Pandey, Rupal Dubey, Neeraj Upmanyu, 2014.
- [3]. Asavari R. Shinde, Ankita P. Patil, Tejaswini M. Patil, Mr. Rohan R. Vakhariya, Dr.C.S. Magdum, Rajarambu College Of Pharmacy, Kasegaon, Dist. Sangli, Maharashtra, India, 2020.
- [4]. Atul Kadam, Shithalkumar, Sachin Patil, Anil Tumkur, Ashokrao Mane College Of Pharmacy, Peth Vadgaon, Kolhapur, INDIA, Department Of Pharmacy Practice, Internstional Medical university, Kuala Lumpur, MALAYSIA, 2016.
- [5]. P.S. Patil, S.R, Kumbhoje, S.S. Patil, Ashokrao Mane College Of Pharmacy, PethvdgON, Tal- Hatkanamgle, Dist- Kolhapur, 2015.
- [6]. Muhamad Jaseem, Dept Of Pharmaceutics, Pramod Kumar, Dept Of Pharmaceutics and Remya Mariam John, Dept Of Pharmaceutics, 2017.
- [7]. Shivangi Upadhyay & Alok Sinha, 2022.
- [8]. Solomon Ahmed Mohammed, Mesfin Haile Kahissay, Abel Demerew Hailu, 2021.
- [9]. Brooke Brown, 2022
- [10]. Yu Fei Xia and Betty Hui Yu Zhang, McMaster University, 2020.
- [11]. Priya Datta (Dept OF Microbiology), Gursimran Kaur Mohi, Jagdish Chander, 2018.
- [12]. Madhu Bala, (Dept Of Environmental Engineering), Delhi Technological University.
- [13]. Sunil Kumar, Stephen R. Smith, Geoff Fowler, Costas Velis, S. Jyoti Kumar, Shashi Arya, Rena, Rakesh Kumar and Christoper Cheeseman, 2017.
- [14]. Malini R. Capoor, Annapurna Parida, (Dept Of Microbiology) Safdarjung