

## Pharmaceutical waste management and it's impact on environmental

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### Abstract

Pharmaceutical disposal is an important part of pharmaceutical industry which gain more awareness from the healthcare and consumer. Pharmaceutical waste is an alarming issue demand of production of pharmaceuticals increases with increasing the population. Pharmacist has potential to increase awareness and educate people about safe drug disposal management. Pharmaceutical waste is an hazardous, harmful and infectious it also cause cancer. That's why it require proper manager to protect environment. In pharmaceutical disposal include discarded gloves, used bandages, human tissue. Pharmaceutical waste cannot be disposed so it require a special handling. Different regulatory bodies participating to prevent pollution such as environmental protection organisation, waste management agencies and government agencies.

**Keywords:** Pharmaceutical waste disposal, waste disposal regulations, environmental impact assessment, healthcare waste management, pharmaceutical waste recycling

### Introduction

Pharmaceutical waste management has become increasingly critical in recent years as the pharmaceutical industry continues to grow. This article delves into the profound importance, multifaceted advantages, some disadvantages,

essential keywords, practical applications across various sectors, the evolving future scope, and the far-reaching environmental consequences associated with pharmaceutical waste management.



Fig 1: Information about pharmaceutical waste

### Advantages

1. **Public Health Protection:** Perhaps the most immediate advantage is the safeguarding of public health. Proper pharmaceutical waste management significantly reduces the risk of contamination from expired or unused medications, mitigating potential health hazards.
2. **Environmental Preservation:** Beyond human health, responsible waste management helps preserve the environment. The disposal of pharmaceutical compounds into water bodies has farreaching consequences on water quality, affecting aquatic life and ecosystems.
3. **Regulatory Compliance:** Adhering to stringent waste disposal regulations is not just about avoiding legal consequences; it's about promoting responsible corporate citizenship in the pharmaceutical sector and within healthcare facilities.
4. **Resource Recovery:** An often-underestimated advantage is the potential for resource recovery. Some pharmaceutical waste can be repurposed, recycled, or transformed into valuable resources, reducing overall resource wastage.
5. **Cost Reduction:** Efficient pharmaceutical waste management can translate into significant cost savings over time, as proper disposal practices can lead to reduced disposal expenses and regulatory fines.

### Disadvantages

1. **Complexity:** The management of pharmaceutical waste is inherently complex due to the wide variety of waste types generated and the intricacies of waste regulations that can vary by region.
2. **Costly Compliance:** Achieving and maintaining compliance with ever-evolving disposal requirements can be a substantial financial burden, particularly for smaller pharmaceutical companies and healthcare facilities.
3. **Limited Awareness:** A pervasive issue is the limited awareness among healthcare professionals and the general public about proper pharmaceutical waste disposal practices, which can hinder the adoption of responsible waste management.
4. **Environmental Contamination:** Inadequate disposal methods, such as flushing pharmaceuticals down the toilet, can contribute significantly to the pollution of water bodies, potentially causing harm to aquatic ecosystems.
5. **Resistance to Change:** Institutional and cultural resistance to adopting eco-friendly practices can impede progress in pharmaceutical waste management, making it challenging to implement necessary changes.



Fig 2: Pharmaceutical Waste

### Objectives

1. Reduce the environmental and health hazards that arise from indiscriminate dumping of waste and pollution of natural resources like the land, sea etc.
2. To collect information of disposal waste management from different countries
3. Minimize the Production of Waste.
4. Reduce Pollution Effects.
5. Protect Groundwater Sources.
6. Ensure Sustainability

### Applications

Pharmaceutical waste management finds applications in various sectors, including

1. **Hospitals and Clinics:** Ensuring safe disposal of expired drugs and hazardous materials.
2. **Pharmaceutical Manufacturing Facilities:** Properly managing waste generated during drug production.
3. **Research Laboratories:** Handling and disposing of hazardous chemicals and pharmaceutical byproducts.
4. **Pharmacies:** Implementing responsible disposal practices for unused medications.
5. **Home Medicine Disposal Programs:** Educating the public on safe disposal options for pharmaceutical waste.

### Pharmaceutical waste sources

#### 1. Solid Pharmaceutical Waste

- Solid pharmaceutical waste generally encompasses used items containing pharmaceutical residues: Sharps, including scalpels, needles and syringes

- Contaminated items like gloves, masks, bandages and IV bags and tubing
- Drugs containing hazardous or non-hazardous chemicals
- Empty receptacles like pill bottles, blister packs, liquid medicine, Liquid Pharmaceutical Waste

2. Liquid pharmaceutical wastes accrue as pharmaceutical manufacturing facilities perform certain processing operations. Examples of these wastes include sludge from chemical processing and contaminated solvents from tank cleaning.

3. Unused liquid medicines are sometimes classified as pharmaceutical waste, though in some areas, such as Michigan, they are liquid industrial byproducts and subject to different regulations.

### Role of pharmacist in Pharmaceutical waste management

Pharmacists play a pivotal role in understanding the limitations of many medications and bear the responsibility of transforming the entire medication process. Their role encompasses prescription management, guidance, dispensation, pharmaceutical care, and the proper disposal of expired medicines, all aimed at reducing the environmental impact of pharmaceuticals. Additionally, pharmacists safeguard patient well-being by educating them about adverse reactions, potential interactions with other substances, and proper medication usage and disposal. This

concerted effort can raise awareness about medication use and misuse, promote responsible disposal practices, and subsequently mitigate environmental risks. Pharmacists, as trusted sources of drug information, empower individuals of all ages with essential knowledge about medications. They also take the lead in advocating for responsible drug disposal methods to end-users. Continuing education and training are vital to increase awareness of the environmental hazards associated with indiscriminate disposal of pharmaceutical products. Pharmacists, with their expertise, can offer valuable guidance on effective waste disposal methods. Furthermore, pharmacists can contribute to their

communities by opening affordable medicine retail shops to assist underserved populations.

Drug disposal initiatives and pharmaceutical collection events not only facilitate safe disposal but also allow for a deeper examination of the root causes of medication waste. Addressing issues like unused or unwanted drugs, accidental overdoses, and prescription drug abuse is crucial for societal well-being and environmental protection. Pharmacists are well-equipped to provide guidance on proper medication disposal, raise awareness about drug abuse, and participate in various environmental protection initiatives through NGOs.



Fig 3: Role of pharmacist in Pharmaceutical waste management

## Methodology

Pharmaceutical waste management and disposal in India pharmaceutical waste management describe pharmaceutical waste rules which describe various methods tools for proper disposal management.

### 1. Incineration

Incineration is an effective process for management of disposal waste, in which solid organic get combustion then it get converted into residue and gaseous product. This process reduces the 20to30% volume of solid waste from its initial volume. This method used in small scale also in large s it used to dispose solid, liquid, gas wastes. Incineration is a controversial method of waste disposal, due to issue of emission of gaseous pollutant.

### 2. Autoclaving

A waste autoclave is a form of solid waste treatment that uses heat, steam and pressure of an industrial autoclave in the processing of waste. Waste autoclaves process waste either in batches or in continuous flow processes. In batch processes, saturated steam is pumped into the autoclave at temperatures around 160 °C.<sup>[1]</sup> The steam pressure in the vessel is maintained up to 6 bar (gauge) for a period of up to 45 minutes to allow the process to fully 'cook' the waste. The autoclave process gives a very high pathogen and virus kill rate, although the fibrous products which come from the process are susceptible to bacteria and fungus as they are high in starch, cellulose and amino acids.

### 3. Chemical disinfection

This method is most efficient method for liquid waste such as blood, urine, stool etc. The crushed hospital waste is mixed with chemical disinfectant such chlorine dioxide,

sodium hypochlorite and stay for sufficient time during this process organic molecule get decomposed and microorganism get killed.

### 4. Deep burial

1. A pit should dug 2meter then it filled half by using waste then it covered 50cm before filling rest pit with soil.
2. To ensure animal do not have any access to burial site cover with mesh wire.
3. Waste added in a pit a layer of 10cm of soil added to cover waste.
4. Pit stay away from human habitation to ensure no contamination occur on surface or ground water.
5. Location for Deep burial or Pit should be authorized by prescribed authority.
6. The institution will make record of each pit.

### Precaution to be taken at the time of disposal

Make sure that you always segregate your waste products to prevent chemical reactions from happening. Solids, liquids, and gasses should all be separated for disposal. Furthermore, be sure to follow government guidelines of how to separate chemicals into the appropriate categories. Waste Prevention are practices that limit or cut down the amount and/or the toxicity of wastes that are generated at home, work, school and in your everyday life prior to recycling, treatment or disposal. Waste Prevention is also referred as Source Reduction and Waste Minimization. Waste Prevention is NOT recycling.



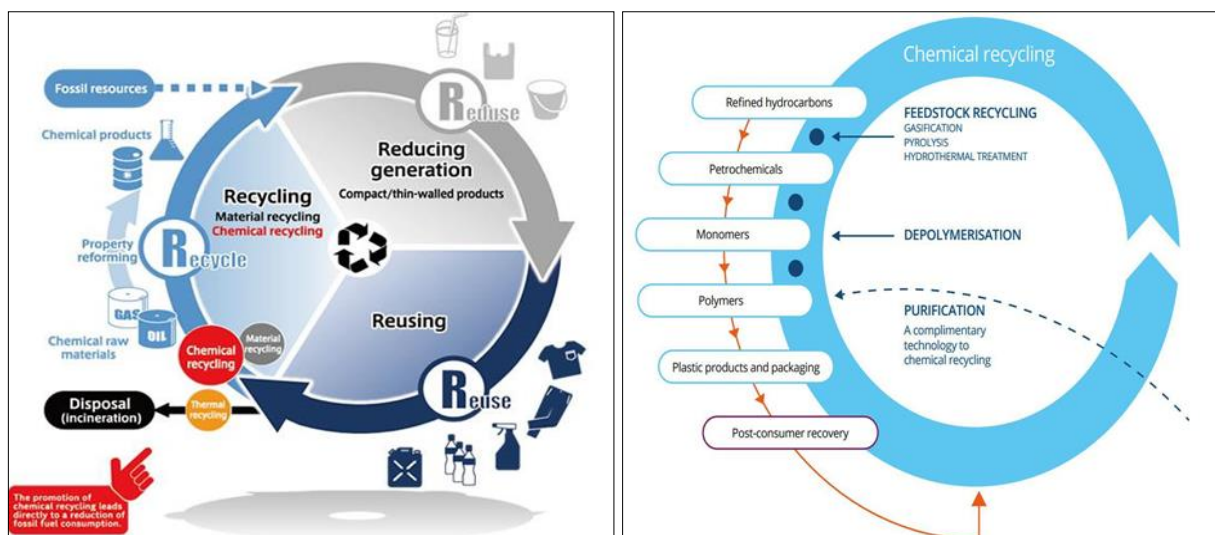


Fig 4: Reduce, reuse, recycle

### Future Scope

The future of pharmaceutical waste management is promising and includes:

1. **Advancements in Waste Separation and Recycling Technologies:** Developing innovative methods to efficiently separate and recycle pharmaceutical waste.
2. **Increased Public Awareness and Education:** Expanding awareness campaigns to inform healthcare professionals and the public about proper disposal practices.

3. **Collaboration between Stakeholders:** Collaborative efforts between pharmaceutical companies, environmental organizations, and government bodies to address waste management collectively.
4. **Eco-Friendly Pharmaceuticals:** Researching and developing pharmaceuticals with reduced environmental impact throughout their lifecycle.
5. **Stricter Regulations and Enforcement:** Anticipating and adapting to stricter waste disposal regulations and more robust enforcement mechanisms.

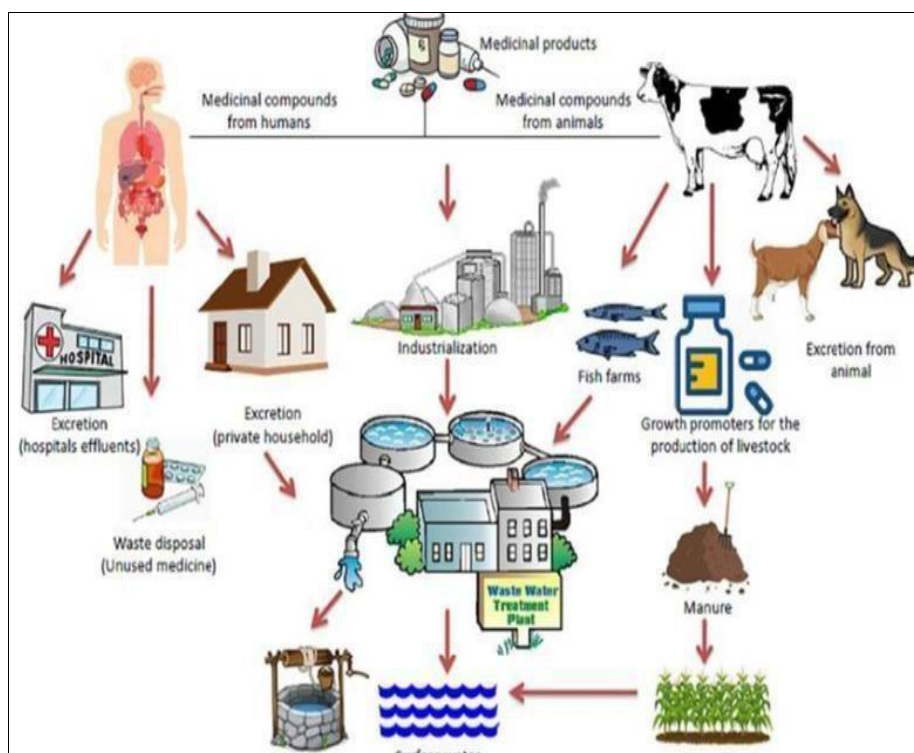


Fig 5: Preventative Major

### Conclusion

Efficient pharmaceutical waste management is indispensable for preserving public health and mitigating the far-reaching environmental consequences associated with pharmaceutical production and consumption. Pharmaceutical waste is hazardous to health of human, It

affect to environment also, pharmaceutical waste management is challenge to pharmacist and all medical staff who are work in different agencies of government. It is duty of Government, NGO's, Public should work together and reduce unused, expired waste in environment. Proper waste management is required for public safety.

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