

Research Paper



The impact of medical waste on the environment and methods of disposal

Yusra A. Radeef^{*}

^{*}Department of Biology, College of Science, University of Babylon, Babylon, Iraq.

Article Info

Article History:

Received: 07 July 2023

Revised: 18 September 2023

Accepted: 24 September 2023

Published: 11 November 2023

Keywords:

Medical Waste

Environment

Health Care

Hospitals

Hazardous Waste

ABSTRACT

Every person has the right to obtain necessary health care. Health services have developed greatly over time and today reach very high levels; however, despite the benefits they provide, they generate medical waste, which is unlike ordinary waste because it contains toxic chemical and metallic substances as well as sharp instruments that are dangerous to the environment and living organisms. This paper reviews the definition and classification of medical waste, its impacts on human health and the environment, and the main methods used for its sorting, treatment, and disposal in hospitals.



Corresponding Author:

Yusra A. Radeef

Department of Biology, College of Science, University of Babylon, Babylon, Iraq.

Email: sci.yusra.ali@uobabylon.edu.iq

Copyright © 2023 The Author(s). This is an open access article distributed under the Creative Commons Attribution License, (<http://creativecommons.org/licenses/by/4.0/>) which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

1. INTRODUCTION

How does medical waste affect the environment, and how can it be managed? Human development in industrial, chemical, and medical fields has been accompanied by harmful effects on the environment,

including air and water pollution, heat retention, and damage to fisheries. Medical waste is an important component of environmental pollution: it is considered one of the most dangerous pollutants because it can cause serious diseases that spread rapidly among people, and it has become a major challenge for the contemporary environment in general and for health institutions in particular [1]. The large quantities of medical materials made of plastic that are used in hospitals and health centres pose a great danger to the environment; according to previous studies, 85% of single-use medical supplies are made of plastic, with negative impacts on human health [2]. Medical waste poses the first danger to health workers and care providers, such as doctors and nurses, who deal with it daily, and it also endangers the environment when it is disposed of improperly, contributing to the pollution of air, water, and soil.

1.1 What Is Medical Waste?

Medical waste comprises all waste produced by health facilities such as hospitals, pharmacies, medical and surgical clinics, dental clinics, medical analysis laboratories, and scientific research laboratories. It includes solid, liquid, and gaseous waste resulting from the diagnosis, prevention, and treatment of human or animal diseases and from related research. Depending on their quantity, concentration, and physical and chemical properties, these substances can affect public health, increase mortality, and harm the environment if they are treated, stored, transported, or disposed of improperly. As defined by the World Health Organization, health-care waste includes all waste generated by health-care establishments, as well as waste from minor or scattered sources, including health care provided at home, such as dialysis and insulin injections [3].

2. CLASSIFICATION OF MEDICAL WASTE

- **Ordinary (Non-Hazardous) Medical Waste:** Waste that does not pose a threat to human health, such as paper, empty bottles, and non-hazardous drug residues [3].
- **Hazardous Medical Waste:** Waste generated from examination, diagnosis, treatment, surgery, autopsy, and laboratory testing that poses serious risks to humans and the environment if handled unsafely; it constitutes 10–25% of all medical waste [3].
- **Biological (Pathological) Waste:** Extremely dangerous waste that includes surgical remains such as removed organs and tissues, body fluids, and blood, which may contain many pathogens, as well as laboratory residues of analysis fluids and samples and the products of chemical reactions discarded after analysis [4].
- **Radioactive Waste:** Waste contaminated with radioactive materials used in diagnosis and therapy, which emit ionizing radiation such as X-rays and gamma rays [3]. Exposure can damage genetic material and, with highly radioactive sources, destroy tissue to the point of requiring amputation; effects range from dizziness and headache to serious damage to the genetic content of cells, depending on the dose and type of radiation.
- **Infectious Medical Waste:** Waste expected to contain pathogens (bacteria, viruses, parasites, or fungi) in concentrations or quantities sufficient to cause disease [3].

Medical waste may therefore have serious impacts on human health in general and on health-care workers in particular, causing many serious diseases and injuries that may lead to death, including reproductive tract infections from samples contaminated with secretions of sexually transmitted infections, intestinal infections from *Salmonella* and *Shigella* in waste contaminated with patients' faeces or vomit, and meningitis after exposure to waste contaminated with cerebrospinal fluid [5].

3. IMPACT OF MEDICAL WASTE ON THE ENVIRONMENT AND HEALTH

Medical waste is a problem for workers in the medical field because of its dangers, and it requires special handling methods to prevent infection and avoid harmful effects on humans and the environment [6]. With the great expansion of health services and the advancement of medical technologies, medical waste from hospitals and health centres has become the focus of great attention regarding how to treat and

dispose of it and avoid its side effects, because it may pollute the environment or affect the health of individuals and communities through the transmission of infection [7]. The health risks of medical waste are not limited to health-sector workers but may extend to other members of the community who are exposed to the waste or its effects, and increased attention to medical waste has drawn attention to its environmental risks and its impact on environmental health [5].

4. METHODS OF WASTE DISPOSAL IN HOSPITALS

- **Sorting (Segregation):** Separating ordinary waste from hazardous medical waste at the point of generation into designated containers, so that each type is treated safely and the two types are not collected together.
- **Colour Coding:** A colour-coding system for all containers (bags, bins, etc.) designated for each type of waste; for example, black for ordinary waste and yellow for infectious medical waste.
- **Incineration:** The most common method for treating hazardous medical waste: a high-temperature dry oxidation process that greatly reduces the volume and weight of organic and combustible waste and kills pathogens, but produces gases such as carbon and nitrogen oxides and other toxic gases, as well as ash containing toxic substances [1].
- **Storage (Isolated Collection):** The collection and holding of waste before treatment or disposal, which may be in surface facilities or in deep geological repositories for radioactive waste or waste mixed with hazardous materials [8].
- **Recycling:** Reusing waste that would otherwise be disposed of, including introducing it into processes that produce other products.
- **Encapsulation:** Placing waste in high-density plastic containers or metal drums, filling them with plastic foam, cement mortar, or clay, and burying them in landfill sites; it is usually used for pharmaceutical and sharps waste.
- **Chemical Disinfection:** Adding disinfectant chemicals to waste to kill pathogens; it is used for some pathological wastes such as blood, urine, and patient secretions, while sharps require shredding before chemical treatment.
- **Steam Sterilization (Autoclaving):** Exposing waste to high temperature and pressure; it is used for sharps and laboratory waste such as bacterial culture dishes.
- **Microwave Treatment:** Exposing shredded and moistened waste to high-frequency waves that rapidly heat the waste liquids and kill pathogens; it is used for infectious and pathological waste.
- **Inertization:** Mixing waste with cement or lime before final disposal to reduce the risk of toxicity; it is used for pharmaceutical waste and incineration ash containing heavy metals [3].

Acknowledgments

The author thanks the researchers whose works have been cited in this paper.

Funding Information

This research has received no external funding.

Authors Contributions Statement

Name of Author	C	M	So	Va	Fo	I	R	D	O	E	Vi	Su	P	Fu
Yusra A. Radeef	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

C : Conceptualization

M : Methodology

So : Software

Va : Validation

Fo : Formal analysis

I : Investigation

R : Resources

D : Data Curation

O : Writing - Original Draft

E : Writing - Review & Editing

Vi : Visualization

Su : Supervision

P : Project administration

Fu : Funding acquisition

Conflict of Interest Statement

No conflict of interest.

Informed Consent

Not Applicable.

Ethical Approval

Not Applicable.

Data Availability

This study draws on publicly available data. No new datasets were created.

REFERENCES

- [1] E. S. Windfeld and M. S.-L. Brooks, "Medical waste management—A review," *J. Environ. Manag.*, vol. 163, pp. 98–108, 2015. doi.org/10.1016/j.jenvman.2015.08.013
- [2] E. J. North and R. U. Halden, "Plastics and environmental health: The road ahead," *Rev. Environ. Health*, vol. 28, no. 1, pp. 1–8, 2013. doi.org/10.1515/reveh-2012-0030
- [3] Y. Chartier, J. Emmanuel, U. Pieper, A. Prüss, P. Rushbrook, R. Stringer, W. Townend, S. Wilburn, and R. Zghondi, Eds., *Safe Management of Wastes from Health-Care Activities*, 2nd ed. Geneva, Switzerland: World Health Organization, 2014.
- [4] Z. Singh, R. Bhalwar, J. Jayaram, and V. W. Tilak, "An introduction to essentials of bio-medical waste management," *Med. J. Armed Forces India*, vol. 57, no. 2, pp. 144–147, 2001. [doi.org/10.1016/S0377-1237\(01\)80136-2](https://doi.org/10.1016/S0377-1237(01)80136-2)
- [5] M. O. Harhay, S. D. Halpern, J. S. Harhay, and P. L. Olliaro, "Health care waste management: A neglected and growing public health problem worldwide," *Trop. Med. Int. Health*, vol. 14, no. 11, pp. 1414–1417, 2009. doi.org/10.1111/j.1365-3156.2009.02386.x
- [6] M. S. Hossain, A. Santhanam, N. A. N. Norulaini, and A. K. M. Omar, "Clinical solid waste management practices and its impact on human health and environment—A review," *Waste Manag.*, vol. 31, no. 4, pp. 754–766, 2011. doi.org/10.1016/j.wasman.2010.11.008
- [7] M. Ali, W. Wang, N. Chaudhry, and Y. Geng, "Hospital waste management in developing countries: A mini review," *Waste Manag. Res.*, vol. 35, no. 6, pp. 581–592, 2017. doi.org/10.1177/0734242X17691344
- [8] The Geological Society of London, "Geological disposal of radioactive waste," Geological Society, London, U.K., 2020. [Online]. Available: <https://www.geolsoc.org.uk>

How to Cite: Yusra A. Radeef. (2023). The impact of medical waste on the environment and methods of disposal. *Journal of Environmental Impact and Management Policy (JEIMP)*, 3(2), 100–104. <https://doi.org/10.55529/jeimp.36.12.16>

BIOGRAPHIE OF AUTHOR

Yusra A. Radeef^{ORCID} is affiliated with the Department of Biology, College of Science, University of Babylon, Babylon, Iraq. Her academic and research interests include biology, environmental biology, biodiversity, ecology, and the study of biological systems. Her research focuses on contributing to scientific understanding of biological processes and their relevance to environmental and ecological challenges. Through her academic work, she aims to support the advancement of biological sciences and promote a

	deeper understanding of living organisms and their interactions with the environment. Email: sci.yusra.ali@uobabylon.edu.iq
--	---