The impact of medical waste on the environment

تأثير النفايات الطبية على البيئة

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Abstract :

The study aims to reveal the impact of medical waste on the environment, as we are witnessing a significant expansion in medical services and health facilities today. However, we still suffer from the problem of medical waste, which is classified as one of the most dangerous types of waste because it contains infectious or toxic materials, if it is not treated properly. The study concluded that medical waste can lead to soil, water and air pollution, and cause the spread of infectious diseases, especially when it is disposed of unsafely. Therefore, it is essential for healthcare facilities to adopt strict procedures for disposing of medical waste to ensure the protection of the environment and the health of the community .

Keywords :environment; waste; medical waste; pollution; health facilities.

الملخص:

تهدف الدراسة إلى كشف تأثير النفايات الطبية على البيئة إذ نشهد اليوم توسعا كبيرا في الخدمات الطبية والمنشآت الصحية، بالمقابل لا زلنا نعاني من مشكلة النفايات الطبية التي تصنف من أخطر أنواع النفايات لاحتوائها على مواد معدية أو سامة، إذا لم تتم معالجتها بطريقة صحيحة، وتوصلت الدراسة إلى أن النفايات الطبية يمكن أن تؤدي إلى تلوث التربة والمياه والهواء، كما تتسبب في انتشار الأمراض المعدية، خاصة عندما يتم التخلص منها بشكل غير آمن. لذلك من الضروري أن تتبنى المنشآت الصحية إجراءات صارمة للتخلص من النفايات الطبية لضمان حماية البيئة وصحة المجتمع.

الكلمات المفتاحية: البيئة -النفايات - النفايات الطبية -التلوث –المنشآت الصحية.

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Introduction:

There is no doubt that the problem of environmental pollution is closely linked to development methods. Environmental pollution is considered one of its greatest complications, despite the considerable benefits that technological progress brings to all. Environmental pollution generally refers to any change in the natural, chemical, and biological characteristics of the environment in which humans live, resulting in extremely harmful effects on their health.

Among the means of modern development are, of course, medical advances in all fields aimed at preserving human health, combating various diseases, providing first aid, and other modern medical tools, as well as the advancement of surgery, radiology, and other medical fields. However, there is a downside to medical advances and procedures: environmental pollution with various medical contaminants, which can lead to serious and often fatal harm to humans.

Solid medical waste is associated with danger because it is produced from hazardous materials. We do not deny that this association is in fact a charge due to the nature of the waste itself, even though the portion of this waste that constitutes a danger does not represent a large proportion of the total volume of chemical waste.

Perhaps what makes the matter even more difficult and complex is the failure to take into account the nature of the waste and adhere to public health regulations. Let us point out that this waste may be no more than other industrial or chemical waste. From an academic perspective, this waste must be classified to accurately determine the risk. We note that the problem does not lie with the waste itself, as much as it lies in the lack of scientific research, particularly in developing world countries.

2- Methodological Approach

This study adopts a descriptive–analytical approach, which combines the collection of descriptive information on the issue of medical waste with an analytical evaluation of its environmental impacts. The descriptive method allows for the identification of the current state of medical waste management in healthcare institutions, while the analytical dimension provides a critical assessment of how improper waste disposal practices contribute to air, water, and soil pollution. This approach was chosen because it enables a comprehensive understanding of both the environmental and health dimensions of the problem, emphasizing the importance of integrated and sustainable management solutions.

3- The conceptual framework of the topic

2-1-Définition of environnement:

The environment is defined as the medium in which humans and other living organisms live and in which they carry out their various activities. (El-Mohammadi, 2017, p. 22). It is also defined as all the external conditions and factors surrounding the individual or creature, whatever it may be, that affect it directly or indirectly. (El-Saaid, 2000, p. 9).

From the above, we can say: that the environment is the area in which humans exist and share with other living organisms that interact with each other.

2-2-Definition of waste:

Waste is all the remnants of production, transformation, or use processes. It includes any material, product, or filter whose owner intends or is obligated to dispose of it (National Waste Agency, 2019, p. 10).

It is well known that waste has also become the things we need (El-Shamsi, 2023, p. 11).

From the above, we can say that: waste is anything that actually has some utility and can be disposed of.

2-3-Definition of medical waste:

It includes all waste related to diagnosis, follow-up, and treatment, whether palliative or therapeutic, in the human and veterinary medical sectors, as well as all work-related waste, whether palliative or therapeutic, in the human and veterinary medical sectors, as well as all waste that causes explosions in hospitals, clinics, and research scientific and analytical laboratories operating in these fields, as well as all similar institutions. (Ajzoul, 2013, p. 9).

Medical waste is defined as the product of medical activity that may lead to environmental pollution or harm the health of living organisms. (AbouEl-Again, 2011, p. 62).

Based on the above, we can say that: medical waste is the residual material resulting from therapeutic or preventive activities directed at humans or animals, or from scientific experiments and research.

4- Classification of Medical Waste

Medical waste has been classified by various entities, the most important of which are the following:

3-1- The World Health Organization's classification of medical waste:

75% to 90% of waste generated from healthcare facilities is considered non-hazardous waste or near-household waste and is often generated from the administrative and housekeeping functions of healthcare facilities and may also include waste generated during healthcare building maintenance operations.

The remaining 10 to 25% of healthcare waste is considered hazardous and may pose various health risks. What concerns us here is hazardous medical waste, which has been classified as follows (World Health Organization, 2006, p. 3):

3-1-1 -Infectious waste:

Materials suspected of containing pathogens (bacteria, viruses, parasites, or fungi) in a concentration or quantity sufficient to cause disease in susceptible hosts. This category includes waste contaminated with blood or other body fluids.

3-1-2- toxic waste:

toxic waste is highly hazardous and can have mutagenic, teratogenic, or carcinogenic properties. This waste poses serious safety concerns both within hospitals and after disposal and must be given special attention. toxic waste can contain cytostatic drugs, chemicals, and radioactive materials.

3-1-3- Chemical waste:

Chemical waste from healthcare can be hazardous or non-hazardous. In terms of health protection, chemical waste is considered hazardous if it has at least one of the following characteristics: toxic, corrosive, flammable, reactive, explosive, or genotoxic.

3-1-4- Waste with high heavy metal content:

Waste containing high levels of heavy metals represents a subcategory of hazardous chemical waste and is typically highly toxic. Mercury waste is generated by spills from broken clinic instruments. Dental waste contains high mercury content. Cadmium waste is primarily generated from spent batteries.

Some lead-containing laminated wooden panels are still used for radiation shielding in x-ray and diagnostic departments. A number of drugs contain arsenic, but they are treated here as pharmaceutical waste.

3-1-5- Pathological waste:

Waste consists of tissue fragments, organs and body parts, aborted fetuses, animal carcasses, blood and body fluids also called human body or viruses that can

be distinguished as anatomical waste within this category and must be classified as a subcategory of waste even if it contains non-diseased body parts.

3-1-6- Sharp tools:

Sharps are items that can cause cuts or puncture wounds and include needles, hypodermic needles, scalpels, blades, knives, implants, saws, broken glass, and nails. Such items are generally considered high-risk healthcare waste, whether contaminated or not.

3-1-7- Pharmaceutical waste:

Pharmaceutical waste includes expired medicines and other used and spilled products, contaminated pharmaceutical products, medicines, syringes and serums that are no longer needed and require disposal, this category includes items used in the handling of pharmaceuticals, such as bottles or boxes containing pharmaceutical residues, gloves, masks, connecting tubes, and medicine bottles.

3-1-8- Compressed packages:

Many types of gases are used in healthcare, often stored in pressurized cylinders, cartridges, and aerosol canisters. Many of these containers and cylinders, whether empty or no longer in use, can be reused, but some types, particularly aerosol canisters, must be disposed of.

3-1-9- Radioactive waste:

Radionuclides are substances contaminated with radionuclides, produced as a result of procedures such as laboratory analysis of tissues and body fluids, in vivo organ imaging and tumor localization, and various investigational and therapeutic practices. These include liquids, gases, and solids contaminated with radionuclides whose ionizing radiation has genotoxic effects. Ionizing radiation of medical importance includes X-rays and ray radiation, as well as CX and B particles.

3-2- National Waste Agency Classification:

The classification of medical waste depends on the absence or presence of hazards and the nature of these hazards. It is estimated that 80-85% of the waste produced by healthcare facilities is non-hazardous waste, while the remaining 15-20% is considered hazardous to health and the environment. There are two main categories of waste from medical activities: hazardous waste and non-hazardous waste (National Waste Agency, 2019, p. 24).

The latter is classified into four categories similar to the WHO classification, except that it combines two or more categories under one name:

3-2-1 Infectious medical waste:

Which represents an infectious hazard because it contains or may contain living microorganisms whose toxins may affect human health, and includes sharp waste and soft or solid waste.

3-2-2- Hazardous chemical and/or toxic waste:

This includes products that are harmful to cells, pharmaceutical waste, and waste containing heavy metals.

3-2-3- Human organ waste:

Defined as "all waste resulting from human limb operations from operating rooms and delivery rooms."

3-2-4 Radioactive Waste:

Nuclear medicine departments handle radioactive elements that generate radioactive waste by disposing of them according to a series of white paper procedures as specified in the national regulations.

5- Impact of medical waste on the environment:

Medical waste has a negative and widespread impact on the environment, threatening the health of humans, animals, and ecosystems. This impact is evident through the infringement of the essential interests of the environment through its

components, as well as the infringement of improvement interests (El-Dabassi, 1433, p. 37). These impacts can be summarized as follows:

4-1 Air pollution:

Air pollution is caused by medical waste through the release of pollutants including vapours of toxic chemicals resulting from the irregular burning of hazardous waste. The burning of medical waste, especially plastics and chemicals, also results in the emission of toxic and air-polluting gases such as dioxins and furans, which are known for their ability to cause cancer and respiratory diseases (Labsir, 2023, p. 116).

In addition to the emission of fine particles and dust from exposed medical waste collection sites, it pollutes the air and affects air quality. Reactive or radioactive chemical waste is one of the most important causes of polluted air and an infected environment that threatens the lives of humans and animals.Also, the waste resulting from surgical and autopsy procedures, such as tissues, organs, and blood, which, if not disposed of in the prescribed manner, cause infection and foul odors, which spoil the purity of the air and create a suitable environment for the proliferation of harmful germs and viruses.

4-2-Soil Contamination:

The chemicals, heavy metals, and pesticides found in medical waste contaminate soil, affecting its fertility and ability to support plant life. Pathogens contaminate soil and pose a threat to public health.

The unsafe management of flammable chemicals causes many fires that destroy many forms of life and beauty on this earth. It also pollutes the soil and harms its plants and the microscopic biological organisms found in it, and extends to humans through the food chain (Saber, 2000, p. 38).

Some pharmaceutical waste also has devastating effects on natural ecosystems, such as the residues of antibiotics and drugs used to treat cancer, which can kill existing microorganisms essential to those ecosystems, as well as cause mutations and deformities in surrounding organisms.

The presence of large quantities of liquid medical waste from hospitals, mixed with heavy metal residues such as mercury, phenol compounds and their toxic derivatives, and some sterilization and disinfection products, also contributes to the destabilization of these systems.

4-3- Water Pollution:

Water pollution is a form of corruption caused directly or indirectly by humans. Despite people's awareness of the importance of water, they insist on using it as a means of disposing of organic waste, toxic or radioactive chemicals, and harmful bacteria and microbes. Hazardous chemicals from medical waste leak into surface and groundwater (Labsir, 2023, p. 119).Polluting it and affecting its quality, affecting aquatic organisms and making it unfit for human consumption. Improper handling and disposal of medical waste can have far-reaching effects on human and ecological health. Toxic emissions from the burning of plastics and chemical waste can release carcinogenic compounds such as dioxins and furans (WHO, 2022). Additionally, untreated liquid waste can contaminate water sources, threatening aquatic life and public health (UNEP, 2023).

6- The Harmful Effects of Medical Waste:

The claim that human aggression against air, soil, and water affects the essential interests of human societies stems from the fact that the conflict with the environment and the deliberate destruction of it by humans constitutes an indirect aggression against themselves and their existence, given the harm caused to their environment.It must move to it, as it breathes its air and cannot do without its water or the blessings

that its soil provides to it. Corrupting that means corrupting all forms of life on Earth, including human life.

Environmental pollution by hazardous waste, although it may seem at first glance to be a local problem, is a global catastrophe. Pollutants are influenced by many factors that do not recognize political boundaries. They are characterized by their ability to move and transfer from one location to another in the short or long term. Winds, clouds, and water currents contribute to transporting vapors, smoke, and harmful gases to remote countries and places far from them.

Therefore, the assault on nature and its components leads, over time, to environmental degradation until many human activities, including medical activities, which were originally designed to bring progress and development, become a cause of destruction and backwardness.

Regardless of the health damages of medical waste of all kinds, there is a lack of acceptance and dissatisfaction, and a great sensitivity to seeing the waste of health institutions containing human remains from surgical waste, human organs and placentas, or seeing contaminated blood remains here and there. In all human civilizations, it is absolutely rejected to throw organs and human remains from operations with the waste and then throw them in public landfills.

The accumulation of medical waste in front of nursing homes deprives the environment of its beauty and gives the viewer the impression of a great deal of chaos and neglect, which is reflected in the interests of improving the environment (El-Dabassi, 1433, p. 41).

It is inevitable that the damage to health and the environment results in many other damages, such as economic, social, psychological and other damages. Projects to purify the environment from pollution and treat people from their chronic diseases and dangerous medications resulting from pollution cost countries huge budgets.

In addition, pollution destroys wealth that may be the only source of livelihood in some countries, contributing to the spread of poverty and unemployment, such as destroying agricultural wealth by spoiling the soil, poisoning crops, and poisoning aquatic organisms.Which affects the utilization of marine resources and the fishing profession, especially since the toxins that are released into the environment randomly, some of which remain for decades. Due to the severity of the impact of environmental crimes on economic aspects, some have classified the crime of environmental pollution as an economic crime.

As for the psychological damage, it is represented by the lack of environmental security for the person, as he feels that he is living in an unsuitable environment, polluted with dangerous waste and deadly toxins, which negatively affects his psyche and makes him a prisoner of illusion and obsessions regarding everything that comes to his hands, whether food or drink.

From a social perspective, the spread of unemployment, poverty, and the lack of income of individuals harms the social situation. Moreover, the injury or death of a relative or the occurrence of birth defects in some newborns due to these toxins has a negative impact on societies that cannot be ignored.

6-towards sustainable medical waste management

Sustainable management of medical waste requires an integrated strategy combining prevention, segregation, treatment, and safe disposal. Healthcare institutions must adopt environmentally sound technologies such as autoclaving, microwave disinfection, and non-incineration methods (WHO, 2023). Moreover, governments should enforce strict regulatory frameworks and encourage training programs to ensure proper implementation. Raising awareness among healthcare personnel and the public about the hazards of medical waste is also crucial for achieving long-term environmental sustainability (OECD, 2024).

Conclusion:

Medical waste is a serious environmental and health issue, as it contains materials that may be harmful to humans and wildlife. The concentration of toxic substances and potential infections found in this waste can lead to soil and water contamination, negatively impacting biodiversity and the health of communities.

When medical waste is left untreated, it contributes to the spread of disease and increases antibiotic resistance, further challenging healthcare systems. In addition, improper disposal of this waste can lead to the emission of harmful gases that contribute to climate change.

Therefore, it is essential to develop effective strategies for managing medical waste, including its safe collection, sorting, and treatment, and the implementation of strict legislation. In this regard, we offer the following key recommendations:

❖ Increase the amount of financial allocations allocated for medical waste disposal.

❖ Focus on developing and qualifying the workforce specialized in medical waste management.

❖ Expand licensing of qualified and certified medical waste management companies.

❖ Raising the level of oversight and supervision departments responsible for medical waste disposal and supporting them by expanding their workforce and budgets.

❖ Launching awareness campaigns to highlight the dangers of medical waste to the environment and human health.

❖ Establishing partnerships with media institutions to achieve awareness-raising objectives and implement them properly.

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