



Study Around the Management of Medical Waste and Its Impact on the Good Functioning of Health Services and How To Deal With It and the Resulting Damage

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Abstract: Four strains of Lactic Acid Bacteria (LAB), isolated from various Thai traditional fermented foods, were investigated on free radical scavenging activity of 2, 2-Diphenyl-1-Picrylhydrazyl (DPPH) and 2, 2-Azino-bis-3-ethylbenzothiazoline-6-sulfonic Acid (ABTS). Antioxidant activity by all isolated LAB in Intracellular Cell-Free Extracts (ICFE) was higher than in intact cells. The LAB strains FF and FB, isolated from fermented foods (fish and sliced beef), (ICFE) showed the highest radical-scavenging activity for DPPH and ABTS at 65% and 60%, respectively for the former strain. The detection of amino acid decarboxylase of LAB was investigated by growing on decarboxylase medium and quantitatively evaluated by confirming amine forming capacity using an HPLC procedure. All tested LAB strains were tyramine producers; however, the weakest strain was FF, followed by strain FB. In contrast, all of them did not produce histamine. Based on 16S rRNA genes, strain FF was identified as *Lactobacillus fermentum*, while strain FB was *Lactobacillus plantarum*. Both are potential starter cultures for producing fermented meat sausages.

Keywords: Medical waste, waste risk, segregation, color coding and health services

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I. INTRODUCTION

The value of disposing the medical waste in an appropriate way in the health facilities has emerged after it has been scientifically proven that the inappropriate management and disposal of these wastes can cause many diseases, including serious ones such as HIV and hepatitis viruses, namely hepatitis B and hepatitis C. Those diseases can be transmitted to victims by being injured by sharp instruments contaminated by patients blood or fluids, e.g., needles, scalpels [1]. Most of the developing countries don't have specific rules to govern the medical waste disposal and so, can't reduce the negative impact of those wastes on people [2].

It is different in the countries of the developed world where there are federal and state rules to regulate

safe disposal of the medical wastes, as long as some of the local governmental agencies, like that in the United States [2, 3].

Many health facilities and related research centers and pharmaceutical factories have been involved in the procedure of regulating the efficient management of all medical wastes to avoid the hazards of these waste on the peoples health [4].

Handling medical waste requires caution and full knowledge of its characteristics and methods of dealing with them from the origin of production to treatment till disposal.

This is to achieve the principle of integrated management of the safe disposal of these wastes which includes waste reduction, reuse of waste, waste recycling

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followed by recovery and disposal [5].



Fig. 1. Waste Disposal

II. WASTE IDENTIFICATION AND CLASSIFICATION

There are many different terms and definitions used in the field of safe waste disposal to describe any major activity or product in the field [6]. Due to the multiplicity of these definitions and their impact on the classification of wastes, the definitions contained in the publications have been adopted to the WHO Unified System for Health Care Waste Management in the GCC States and Arab Gulf, adopted by the Supreme Council at its twenty-second session [6, 7].

Waste of health care activities: It includes all the waste produced by health-care institutes, research establishments, and medical labs. It also involves the waste from minor or dispersed sources, e.g., those produced during health care occurred at home like insulin injection [7, 8].

There are two classifications of the medical waste, one of them is according to the infectivity and the type of hazard associated with the medical waste, and the other classification is according to the physical type of the medical waste. We are going to highlight the both classifications.

The first one is dividing the medical waste into:

A. General Health Care Waste

It constitutes 75-90% of the medical waste. These are all wastes that contain materials such as those found in municipal waste and are produced from administrative departments and general cleaning work inside health facilities, so they are comparable to the domestic waste and is treated as municipal waste [6, 9, 10].

B. Hazardous Health Care Waste

It includes all the chemical medical waste that can harm the human being in non-infectious way. e.g., old drugs and chemotherapeutics [9].

C. Infectious Health Care Waste

All the equipments soiled with patients fluids and tissues are supposed to be infectious. In addition, all the research animals bodies and fluids are considered infectious.

D. Radioactive Health Care Waste

This type includes the cancer medications and radioactive isotopes equipment. It is the lowest proportion of total healthcare waste as it is considered a risk to the individual, society, as well as, environment. This risk can happen during their production, collection, storage, transport or disposal [6, 9].

The second classification is according to the references of World Health Organization and also in according to the common system of Gulf Cooperation Council.

It classifies the medical waste into Ten categories exist (category code No 1 to 10) as listed here [11, 12].

1. Anatomical human waste: (organs and body parts).
2. Animal waste: (include animals used for researches as well as waste from veterinary hospitals or similar animal caring institutes).
3. Microbiological waste or biotechnology ones: (all waste from cultures at labs, biopsies of microorganisms, attenuated vaccines or live vaccines).
4. Sharps: (needles, syringes, scalpels, blades, glass etc.).
5. Discarded medications and cyto-toxic medications.
6. Soiled wastes: (that waste contaminated with any body fluids or blood, like dressings, plaster casts, bedding etc.).
7. Solid wastes: (includes waste from disposable items, e.g., tubes, catheters, intravenous sets, etc.).
8. Liquid waste: (those waste from washing, cleaning, and disinfection activities as well as activities in all laboratories).
9. Incineration ash: (resulting from incineration of all biological medical waste).
10. Chemical waste: (include chemical substances used in disinfection, old expired medications, etc.).



Fig. 2. Methods

TABLE 1
METHOD OF CLASSIFYING THE MEDICAL WASTES

1	Sharps	Waste Entailing Risk of Injury.
2	a. Waste carrying risk of contamination b. Anatomical waste c. Infectious waste * Blood or secretions, human parts or contaminated tissues.	* Large quantities of material, substances or cultures carrying the risk of disseminating infectious agents
3	a. Pharmaceutical waste 1. Chemical waste 2. Waste containing heavy metals 3. Cytotoxic waste	* Spilled medications, after date drugs and used medications. *Expired or leftover cytotoxic drugs, equipment contaminated with cytotoxic substances. *Batteries, mercury waste * Waste involving chemical substances: Solvents used in labs, disinfectants, etc. Cylinders containing gases and aerosol containers.
4	Pressurized containers	Radioactive substances used in lab, urine or excretions of patients.
5	Radioactive wastes	

The medical waste should be handled in an appropriate way in order not to cause human injury or harm during this risky process [13]. The first step of the safe disposal of them is the segregation at its source, this will

facilitate the process. Each type of the medical waste better put in a suitable bag with specific color and with the international infectious symbol painted on [14].



Fig. 3. Infectious waste

There should be available containers or bag holders to be distributed adequately in the places where specific categories of waste are generated. Clear instructions should be available at each collection point. The containers should be made of combustible, non-halogenated plastics and to be removed whenever they become three quarters full [14].

E. Red

It is used for anatomical waste which should be incinerated e.g., placenta and excised organs.

F. Yellow Bags

A color coding that means offensive/hygiene waste which may be incinerated or deep land filled. This type of waste can include items contaminated with body fluids, e.g., catheter bags or maternity waste.

G. Blue

This is for non-risky medical waste which should be incinerated. This may involve partially empty containers containing remnants of non-cytotoxic medications, expired medications, denatured drugs and waste medicines.

H. Black

Used for house-hold or municipal waste which are not containing any hazardous material, sharp instruments or medical products e.g., food and tissues.

I. White

Is left for waste of dental procedures, white color coding is used to hazardous materials such as dental amalgam or mercury to dispose them properly (or recycling or recovery) [14, 15].

Staff should not correct errors of segregation by removing items from a bag after disposal, or by placing one

bag inside another bag of a different color [14].

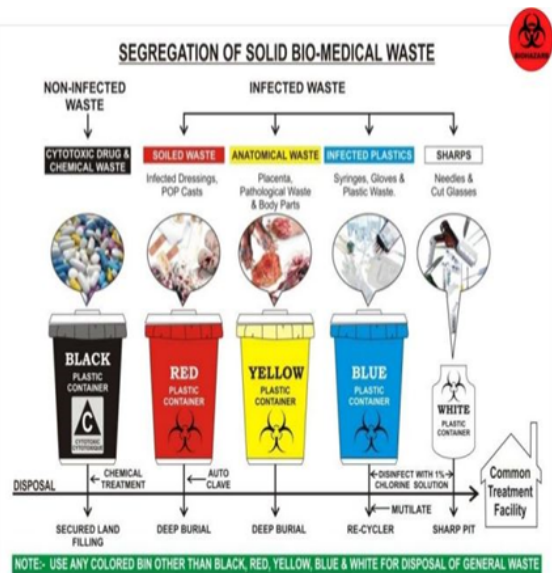


Fig. 4. Segregation of solid bio-medical waste

III. HEALTH RISKS OF MEDICAL WASTE

There is deficient management of health care waste in medical and research facilities. This causes risks which vary according to the type of waste as [16].

A. Risk of Infection

The most important of these risks is: the possibility of transmission of blood borne infections and diseases which are transmitted by contaminated instruments. The infection is transmitted through wounds and injuries or through the eye membranes if the infectious substance is volatilized.

Studies have shown that Hepatitis C virus can continue infectiously into the syringe for eight days from the date of taking.

World Health Organization stated that the probability of transmission is a needle prick incident as following:

- 0.3% for AIDS
- 3% for hepatitis B.
- 3-5% for hepatitis C.

Other diseases, such as tetanus, local or general infections, may also occur after injury resulting from dealing with infectious waste.

The most vulnerable to medical waste are health staff (e.g., doctors, nurses and laboratory technicians) as well as cleaners for medical waste.

The infection may be transmitted to family members and co-workers, and drug addicts may take some syringes to inject themselves, which may cause them to be infected.

Because medical waste contains infectious bacteria, it may result in contamination of the hospital environment. This leads to a high prevalence of hospital infections. One of the risks is that they cause the spread of species of any antibiotic resistant bacteria.

B. Risk of Poisoning and Burns

Drugs and tablets discarded with medical waste may cause those to pick them up from the public or children and may have health damaging effect when swallowed or reused.

The waste of chemical medicines used in the treatment of cancer may cause a risk to the health of individuals and the environment if not collected and treated appropriately.

C. Radiation and Chemical Hazards

In addition to the biological and physical hazards that result mainly from acute waste, poor management of medical waste results in chemical and radiological hazards that are harmful to health.

In Rio-de-Janeiro, because of the poor storage of radioactive waste, it has caused medical waste to kill four people and injure 28 with severe burns [16].

IV. PROPER HANDLING OF HAZARDOUS WASTE IN HEALTH CARE FACILITIES

A. The First Step

Segregation of the medical wastes in color coded containers as mentioned before.

B. The Second Step

This requires putting bags in the waste sections taking in consideration: the size of the basket, volume of waste, not to fill the baskets too much and to be covered and away from the patient's bed. It is recommended to put two baskets in each patient room. A red bag used for infectious patients waste. The other one is a black bag for paper or cans. Those garbage bags are not to be transported by workers using hands to avoid their rupture.

C. The Third Step

The need to utilize small containers of plastic reinforced with risky biological waste signal to gather the residue of needles and sharps after use immediately, and not to throw them permanently with waste bags and disposed of they had been sterilized by incineration. It is recommended not to fill them more than three-quarters of them.

D. The Fourth Step

The use of waste garbage collection cars (till arrival of the garbage transport vehicle) for each type separately and take into account the following: Waste should not be collected by workers and placed in the corridors in front of pedestrians or visitors until transported outside the health facility.

Do not store the waste in open areas exposed to rain, animals, birds, insects and rodents to avoid transmitting diseases through those animals, but it is preferred to be stored in closed place with excellent ventilation. There should be available easy access of sanitation workers to waste transport vehicles [16].

It is recommended to use two-color vehicles (yellow for medical waste and gray for other waste) in the temporary collection warehouse and placed away from each other so that there is no mixing, and they should be impermeable to liquids.



Fig. 5. Liquids waste

In addition, there should be available water source to clean the floor and drain it well. Removal of temporary waste collection centers from food stores, restaurant and kitchen frequently is recommended.

It is a must to wear gloves and protective coats for workers transporting medical waste in case of acupuncture or leakage of some contaminated liquids. It is advised to identify a fixed time to transport garbage from the health facility, at least once a day and preferably garbage collection in each shift work. It is preferable to collect black bags of ordinary garbage at a time different from the time of collection of red bags of medical waste so as not to confuse them.

It is preferable after the red bags are filled with medical waste to be short marks on the section collected and responsible for that shift and the date of collection. This information is useful in identifying those quantities and quantities and the day of collection to determine the amount of waste for each section and know how to identify it in case of tampering with these waste.

V. CONCLUSION

There is rising importance of appropriate disposal of medical waste. It is essential to limit the transmission of infectious disease and to protect the community from their harmful effect. It is of similar importance in both developing and developed countries and there is great significance of raising the awareness and training level of all health care workers about the process of appropriate medical waste disposal, and to share positively in the process.

This process needs the application of an integrated specific system starting from the health care facility to the incinerator or burying places.

Applying this system in an efficient way, will reduce the chance of injury among the health care workers and limit the risk of being infected or injured by the infectious and hazardous medical wastes, including blood born diseases such as HIV/AIDS, Hepatitis B and C.

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