

PHYSICOCHEMICAL ANALYSIS OF SOLID BIOMEDICAL WASTE PRODUCT OF DIFFERENT HOSPITAL

Abstract— Solids waste generated from medical institutions need to be handled very carefully as these wastes may contain infectious material. Medical waste is unwanted biological products that are highly infectious in nature. It has to be disposed properly otherwise it poses a health and environmental danger. Biomedical waste management is receiving greater attention due to recent regulations of the Biomedical Waste. The present study was conducted to assess the quantities and proportions of different constituents of wastes, their handling, treatment and disposal methods in different health-care settings. Various health care units were surveyed using a modified survey questionnaire for waste management. Hazards associated with poor biomedical waste management and shortcomings in the existing system were identified. The development of waste management policies, plans, and protocols are recommended, in addition to establishing training programs on proper waste management for all healthcare workers.

Keywords— Medical Waste, Biomedical Waste, Environment, Physicochemical

I. INTRODUCTION

All human activities produce waste. We all know that such waste may be dangerous and needs safe disposal. Industrial waste, sewage and agricultural waste pollute water, soil and air. It can also be dangerous to human beings and environment. Similarly, hospitals and other health care facilities generate lots of waste which can transmit infections, particularly HIV, Hepatitis B & C and Tetanus, to the people who handle it or come in contact with it. Bio-medical waste means “any solid and/or liquid waste including its container and any intermediate product, which is generated during the diagnosis, treatment or immunization of human beings or animals or research activities pertaining thereto or in the production or testing of biological or in health camps. Domestic and commercial wastes are commonly termed as SBMW and both these account for bulk of the waste in developing countries. For beneficial management, wastes should be regarded as “a resource in the wrong place”, as botanist regards weed as “a plant in the wrong place”, waste generally refers useless remains with lack of value. A basic way to deal with waste is to restore value from it. But in most of the developing countries, in major cities SBMW is made to compost. Generally, manual segregation has been done for SBMW, but if segregation is not done properly, there is possibility of heavy metals to enter in our food chain. Therefore, need arises to inventories the metal in SBMW.

Composting is a simplest way to restore value in SBMW. Aerobic composting with windrows method after proper segregation of SBMW is recognized as a cost-effective method that results in an end product that can be used as soil amendment. Several authors have reported beneficial effects of compost on soil productivity. These developments can be examined from the perspectives of waste management, agriculture and climate change. The technology to be used for this purpose is relatively simple and affordable, while the end-product is beneficial for soil and ensures significant saving of scarce land (required for land-filling). However, public-private partnership efforts are constrained due to quality requirements, marketing, pricing issues and ways to make it sustainable on a long-term basis. The reducing, reusing, recycling and rebuying - the 4 R's is key of diverting organic materials from landfill and prevents green- house gases (GHG's) emissions, reduces pollutants, conserves resources and reduces the need for new disposal facilities.

General Principles of Hygiene and Sanitation

Observance of general principles of hygiene and sanitation such as cleanliness, good house-keeping, adequate supply of safe water, sanitary facilities and proper ventilation are essential components of a good bio-medical waste management plan.

Waste Minimization

It is essential that every waste generated from the hospital should be identified and quantified. Hospitals should endeavour to reduce waste by controlling inventory, wastage of consumable items and breakages etc. Waste can also be minimized by recycling certain waste such as glassware, plastic material etc after proper cleaning and disinfection.

Waste Segregation

Segregation of waste at source and safe storage is the key to whole hospital waste management process. Segregation of various types of wastes into different categories according to their treatment/disposal options should be done at the point of generation in colour coded plastic bags/containers as per schedule II of the gazette notification. The needles and syringes should be disinfected and mutilated before segregation.

Waste Treatment on Site

Microbiological and biotechnology waste being highly infectious should be treated on site by autoclaving/microwaving/chemical treatment. The guidelines for chemical disinfection of different categories of biomedical wastes are shown in the following table 1:

Table 1 Waste Treatments on Site

Name of disinfectant	Available chlorine	Required chlorine	Contact period	Amount of disinfectant to be dissolved in 1 litre of water
Sodium hypochlorite	5%	0.5%	30 minutes	100 ml
Calcium hypochlorite	70%	0.5%	30 minutes	7.0 g

Name of disinfectant	Available chlorine	Required chlorine	Contact period	Amount of disinfectant to be dissolved in 1 litre of water
NaOCl powder (Sodium dichlorosocyanurate)	-	0.5%	30 minutes	8.5 g
NaOCl tablets	-	0.5%	30 minutes	4 tablets
Chloramine	25%	0.5%	30 minutes	20 g

II. RELATED WORK

Biomedical waste management has recently emerged as an issue of major concern not only to hospitals, nursing home authorities but also to the environment. The bio-medical wastes generated from health care units depend upon a number of factors such as waste management methods, type of health care units, occupancy of healthcare units, specialization of healthcare units, ratio of reusable items in use, availability of infrastructure and resources etc. The Medical Waste Tracking Act of 1988 defines medical waste as “any solid waste that is generated in the diagnosis, treatment, or immunization of human beings or animals, in research pertaining thereto, or in the production or testing of biologicals.” Medical waste can be identified by one of four different categories: infectious, hazardous, radioactive, and general.

Infectious waste describes waste that has the possibility of causing infections to humans. It can include human or animal tissue (blood or other body parts), blood-soaked bandages, discarded surgical gloves, cultures, stocks, or swabs to inoculate cultures. Much of this category, including human or animal tissue, can also be labeled as pathological waste, which requires specific treatment methods. Pathological waste is either known or suspected to contain pathogens.

Hazardous waste describes waste that has the possibility to affect humans in non-infectious ways, but which meets federal guidelines for hazardous waste under the Resource Conservation and Recovery Act. Some medical waste is hazardous waste. This includes sharps, which are generally defined as objects that can puncture or lacerate the skin, but can include needles and syringes, discarded surgical instruments such as scalpels and lancets, culture dishes and other glassware. Hazardous waste can also include chemicals, both medical and industrial. Some hazardous waste can also be considered infectious waste, depending on its usage and exposure to human or animal tissue prior to discard. Old drugs, including chemotherapy agents, are sometimes hazardous.

Radioactive waste can be generated from nuclear medicine treatments, cancer therapies and medical equipment that uses radioactive isotopes. Pathological waste that is contaminated with radioactive material is treated as radioactive waste rather than infectious waste.

General waste makes up at least 85% of all waste generated at medical facilities, and is no different from general household or office waste, and includes paper, plastics, liquids and any other materials that do not fit into the previous three categories.

The classification of healthcare waste can be done also according to World Health Organization in two categories:

1. General (85% of the Hospital waste), non-hazardous to human beings, separating in bio-degradable (cotton, paper, packaging materials) and non-bio-degradable (plastic, soil, caps, lids, tops)
2. Biomedical, separated in pathological, infectious, sharps, pharmaceutical, chemical and radioactive.
3. The Classification of biomedical hazardous health care waste is summarized in the following table 2:

Table 2 Classification of Biomedical Hazardous Health Care Waste

Waste Category	Description and Examples
Pathological	Human tissues or fluids e.g. body parts, blood and other body fluids, fetuses. Also glass slides containing fixed and embedded tissue, all materials used in embedding fixed tissue and containers with fixative for fixing tissue. Note: It is debated that the anatomical waste should better be regarded as a subcategory of infectious waste, rather than pathological, even though it may also include healthy body parts.
Infectious	Waste suspected to contain pathogens e.g. laboratory cultures, waste from surgery, isolation wards, tissues (swabs), materials, or equipment that have been in contact with infected patients, excreta etc. All materials which cannot be resterilized or reused within or brought into patient care.
Sharps	Any waste materials which could cause the person handling it a cut or puncture and have been used in animal/human patient care or treatment. Sharp waste include e.g. needles, infusion sets, scalpels, knives, blades, broken glass etc.
Pharmaceutical	Waste containing pharmaceuticals e.g. pharmaceuticals products, drugs, and chemicals that have been returned from wards, are expired/ outdated or no longer needed, items contaminated by or containing pharmaceuticals (bottles, boxes).
Genotoxic	Waste containing substances with genotoxic properties e.g. waste containing cytostatic drugs (often used in cancer therapy), genotoxic chemicals. Classified as carcinogenic cytotoxic and other drugs such as azathioprine, chlorambucil, chlornaphazine, ciclosporin, cyclophosphamide, melphalan, semustine, tamoxifen, thiotepa, treosulfan.

Chemical	Waste containing solid, liquid and gaseous chemical substances e.g. laboratory reagents, photographic fixing and developing solutions in X-ray departments (the fixer usually contains 5-10% hydroquinone, 1-5% potassium hydroxide, and less than 1% silver and the developer approximately 45% glutaraldehyde), cleaning products, disinfectants (ethylene oxide for sterilization of surgical equipment and medical devices).
Radioactive	Includes solid, liquid and gaseous waste that is contaminated with radio nuclides generated from in vitro or in vivo analysis. The radioactive waste by health-care can be classified as follows: <ol style="list-style-type: none"> 1. low-level solid waste, e.g. absorbent paper, swabs, glassware, syringes, vials; 2. residues from shipments of radioactive material and unwanted solutions of radionuclides for diagnostic or therapeutic use; 3. liquid immiscible with water, such as liquid scintillation-counting residues used in radioimmunoassay, and contaminated pump oil;

Safety and Measures for Auxiliary Staff Associated With Hospital Waste Disposal

PV Palwankar(2012) Not much attention has been paid to the management of biomedical waste.(BMW) in recent years, in dental colleges and hospitals With increasing population, the number of dental colleges and hospitals has also increased. The medical waste generated by these hospitals is disposed of together with municipal and industrial solid wastes. There is no effective waste segregation, collection, transportation & disposal system. There is lack of segregation between infectious and non-infectious biomedical waste as well as failure to implement the prescribed rules for proper management of hospital waste and also inadequate training of personnel, insufficient protective equipment, and lack of knowledge regarding use of such equipment There is immediate and urgent need to train and educate all dental and paramedical staff to adopt effective waste management practises. It is high time, we realize the importance of hospital waste management and the need of sensitizing the top level managers orienting them with various type of waste, their generation, segregation, collection, transportation & final disposal also, it is important that all the hospital waste is managed in a proper scientific fashion. The present paper describes various safety precautions to be taken for the hospital employee and measures to be adopted to minimise health risks due to hospital waste, and the implication of hospital waste on employee, public & environment .

Characterization of Medical Waste from Hospitals

Medical waste has not received enough attention in recent decades in Iran, as is the case in most economically developing countries. Medical waste is still handled and disposed of together with domestic waste, creating great health risks to health-care staff, municipal workers, the public, and the environment. A fundamental prerequisite for the successful implementation of any medical waste management plan is the availability of sufficient and accurate information about the quantities and composition of the waste generated. The objectives of this study were to determine the quantity, generation rate, quality, and composition of medical waste generated in the major city northwest of Iran in Tabriz. Among the 25 active hospitals in the city, 10 hospitals of different size, specializations, and categories (i.e., governmental, educational, university, private, non-governmental organization (NGO), and military) were selected to participate in the survey. Each hospital was analyzed for a week to capture the daily variations of quantity and quality. The results indicated that the average (weighted mean) of total medical waste, hazardous-infectious waste, and general waste generation rates in Tabriz city is 3.48, 1.039 and, 2.439 kg/bed-day, respectively. In the hospital waste studied, 70.11% consisted of general waste, 29.44% of hazardous-infectious waste, and 0.45% of sharps waste (total hazardous-infectious waste 29.89%). Of the maximum average daily medical waste, hazardous-infectious waste, and general waste were associated with N.G.O and private hospitals, respectively.

Waste generated in a dental teaching hospital is similar to that generated by other hospitals which include a large component of general waste and a smaller proportion of hazardous waste. Dental professionals are at a greater risk for acquiring cross-infection while treating patients. This is evident from the fact that most of the human pathogens have been isolated from oral secretions. Dental hospitals use instruments and materials that are directly exposed to blood and saliva and are therefore potential sources of infection. Many chemicals like acrylics, impression materials and mercury used for restorative purposes may have a possible environmental and human health impact if not handled properly.

III. CONCLUSIONS

This paper discussed about a major issue related to current Bio-Medical waste management in many hospitals is that the implementation of Bio-Waste regulation is unsatisfactory as some hospitals are disposing of waste in a haphazard, improper and indiscriminate manner. The safe and effective management of health care biomedical waste has received much attention for improper and inadequate management is associated with an increase in the incidence of health risks to the healthcare workers, the patients, and their environment and to the community at large. Hence the development of safe and effective management of biomedical waste along with handling protocols, institutional plans and policies, appropriate training and feedback programs on proper waste management and handling for all the healthcare workers are highly recommended.

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