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Original Research Article

PHYSICOCHEMICAL ANALYSIS OF SOLID BIOMEDICAL WASTE PRODUCT OF DIFFERENT HOSPITALS OF METRO CITIES

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Abstract: Biomedical waste management is increasingly being considered due to the recent regulation of biomedical waste (Management and Handling Rules, 1998). Inadequate treatment of biomedical waste can pose risks for Health workers, patients, communities and their environment. This study was done to physicochemical Analysis of Solid Biomedical Waste Product of Different Hospital of Metro cities. Several healthcare facilities were identified using a modified questionnaire for biomedical waste management. This questionnaire was prepared by the World Health Organization (WHO) for the purpose of evaluation Treatment systems for the disposal of biomedical waste. The risks associated with the mismanagement of biomedical waste were identified in the existing system. Development of policies, plans, and waste management Protocols are recommended, in addition to the proper waste management training programs for all Health workers.

Keywords: Biomedical waste, Waste disposal, Waste management, Physicochemical

Introduction: Recent developments in healthcare units are specifically designed to prevent and protect community health. Sophisticated instruments have emerged in various operations for the treatment of diseases. Such an improvement and Advances in scientific knowledge have led to a generation of waste in health units per person. Waste produced in healthcare, consist of a variety of wastes that include needles, scalpels, blades, clinical cotton fabrics, gloves, bandages, clothing, medicines and discarded body fluids, human tissues and organs, Chemicals and other wastes generated in health care facilities include radioactive waste containing mercury. Instruments, PVC plastics, etc. are the most environmentally friendly health products and need more Attention that needs to be monitoring (Remy, 2001).

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The World Health Organization states that 85% of hospital waste is not really dangerous, while 10% is contagious. And 5% are not infectious but contained in hazardous waste. About 15% to 35% of hospital waste is regulated as infectious waste. This range depends on the total amount of waste produced (Glenn and Garwal, 1999). These waste is now threatening the public, as the health foundations are located in the heart of the city. Waste, if not treated properly, can cause dangerous infections and pose a potential threat to the environment. The environment, the people who care about it and the public. Health and environmental impacts, regulatory uncertainty and negative perceptions of waste identifiers are some of the key concerns in HCWMin one country(Freeman, 1998).At the global level, this issue has been seriously addressed and the related waste management systems development and installed. There are many difficulties in implementing this plan in many places. Waste management is regulated by government agencies and regulations, including private organizations. There is currently no information describing current practice in dealing with healthcare waste. The future HWM plan is compatible with BMW (second amendment), 2000, Ministry of the Environment and Forestry. As a result, this study aims to make the treatment of biomedical waste in various healthcare facilities.

Problems Related to Biomedical Waste: In 1998, the Ministry of Environment and Forensics, Government of India gave guidance to treat various biomedical waste (Vijai Krishna), but even after a long period of time Most Indian hospitals do not use the desired standards for biomedical waste management (INCLEN Programme Evaluation Network (IPEN) Study Group). According to the report, 18 to 64 percent of hospitals and other health care facilities do not use satisfactory biomedical waste management (BMW) methods. It has been predicted that this may be due to the insufficient amount of resources needed for BMW or the lack of knowledge of health officials, or it could be due to a wrong disposal method (INCLEN Programme Evaluation Network (IPEN) Study Group). In India, about 30% of all annual injections have been made with reused or poorly sterilized medical equipment, and about 10% of healthcare facilities sell these used syringes to waste collectors. A survey showed that a population 3 km away from old waste incinerators had an increased cancer risk of 3.5% (Anjali Acharya).

Biomedical Waste Management: Biomedical waste management is classified into different categories and each category has its own methods of disposal. These categories are shown below:

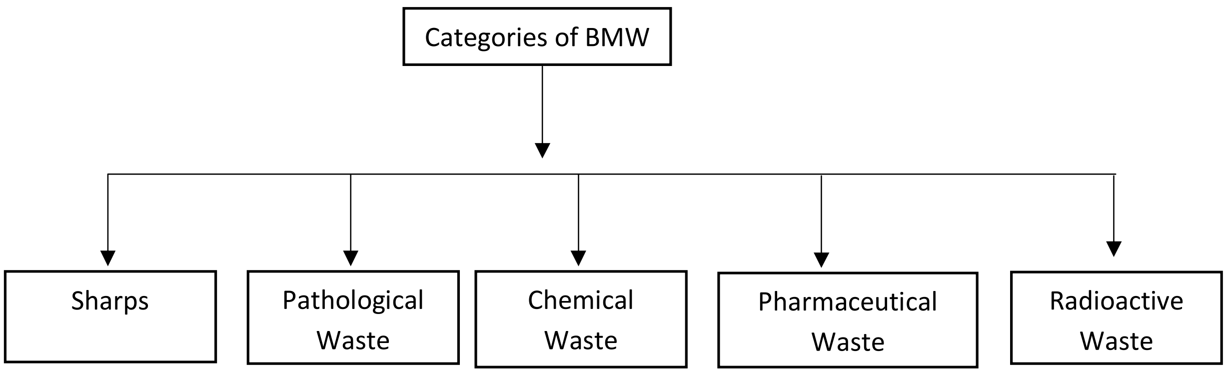

Figure 1: Categories of BMW

Physicochemical Analysis of the Solid Waste: The collection of the solid waste samples was done after selection of twenty different sites from the different parts of the study area. During selection of sampling site, preference was given to the priority order resulted due to the solid waste problem in different hospitals on metro city.

Principles and methods of analysis of solid waste quality parameters

i) pH: pH is a measure of hydrogen ion concentration. It is defined as the negative logarithm of hydrogen ion concentration or more precisely hydrogen ion activity of a solution. pH is expressed by the equation:

$$pH= -log10 [H+]$$

In order to determine pH of the samples, a solution was prepared by dissolving 10g of samples in 100ml of distilled water and stirring it thoroughly. The pH of the resulting solution was measured with a digital pH meter (Elko LI 127). The pH meter was calibrated by standardizing with a buffer solution of known pH.

(ii) Electrical conductivity: The Electrical Conductivity (EC) is a measure of the current carrying capacity, thus gives a clear idea of the soluble salts to present in the solution. The EC value indicates the ionizable constituents of the solution and is measured using a conductivity meter.

To determine the electrical conductivity a solution was prepared by dissolving 10g of ground solid waste samples in 100 ml of distilled water taken in a 250 ml beaker and stirred it thoroughly. The EC was determined using a conductivity meter (Elko CM 180) by dipping the conductivity cell of cell constant 1.0 in 1:10 sample to water suspension. The conductivity meter was calibrated by using the standard 0.01 M KCI solution.

(iii) Moisture content: The moisture content in the solid waste samples was determined by weight loss in the samples by oven drying method. To determine the moisture content of the samples, 10g of fresh solid waste sample was heated overnight in the oven at the temperature of 105^0C and the resulting loss of weight was noted (Nanda *et al.,* 2003). The moisture content is expressed in percentage on dry weight basis.

(iv) Organic matter and carbon content: In order to determine the organic matter content (Nanda *et al.*, 2003) at first the ash content was determined by taking 10g of ground sample and heating it in an electric furnace for 30 minutes at a temperature of 700^0C. The material lost after the heating was taken to be organic matter in the sample while the remainder was taken as the ash content. The carbon content (C) was calculated using an empirical relation known as the "New Zealand formula".

C (%) = 0.58 OM (%) [Nanda *et al.*, 2003]

Where, OM- Organic matter in the sample

The factor 0.58 is based on the assumption that carbon content is only 58% of the organic matter.

(v) Heavy metals: The heavy metals (Fe, Cu, Zn, Ni, Cr, Pb, Mn and Qd) were estimated using Atomic Absorption Spectrophotometer (Varian Techtran AA 575) with air acetylene flame and standards prepared in triple distilled water. For estimation of Iron (Fe) concentration, an alternative method of absorption at 510 nm using UV visible spectrophotometer was also applied.

In order to determine the heavy metals (Sarangthem and Sarangthem, 2003) 5g of ground samples were taken in 250 ml conical flask. A triacid mixture (45m1) consisting of nitric acid (HNO3), sulphuric acid (112804) and per chloric acid ($HC10_4$) in the ratio of 10:1:4 was added to each flask The residue samples were left in contact with the acid mixture overnight for predigest ion and after that digested on a hot plate until the dense white fumes of $HClO_4$ ceased to evolve and a clear extract was obtained. The conical flasks were then allowed to cool and the extracts were filtered with whatman No. 42 filter paper. The filtrates were diluted so that adequate volume of extracts can be obtained for analysis. The dilution factor was noted.

The digestion extracts were analyzed for heavy metals using atomic absorption spectrophotometric method. The dilution factor was accounted during estimating the actual concentration of the heavy metals in the ground solid waste samples.

Results and Discussion: The present investigation was conducted to study the approximate quantity of generation of the biomedical solid wastes as well as to recognize the existing practice of biomedical solid waste handling and disposal methods adopted by the hospitals and nursing homes in Uttar Pradesh city and also to provide suggestions for improvement. The investigation reveals that most of the large modem hospitals in Uttar Pradesh city generate each of the different categories of biomedical solid wastes daily in the range of 1 to 10 kg. It was also observed through the investigation that there is a wide gap between the Biomedical Waste (BMW) disposal rules and its implementation. Most of the hospitals and nursing homes in Uttar Pradesh city are devoid of implementation of BMW disposal rules and are not highly sincere in this regard. It indicates that there is a need to improve the handling and disposal methods of biomedical solid waste. The violation of BMW rules proves that the concerned authorities are yet to be alert for such a vital issue. It needs the State Government along with the Pollution Control Board and municipal bodies to be strict and vigilant at various stages for effective implementation of BMW rules, 1998.In the overall analysis the minimum and maximum values of the different parameters obtained for the biodegradable solid waste samples irrespective of the sampling seasons were as follows: pH :4.12- 10.91

Electrical conductivity : 104.78 - 1614.32 micro S cm-1

Moisture content : 22.56 - 68.95%

Organic matter : 27.2 - 54.8%

Carbon content : 15.8-31.8%

Conclusion: Medical waste should be sorted by origin, typology and risk factors for handling, storage and disposal. Waste separation at the source is the key step, and reduction, reuse and recycling should be considered in the right perspective. We need to consider innovative and radical measures to tackle the catastrophic panorama of lack of civic interest of hospitals and the neglect of state implementation of a minimum of rules, as the production of waste, in particular biomedicine, is directly costly. The challenge is to scientifically manage the increasing volume of biomedical waste that goes beyond existing practices. If we want to protect our environment and the health of the community, we need to be aware of this important issue, not only for the benefit of health administrators, but also for the benefit of the community. Health care is an important part of life. These activities generate a large amount of waste called biomedical waste. These wastes generated by health activities can be hazardous or toxic or fatal as they are contaminated with pathogenic agents that can infect patients, health workers and other nearby target groups. The growth in sanitation and the upward trend in waste recycling have significantly increased the amount of biomedical waste and, as a result, have created serious threats to the health of society and the environment

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