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**CLINICAL WASTE MANAGEMENT PRACTICES: A REVIEW**

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*Abstract*

Clinical waste is potentially dangerous. It may contain various waste from medical, nursing, dental, pharmaceutical, skin penetration and other related clinical activity. Poor management and inappropriate disposal methods exercised during handling and disposal of clinical waste is increasing significantly on health hazards and environmental pollution due to the infectious nature of the waste. By improving the procedure and technology in managing clinical waste it will give big impact to the environment. Therefore, healthcare industry can save money and provide a safe environment for all. Developing country face a problem in generation of clinical waste and significantly increased significantly over the few decades. This research is an overview on the existing researchers in the area of clinical waste management to investigate different finding regarding waste segregation and disposal. It is discovered the alternative treatment method and it will become major challenges in the future. The alternative method for the future is very important to help environment by reducing the pollution

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**Keywords:** Clinical waste, clinical waste management, disposal strategies



## 1. Introduction

Over the past decade, the management of clinical waste continues to be a major task and predominantly in most healthcare facilities of the developing world. A study from Sohrab Hossain et al., (2013) also mention that the generation of clinical waste in Malaysia has increased significantly over the last few decades. The management of wastes materials requires the immediate attention of the newly emerging economy a country such as Malaysia (Ambali, Bakar, & Merican, 2013)

In Malaysia, Clinical waste management is controlled by Department of Environment Quality Act 1974. Ministry of Natural Resources and Environment (2009) also, construct a guideline on the handling of clinical waste in Malaysia 2009. In This guideline indicate on handling international classification of clinical and related wastes arising from medical, nursing, dental, veterinary, or similar practices.

Tabasi & Marthandan (2013) mention about the complexity and importance of waste management issue can be changed in development and developing nations. In the UK, Blenkharn (2006) indicated the safe disposal and subsequent destruction of clinical waste is a key in the reduction of illness or injury through contact with the potentially hazardous material, and in the prevention of environmental contamination. Past study by Shamim Al Razib, Hasan, & Supriya (2017) stated that, in Bangladesh, management of clinical waste is of great importance due to its infectious and hazardous nature that can cause risks on the environment and public health in Bangladesh. Tabasi & Marthandan (2013) presented the number waste generation of clinical waste has increased significantly in many developing countries and need to develop an appropriate model for accurate prediction of waste generation rate

### 1.1. Clinical waste management in Malaysia

Malaysia as a developing countries and controlled by Department of an environment are interested to manage clinical wastes effectively, under the guideline on handling clinical waste, the waste generator need to do minimization of waste during the procedure, do source separation and segregation identification of waste and labelling, handling and storage, safe transportation, treatment and disposal of residues (including emissions), occupational safety and health, public and environmental health, research and development into improved technologies and environmentally friendly practices.

Incineration and other medical waste treatment processes can generate secondary waste and pollutants if the treatment facilities are not properly designed, constructed and operated. These pollutants may have adverse environmental impacts on human health. Polychlorinated dioxins and dibenzofurans and corrosive gases may be produced by medical waste incineration (Ambali et al., 2013).

Referring the quality Report 2012 until 2015 total of 25523.3 metric tonnes of clinical wastes were generated. This represents an overall increase of 17.40% as compared to 21976.12 metric tonnes reported in 2014

Past studies Razali & Ishak (2010) seeks to examine the management of clinical waste in Selangor's government hospitals as well as problems that arise from the current practice of clinical waste management. They also found the obstacles faced by minimizing and recycling, as well as the alternative treatment methods for incineration, are regarded to be major challenges in the future. Others study from Hossain et.al emphasis to continue the recycle-reuse program of CSW materials after sterilization by

using supercritical fluid carbon dioxide (SF-CO<sub>2</sub>) sterilization technology at the point of initial collection. The advantage of this technology the healthcare facilities can both save money and provide a safe environment for patients, healthcare staff, and clinical staffs.

In Summary, research into the impact of clinical waste management in Malaysia to the environment and economics is very important. Thus, this study aims to identify the suitable process from clinical waste generated until clinical waste disposal. The result may help the policymaker from the healthcare industry and also Department of Environmental to protect our environment for the next generation

## 2. Problem Statement

Research about clinical waste in the healthcare industry is very important at Malaysia, which is, the healthcare industry in Malaysia produce lots of clinical waste need to manage accordingly. Lack of awareness about the health hazards related to health-care waste, inadequate training in proper waste management, absence of waste management and disposal systems, insufficient financial and human resources and the low priority given to the topic are the most common problems connected with health-care waste (WHO, 2018). Referring article from Ambali et al., (2013), by the year 2020, the estimated number of clinical waste about 33 000 tonnes annually and now this, the capacity of incineration in Malaysia limited to processing 18 000 tonnes of waste per year (Sullivan & Frost, 2010).

According to Razali & Ishak (2010) until the 1980s, Malaysia has no proper system for the management of clinical waste. The environmental issue about the uncontrolled dumping of biomedical waste has the potential for transporting pathogens or disease producing that can cause a significant impact on human health and environment (Laws of Malaysia, 2006). A study by (Ambali et al., 2013) shows that management of waste is a general acute problem around the globe. Which is waste management being of great concern as urbanization and economic development increase leading to the generation of a larger quantity of waste materials. Many developed nations have medical waste legislation, however, there is generally little guidance as to which objects can be defined as infectious. This lack of clarity has made sorting medical waste inefficient, thereby increasing the volume of waste treated for pathogens, which is commonly done by incineration (Windfeld & Brooks, 2015).

Research from Hossain Santhanam, Norulaini, & Omar (2011) found that the poor management of clinical solid waste is a significant problem in most economically developing countries. His study also indicated poor conduct and inappropriate disposal methods exercised during handling and disposal of CSW is increasing significant health hazards and environmental pollution due to the infectious nature of the waste. This issue becomes more critical when Malaysian Pharmaceutical Society (2015) TV3 Aduan Rakyat has reported the problem of uncollected clinical waste at 48 hospitals in the Klang Valley and east coast, including Hospital Kuala Lumpur. It was reported that hundreds of yellow plastic bags filled with clinical waste, including amputated body parts, placenta, used syringes and blood-stained materials, were left lying outside the hospitals' cold storage clinical waste store. This happened because the incinerator posed a danger of dioxin pollution in the area and need to close for repairs.

Kualiti Alam (2017) a company that manages Clinical waste reported about their secured landfill at the WMC was close to full capacity and company have a major problem to find adequate space for

incoming waste. A company plan for next four years, a 24m high geogrid wall will be built along the 1.the 7km parameter of our existing secured landfill.

In the study of Jang, Lee, Yoon, & Kim, (2006) the generation of medical waste from healthcare industry has rapidly increased over the past decade and medical waste had been regulated by the Medical Law under the Ministry of Health and Welfare until 1999, Korea. Research from (Cheng et al., 2009) In Taiwan, analysed the total amount of medical waste was estimated to increase from 61,343 Tons in 2002 to 117,544 tons in 2004, including 10,943 and 22,326 tons of hazardous waste, respectively. In Bangladesh, as in many other developing countries, no proper and an efficient rule has been compiled as yet and also there is no useful information about clinical waste management (Shamim Al Razib et al., 2017). Inadequate management of biomedical waste can be associated with risks to healthcare workers, patients, communities and their environment (Radha, K.Kalaivani, & R.Lavanya, 2015)

### **3. Research Questions**

- i. How about the current clinical waste management?
- ii. What is the latest technology in disposal of clinical waste management?

### **4. Purpose of the Study**

This research will contribute to creating a new policy in the management of clinical waste management in Malaysia. It will also recommend to Government and policymakers on the need to recycle plastic medical waste which will be beneficial to the community. And also, to advise health providers on the need to ensure proper collection, storage, transportation, treatment and final disposal of hospital waste

### **5. Research Methods**

To achieve objectives of this research a mixed qualitative and quantitative research will be used. To achieve objective 1, literature review, experience, and observation of the researcher and also the interview with the experts of the field will be considered. Objective 2 and 3 will be achieved with a survey and statistical analysis. Base on the result from objective 2 and 3, the last objective will be achieved through an interview with experts and literature.

### **6. Findings**

This paper presentation a review of studies in clinical waste management areas focusing in the component in clinical waste and the disposal method. 9 papers reviewed are those the effective factors waste generation. Table 22 shows the distribution of component in clinical waste in healthcare industry. Out of 9 studies, studies (57%) shows the main components in clinical waste is Pathological Waste/Biomedical waste. Infection waste recorded 10% from 9 articles. The others component of clinical waste about 9% for plastic.

**Table 01.** The component of clinical waste

| Component of clinical waste         | Sources       |               |                               |                                 |   |  |                              |   |                       | Total   |
|-------------------------------------|---------------|---------------|-------------------------------|---------------------------------|---|--|------------------------------|---|-----------------------|---------|
|                                     | (Perry, 2000) | (Dawat, 2017) | (Sohrab Hossain et al., 2013) | (Jang, Lee, Yoon, & Kim, 2006). | (B. K. Lee, Ellenbecker, & Moure-Eraso, 2002) | (Dehghani, Azam, Changani, & Fard, 2008) | (Liu, You, Lu, & Chen, 2015) |   | (Curtis, & Mak, 1991) |         |
| Pathological Waste/Biomedical waste | √             | √             | √                             | √                               | √   | √  | √                            | √ | √                     | 9       |
| Pressurized Containers              | √             |               |                               |                                 |   |  |                              |   | √                     | 2       |
| Waste with high heavy metal content |               | √             |                               |                                 |   |  | √                            | √ |                       | 4       |
| Sharp                               | √             | √             | √                             | √                               |   |  | √                            | √ | √                     | 7<br>12 |
| Radioactive waste                   | √             |               | √                             |                                 |   |  |                              |   | √                     | 3       |
| Chemical waste                      |               |               | √                             |                                 |   |  |                              | √ | √                     | 3       |
| Infectious Waste                    | √             | √             | √                             |                                 |   |  | √                            | √ | √                     | 6       |
| Genotoxic Waste                     |               |               |                               |                                 |   |  |                              |   |                       |         |
| Pharmaceutical Waste                | √             |               | √                             |                                 |   |  |                              | √ | √                     | 4       |
| Paper                               |               | √             |                               |                                 | √   | √  | √                            |   |                       | 4       |
| Plastic                             |               | √             |                               | √                               | √   | √  | √                            |   |                       | 5       |
| Glass                               |               | √             |                               |                                 |   | √  | √                            |   |                       | 3       |
| Textile                             |               | √             |                               |                                 | √   | √  | √                            |   |                       | 4       |
| Absorbent cotton                    |               |               |                               | √                               |   |  |                              |   |                       | 1       |
| Tissues                             |               |               |                               | √                               |   |  |                              |   |                       | 1       |
| Organics                            |               |               |                               |                                 | √   |  |                              |   |                       | 1       |

### 6.1. Clinical waste treatment and disposal

The WHO directed that the selection of clinical waste disposal methods must be cost effective, easily implemented and environmental friendly. Tesfahun (2015) also point out that a proposed waste disposable method must have-

- 2.4.1 minimal risk assessments for proposed waste management facilities,
- 2.4.2 minimal human health impacts
- 2.4.3 minimal environmental impacts

**Table 02.** the most common disposal methods of clinical waste in healthcare centres of different countries. The table develop by (Sohrab Hossain et al., 2013).

| Country   | Disposal Method             | References                                    |
|-----------|-----------------------------|---|
| Sri Lanka | Open dumping & Incineration | (Bendjoudi, Taleb, Abdelmalek, & Addou, 2009) |

|                               |  |  |
|-------------------------------|--|--|
| Mongolia                      | Open dumping or open Burning, Incineration & Autoclaving | (Shinee, Gombojav, Nishimura, Hamajima, & Ito, 2008) |
| South Africa                  | Landfill, Open dumping, Incineration & Autoclaving       | (Nemathaga, Maringa, & Chimuka, 2008)                |
| Palestinian-Territory         | Open burning, Incineration & Thermal Disinfection        | (Al-Khatib & Sato, 2009)                             |
| Bangladesh                    | Open dumping or open Burning & Incineration              | (Taghipour & Mosaferi, 2009)                         |
| Nigeria                       | Dumping, Burning & Incineration                          | (Coker et al., 2009)                                 |
| Mauritius                     | Incineration Sanitary Landfill                           | (Mohee, 2005)  |
| Libya                         | Dumping Incineration                                     | (Mohamed, Ebrahim, & Al-Thukair, 2009)               |
| Brazil                        | Landfill Incineration Autoclave                          | (Da Silva, Hoppe, Ravello, & Mello, 2005)            |
| Kingdom of Bahrain            | Landfill Incineration Autoclave                          | (Mohamed et al., 2009)                               |
| El-Baheira Governorate, Egypt | Dumping Incineration                                     | (Liu et al., 2015)                                   |
| Malaysia                      | Landfill Incineration Recycling                          | Personal Investigation                               |

In this study also found the alternative method for clinical waste. Out of 8 studies, 6 studies proposed for waste minimizing and recycling. Others alternative have own reason to choose disposal method in dispose the clinical waste.

**Table 03.** Alternative treatment for clinical waste

| Alternative Treatment Methods  | Sources        |  |                  |                        |                     |                   |                   | Total |
|--------------------------------|----------------|--|------------------|------------------------|---------------------|-------------------|-------------------|-------|
|                                | (Razali, 2010) | (Marinković, Vitale, Holcer, Džakula, & Pavić, 2008) | (Blenkham, 2005) | (Sohrab Hossain, 2010) | (Jang et al., 2006) | (B.-K. Lee, 2010) | (Marchetti, 2012) |       |
| Waste minimizing and recycling | √              | √  | √                | √                      | √                   | √                 |                   | 6     |
| Incineration process           |                | √  |                  |                        |                     |                   |                   | 1     |
| SF CO2 Sterilization           |                |  |                  | √                      |                     |                   |                   |       |
| Reusable Container             |                |  |                  |                        |                     |                   | √                 | 1     |
| Stim Autoclaving               |                |  |                  |                        |                     |                   | √                 | 1     |

## ▪ Conclusion

The current practices for handling and disposal of waste generated at the hospital and healthcare industry need to change and major improvements. Poor segregation and classification procedure of the generated waste were observed in healthcare industry. The healthcare waste is still being dumped and mixed with domestic waste.

In conclusion, obtained results are useful for healthcare facility and Clinical waste management service providers and also researchers to develop and offer suitable method in waste segregation and waste disposal. The components of clinical waste such as plastic maybe can be recycle become something value example used in mainstream construction products such as damp proof membrane, drainage pipes, ducting and flooring. In this study, also found glasses in the types of clinical waste. As we know glass is item can be recycling. In Pahang, Kuantan district Council are committed to explore the potential from increasing recycling by collection at source sorted glass in Kuantan.

The incineration method for disposal most common method while landfill and open dumping. This method give impact for environment and involve high costs. By minimize and recycling of clinical waste, the actual quantity need to incineration can be reducing and given impact to environment and cost totally.

## 7. Conclusion

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