

Research Paper

Management of Medical Wastes in Public Hospitals: A Case Study



Ali Hosseinzadeh¹, Saeid Gitipour^{1*}, Maryam Pazoki¹, Mir Amir Mohammad Reshadi², Morteza Nazaripour², Masomeh Rezaei³

1. Department of Environmental Design Engineering, Faculty of Environment, University of Tehran, Tehran, Iran.

2. Department of Civil Engineering, Faculty of Engineering, K. N. Toosi University of Technology, Tehran, Iran.

3. Department of Environment, Faculty of Engineering, Azad University of Tehran, Tehran, Iran.



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ABSTRACT

Background: Medical wastes are one of the health and environmental challenges across the globe. Also, hospitals are one of the most important medical waste generators.

Methods: In this study, the quantity and composition of solid wastes generated in 10 public hospitals in the city of Tehran were investigated. Medical wastes were classified into four groups and the one-year average was considered.

Results: The results showed that the range of waste generation in public hospitals was from 107.5 to 2508 kg/day. Considering account hospital beds, the production of medical wastes in public hospitals was 3.53 kg/bed/day. Moreover, 67.45% of medical wastes in the hospitals studied included common wastes, but infectious and sharp wastes accounted for 31.65% of the medical wastes. Besides, chemical and pharmacy wastes accounted for an average of 0.8% of the medical wastes.

Conclusion: Due to the importance of medical waste management, it is necessary to pay more attention to segregation and reduce the proportion of infectious wastes in the hospital studied.

* Corresponding Author:

Saeid Gitipour

Address: School of Environment, College of Engineering, University of Tehran, Tehran, Iran.

Phone: +98 (935) 9153150

E-mail: gitipour@ut.ac.ir

1. Introduction

In recent decades, due to an increase in health services and population growth, the generation of medical wastes in the world has received serious attention [1]. Medical wastes are solid wastes generated in hospitals, clinics, medical laboratories, blood centers and so forth [2]. Infectious wastes are also any type of waste contaminated with a pathogen that can cause a disease [3]. Furthermore, hospitals are one of the most important sources of medical waste generation, which is called hospital waste [3].

The amount of medical wastes produced in hospitals varies depending on factors such as the number of beds, the type of hospital, and the number of referrals [4]. In Iran, the average generation of medical wastes is 3.7 kg/bed/day [5]. However, this amount can change in different hospitals, as 2 and 6 kg/bed/day have been reported in previous studies [6]. In terms of quality, medical wastes can be classified into two general forms, common wastes and hazardous wastes. But, in better classification, medical wastes include general, infectious, sharp, chemical and pharmacy wastes [7]. The World Health Organization (WHO) defines medical wastes as wastes generated in the process of diagnosis, treatment and immunization of humans and animals. It is estimated that about 20% of this wastes are due to properties such as infectivity, toxicity and radioactivity and can be classified as a hazardous waste [1].

The management of medical wastes is a regular process that includes the stages of generation control, separation, storage, collection, disinfection and disposal [8]. It should be pointed out that a proper management of medical wastes is effective in reducing the environmental risk and health problems. One of the most important factors in proper

management of medical wastes is having access to data showing the amount of waste generation and the ratio of infectious wastes. Hence, the purpose of this study was to investigate the quantity of medical wastes in public hospitals in the city of Tehran and compare them with each other, as well as to investigate the ratio of their components.

2. Material and Methods

This study was done by investigation the quantity and composition of medical waste in 10 public hospitals in Tehran. The 10 studied hospitals were arranged alphabetically from A to J. The data were obtained by means of interviews from the waste management staff in hospitals as well as official statistics in the hospitals. The data of quantity and composition of medical wastes were obtained based on physical analysis of them in one year. Also, only the weight of medical waste was considered. To investigate the composition of medical wastes, they were classified in three groups as follows [5] and then the data were analyzed in statistical software:

- Common wastes such as nylon, plastic tumbler, food waste, and tea slag;
- Infectious and sharp wastes such as blood-contaminated gauze, latex gloves, syringes needles, and surgical blades;
- Chemical and pharmaceutical wastes such as used medicine ampoule, acrylic, and wax.

3. Results and Discussion

The results showed that the average generation of medical wastes in the hospitals studied was 3.53 kg/bed/

Table 1. Quantity and composition of medical wastes in hospitals studied (kg/bed/day)

Hospitals	Number of Beds	Occupied Bed (%)	Common Waste	Infectious and Sharp Waste	Chemical and Pharmacy Waste	Total Waste
A	452	95	1157	660	4	1821
B	143	84	748	252	2	1002
C	118	62	50	80	15	145
D	260	84	850	140	1.5	1005
E	186	83	250	200	1.5	451.5
F	290	91	945	402	7.5	1354.5
G	820	92	1750	723	35	2508
H	412	93	1100	703	10	18.13
I	227	89	460	260	2.5	722.5
J	72	79	62.5	40	5	107.5

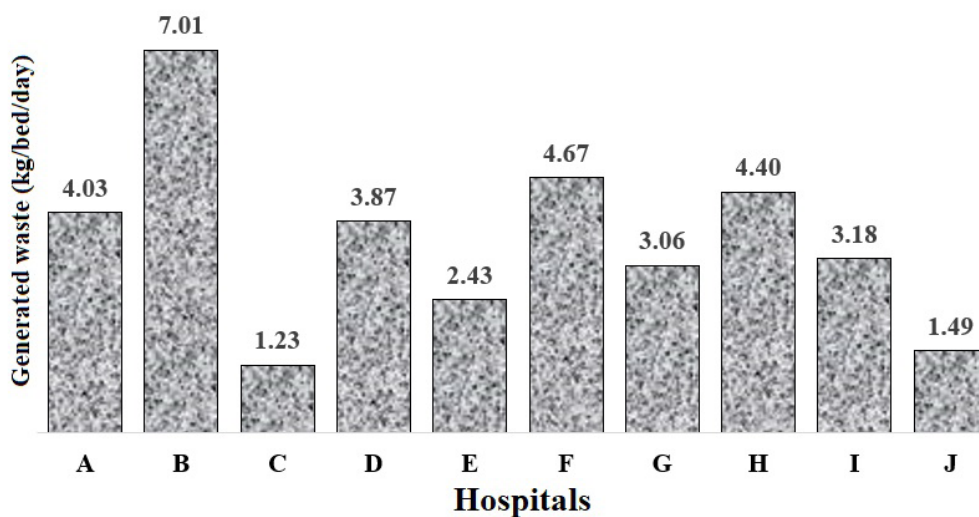


Figure 1. Medical waste generation in the hospitals studied (kg/bed/day)

day. As can be seen in Table 1, the generation of medical wastes in the hospitals ranged 107.5 to 2508 kg/day. Although the generation of medical wastes in the hospitals was in the range of 1.22 to 7 kg/bed/day (Figure 1), it was in the range of medical waste generation in Iran. In previous studies, the rate of medical waste generation in Iran reported to be less than 2 kg/bed/day to more than 6 kg/bed/day [6]. However, in various studies, the average generation of medical wastes in Iran were reported in the range between 3.1 and 3.7 kg/bed/day [5, 6, 9].

Considering the ratio of occupied beds in the hospitals studied, the amount of medical waste generation in them can be expressed as 1.88 to 8.34 kg/patient/day (Figure 2). Although this criterion is not very common for the generation of medical wastes, in similar studies the generation of medical wastes in Iran has been report-

ed up to 10 kg/patient/day [10]. Of course, this criterion has been used more to express the generation of medical wastes in medical laboratories; in previous studies in Iran, its rate was reported 0.5 to 0.6 kg/patient/day [11]. Therefore, based on different criteria, the amount of medical waste generation in the hospitals studied adopted with average of medical waste generation in Iranian hospitals. Of course, the reason for the difference between other studies and this study can be found in the type of medical centers, the difference between public and private hospitals, and the number of hospital beds [5].

As shown in Figure 3, most of the medical wastes in the hospitals studied were of common wastes. This type of waste in different hospitals included 34.4 to 84.5% of medical wastes. Also, chemical and pharmacy waste was the smallest component of the medical wastes in

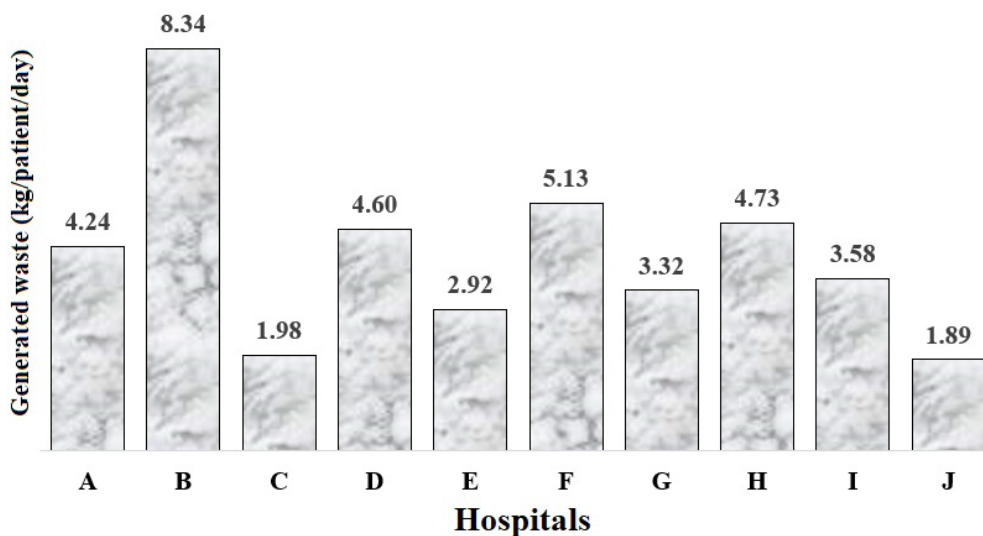


Figure 2. Medical waste generation in hospitals studied (kg/patient/day)

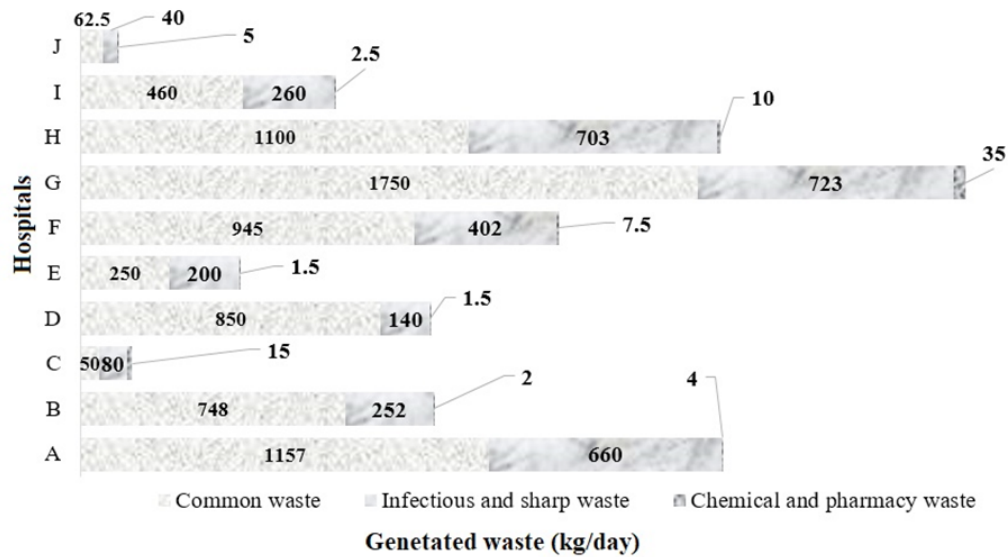


Figure 3. Composition of medical wastes in hospitals studied

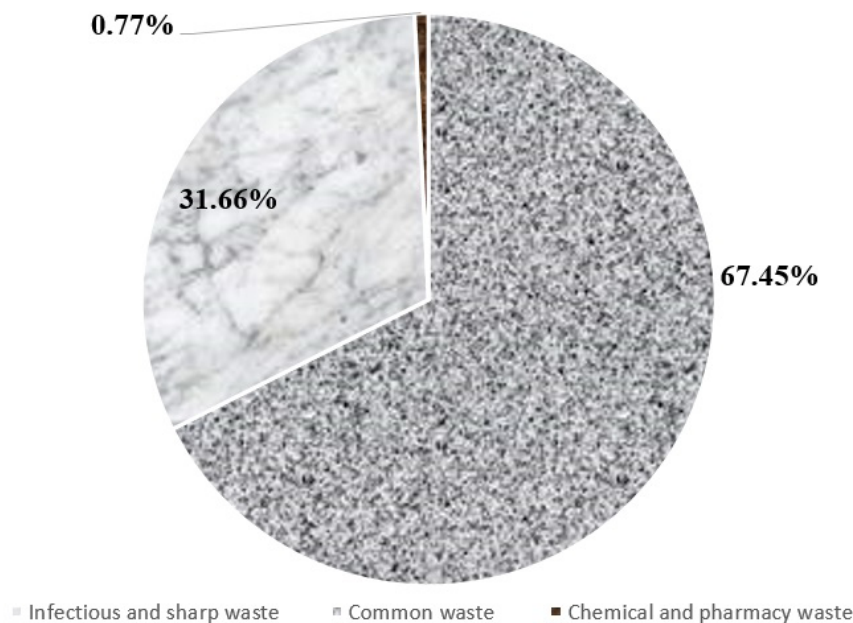


Figure 4. Composition of medical waste in the hospitals studied

the hospitals, which was observed in the range of 0.2 to 10.3%. However, infectious and sharp wastes as the most important medical wastes accounted for 13.9 to 55.1% of the medical wastes in the hospitals. As Figure 4 shows, the average composition of medical wastes in the hospitals studied included general wastes (67.45%), infectious and sharp wastes (31.65%), and 0.76% chemical and pharmacy waste. In previous studies, the ratio of infectious wastes in the medical waste mass was reported about 37% to 44% [5] which shows that, in the studied hospitals in this study, the ratio of in-

fectious waste was adopted with reported ratio for other hospitals in Iran. Of course, this ratio is reported differently in different hospitals. For example, in two studies in Tehran hospitals, the ratio of infectious and sharp wastes was 21% and 24 % [12, 13], while, in a study in Shiraz, this ratio was reported to be 48% [14]. Also, the results of medical waste management study in hospitals of 13 provinces in Iran showed that 37% of the studied waste lied in the category of infectious and sharp wastes [6].

Of course, the ratio of sharp wastes is much lower than the infectious wastes; in studies conducted in Iranian hospitals, the ratio of sharp wastes was reported 1 to 5% [4, 12, 14-16]. However, common wastes, as observed in the results of this study, contain the largest share of medical wastes in Iran. In comparison with the findings of this study, in the reports of medical waste studies in Iranian hospitals, the share of common wastes is more than 50% (49%-72%) [4, 10-16]. The proportion of infectious wastes in the medical waste mass depends on the amount of waste segregation in hospital [5, 8]. If the segregation of this kind of waste in hospital is done helpfully, the ratio of infectious wastes will decline and most of the medical wastes will be of common wastes. It is reported that, due to improved segregation and proper storage in a hospital, the share of infectious wastes was reduced by 13% [4].

The amount of medical waste generation in the hospitals studied was in the common range of medical waste generation in Iran and the composition of this wastes accorded with other reports. However, the amount of medical waste generated in the hospitals may be different from other countries. For example, it is reported that in the United States, 465,000 tons of biologically hazardous wastes is generated annually by 377,000 health care centers [17]. Hospital waste generation in some European countries and the United States is 0.25-7.0 kg/bed/day. In comparison, this rate is 0.4-5.5 kg/patient/day for 12 developed and developing countries. Hospital waste generation in Japan, Turkey, Canada, India, Thailand and Bangladesh is also estimated at 0.11-3.9 kg/bed/day [8]. A study performed in Taiwan found that rates of infectious waste generation in four different facilities were, respectively, as follows: blood centers (3.14 kg/bed/day), private clinics (1.91 kg/bed/day), medical laboratories (1.07 kg/bed/day) and public clinics (0.053 kg/bed/day) [18].

One of the main concerns in the management of hospital wastes is to make the choice of a suitable disinfection method to reduce health and environmental threats. The results of this study indicated that a significant share of hospital wastes was of infectious and sharp wastes; therefore, it is of great importance to select an appropriate disinfection measure. The observations of a study indicated that, in Iran, on-site disinfection methods are more desirable than out site disinfection methods [8]. The results of our studies illustrated that the hospitals had autoclave as an on-site disinfection system. The use of different disinfection methods for infectious wastes has been reported in various parts of the world. In Spain, the methods utilized for disinfection included incinerator, sterilization, autoclave, chemical

stabilization, and microwave [19]. In the United States, 49%-60% of this type of waste has been disinfected by incineration, 20%-37% by autoclave, and 4%-5% by other technologies [1]. In South Korea, the final disposal method for 52.7% of hospital wastes is incinerators and for 46.4% of hospital wastes is steam sterilization, and other methods such as microwave and chemical disinfection are used for less than 0.2% of hospital waste [20]. In Japan, 218,000 tons of infectious wastes generated per year, of which 82% is eventually incinerated [21]. However, in Iran, according to experts, the application of microwaves and autoclaves for disinfection of medical wastes is a priority, and the use of incinerators is no longer desirable due to the emission of gases and the risk of contamination [8].

4. Conclusion

In the current research, medical waste management was studied in 10 public hospitals in the city of Tehran. The observations showed that the average generation of hospital wastes was 3.53 kg/bed/day. According to the ratio of occupied beds in the studied hospitals, the amount of medical waste was 4.07 kg/patient/day. Considering the average generation of medical wastes in Iran, which is about 3.7 kg/bed/day, it can be said that the amount of waste generation in the hospitals studied was in line with the general pattern of the country. It should be pointed out that 67.5% of medical wastes in the hospitals was of common wastes. And, 36.5% was infectious and sharp wastes, and 0.8% was chemical and pharmacy wastes. The difference in the quantity of medical wastes in the studied hospitals and also the difference in the ratio of infectious wastes showed that waste management in them was different from each other. Due to the existence of disinfection equipment in the hospitals studied, more attention to medical waste segregation to reduce the ratio of infectious wastes can be effective in reducing the risk and the cost of waste management.

Ethical Considerations

Compliance with ethical guidelines

There were no ethical considerations to be considered in this research.

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Authors' contributions

All authors equally contributed to preparing this article.

Conflict of interest

The authors declared no conflict of interest.

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