

A Review of Challenges Facing Clinical Water Management in the Malaysian Context

Afiza Abdullah Suhaimi, Niza Shamsuddin, Mohd Armi Abu Samah

ABSTRACT---Given that clinical waste could cause environmental and health problems, an important subject that emerges concerns its management. This study employed a gap analysis approach to determine Malaysia's challenges in relation to the management of clinical waste, as well as quo practices in the country. With the objective of analyzing the state of clinical waste management, some of the specific subjects that were investigated included recommendations, challenges, policies and legislation, technology, and the treatment of clinical waste. Notably, one of the crucial forces that were worth considering involved the economic status of the country, especially because of the role of this factor in determining trends in waste disposal and treatment. From the results, Malaysia needs an effective approach to clinical waste management, especially through healthcare establishments (HCEs). Also, the country needs a holistic approach involving steps such as the use of environmentally safe and sound technologies, occupational safety and health programs, and waste segregation and minimization.

Keywords—healthcare establishment, hazardous waste, waste management, clinical waste

I. INTRODUCTION

The subject of clinical waste management has continually received growing attention on a global scale. One of the factors accounting for this debate is that clinical waste, if poorly management, could cause environmental unfriendliness and health hazards. Also, poor clinical waste management affects the hospital environment, patients, and health care teams directly and indirectly [1-3].

In the investigation by Hauri et al [4], it was observed that contaminated injections account for increasing disease burden in health care systems. In 2000, the study revealed that about 260,000 HIV infections and two million HCV infections arose from contaminated injections. In another study, Fajriyah et al [5] indicated that at the waste disposal sites, rodents account for over 50 percent of cases of leptospirosis. Also, an investigation by Gonzenbach and Coach [6] revealed that at the waste disposal sites, *Aedes Aegypti* and *Anopheles* mosquitoes are common and that they account for growing cases of dengue fever and malaria. To the global community, the trends are alarming and attract interventions towards effective clinical waste management processes.

In developing studies, additional scholarly investigations have focused on the subject of clinical waste management [2, 7-12]. From the insights gained, most of these investigations avow that some of the challenges facing clinical waste

management activities in developing countries include lack of adequate training, financial constraint, and lack of awareness and knowledge about clinical waste management. Also, some studies avow that the problem arises from factors such as lack of guidelines and national policies regarding effective clinical waste management [13, 14].

In the context of Malaysia, some studies have also examined the aspect of clinical waste management. Indeed, the majority of these investigations report that some of the problems facing the clinical waste management process include low-level education and training, financial resource and budget constraint, and lack of effective (and poor implementation) of regulations and rules [15-17]. Given these trends, the need for an effective and systematic clinical waste management process cannot be overstated. Particularly, the country requires attention from the research community, local and national governments, and other relevant stakeholders; a dilemma coming in the wake of increasing numbers of healthcare facilities in the country.

To steer improvements in the country's clinical waste management process, it is also important for a benchmark to be set, especially regarding good clinical waste management practices; replicating a case such as that which is implemented in Korea – in which the World Health Organization acknowledges the implementation of good clinical waste management procedures [18]. In 2005, WHO noted that several strategies are worth implementing [19]. Some of these strategies include full participation and adequate financing of trained staffs, underspinning legislation, sound organization, careful planning, good administration, and the provision of a dedicated waste management team. The main aim of the current review is to unearth the current challenges and state of management of clinical wastes in Malaysia's healthcare establishments (HCEs). Also, the study seeks to investigate some of the good practices that are worth implementing, including Korea's clinical waste management procedure.

II. METHODOLOGY

The study employed a gap analysis technique. The objective was to determine differences between the current state of clinical waste management at the country level and where Malaysia seeks to be in relation to its future of clinical waste management. Hence, the study relied on some of the previous scholarly studies that had investigated the subject, with Korea on focus. The inclusion criterion was set

Revised Manuscript Received on May15, 2019.

Afiza Abdullah Suhaimi, (afiza@ump.edu.my)
NizaShamsuddin, India
MohdArmi Abu Samah, India

in such a way that the studies that were considered were those that had been published in 2000 onward. This criterion sought to ensure that the study gained insights from more current scholarly findings. In Figure 1, some of the mechanisms of effective clinical waste management processes are illustrated. Specific parameters that are provided include issues such as full participation and adequate funding of a trained staff, underspinning legislation, sound organization, careful planning, good administration, and the provision of a dedicated waste management team. In this study, issues of interest included the full participation by trained staff, underspinning legislation, and good administration.

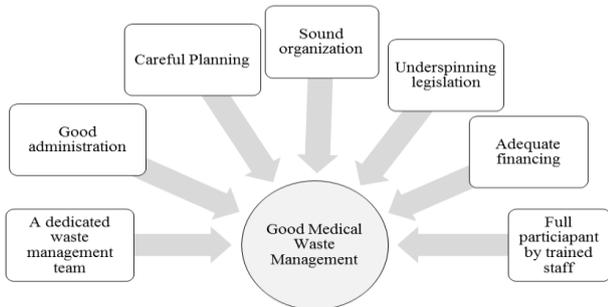


Figure 1: Good medical waste management, WHO 2005.

III. RESULTS

In this section, the main purpose is to present the results obtained from selected studies that had investigated the aspect of clinical waste management and some of the challenges facing the healthcare system, as well as the rest of the Asian context. The motivation is to conduct a gap analysis and predict some of the feasible solutions that the local and national governments could implement.

Focusing on Good Administration

In the last three decades, the Ministry of Health appointed a task force charged with HCW administration. However, the year 2001 saw this task force transferred to the Ministry of Environment. Some of the roles of the latter institution include environmental collaboration with other countries, enhancing cooperation between the country and its environmental wing, the provision of financial and administrative support to local governments (for environmental management), the establishment of standards for waste management regulation, and the establishment and implementation of mid- and long-term environmental conservation strategies. Others include establishing an environmental administration framework, introducing or creating environmental institutions, and enacting and amending environmental regulations and laws in the country (website MOE Korea).

It is also imperative to highlight that Malaysia has implemented waste management privatization. Since 1997, this step has aimed at reducing the administrative and financial burden facing the government, besides the promotion of competition. Furthermore, the decision has been implemented with the motivation of increasing the private sector's role in the process of nation-building; besides the provision of opportunities through which new economic policy could be realized [20]. Also, privatization

proves efficient and effective due to its promise to steer improvements in biomedical waste management quality (UNESCAP, 2000). As such, the Ministry of Health has appointed relevant parties to steer the public health care and clinical waste management improvement. These parties include PantaiMedivestSdnBhd, EdgentaMediserveSdnBhd (M) and Radicare (M) (Malaysia Environmental Industry, 2010). Specific roles of these parties include disposing, transportation, and collecting wastes sustainably.

In Relation to Clinical Waste Regulations, Legislations, and Policies

In a context such as the Republic of Korea, one of the dominant and hazardous wastes involves medical wastes. Until 1999, the Ministry of Health, through the Medical Law, had regulated the management process. At the time, there were improvements in the control of medical wastes between the points where they were generated to the points where they were disposed. Indeed, the Waste Management Act was being implemented by the Korea Ministry of Environment (MOE) [21]. Imperatively, the Act specifies issues such as standards for proper waste disposal and the types of generators and HCWs. The Ministry of Environment offers additional and detailed data regarding HCW disposal guidelines. Recently, the amendment and enforcement of the Act was done in 2016, aiming at improving the living standards of residents. Particularly, the amended Act emphasizes better quality of life or living standards and environmental conservation via the reduction of waste production, as well as proper disposal of wastes; hence environmental friendliness. Furthermore, the Act emphasizes the proper disposal of medical wastes. In Korea, no specific policy outlines the expected procedures of medical waste disposal. Institutions that attempt to address the debate include the Guideline for Health-care Waste Management (2004) and the Second National Comprehensive Plan for Waste Management (2002–2011).

Imperatively, Korea signed the Basel Convention and has had to enforce the trans-boundary hazardous waste movement Act, implementing the same in 2014. The role of the Act lies in the prevention of environmental pollution arising from trans-boundary waste movement. Also, the Act strives to steer improvements in international cooperation relative to the control of inland, import and export transit wastes; ensuring that the operation adhere to regional, multilateral, and bilateral agreements – as governed by the aforementioned conventions.

In the context of Malaysia, clinical waste management legislation is governed by a cradle to grave principle. Hence, the 1974 Environmental Quality Act has empowered the DOE to ensure that pollution is prevented and controlled, especially due to the growing demand for environmental quality enhancement [22]. Also, the existing regulations in the country aim at handling hazardous ways of waste disposal and touch on issues such as waste treatment, transportation, and storage; steps that were enforced in 1989. It is also worth indicating that in Malaysia, clinical



waste management I achieved via the implementation of other laws or regulation. Examples include the 1993 Guidelines for the Management of Clinical and Related Wastes in Hospital and Health Care Establishments, the 1988 Prevention and Infectious Disease Act 1988, and the 1994 Occupational Safety and Health Act.

Table 1: An illustration of Malaysia clinical waste management regulations

Year	Regulations
1988	Prevention and Infectious Disease Act
1989	Environmental Quality (Prescribed Premises) (Scheduled Waste Treatment and Disposal Facilities) Regulations
1993	Guidelines For The Management Of Clinical and Related Wastes In Hospital and Health Care Establishments
1994	Occupational Safety and Health Act
2002	Guidelines On Clinical Waste Management For Health Clinic
2005	Environmental Quality (Scheduled Wastes) Regulations

From the table above, the role of the private healthcare facilities services and the private healthcare facilities and services Act lies in the need to address the country's non-infectious and infectious wastes. Whereas some of the non-infectious wastes include explosive, flammable, radioactive, cytotoxic drug, and toxic chemical wastes, infectious wastes include contaminated sharp items, biological, animal, and human waste [23].

C. The Case of Full Participation by Trained Staffs

In the Korean context, one of the areas that have been prioritized involves the training in medical waste disposal and management [19]. The Malaysian context has also embraced these procedures through certain consultants or appointed contractors, as well as local and national governments [18].

D. Short Comings in the Existing System

From the recommendations by WHO, waste management processes ought to be comprehensive and systematic, including in the healthcare systems. In Malaysia, some of the processes of clinical waste management include disposal, transportation, treatment, storage, containment, labeling, segregation, and the identification of wastes. In Figure 2, Selangor's government's clinical waste management process is illustrated.

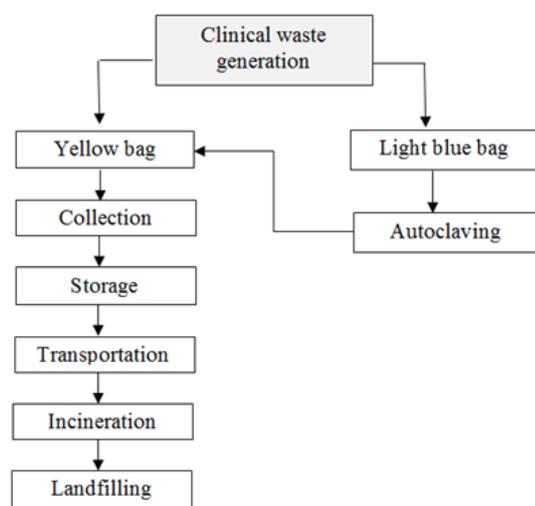


Fig. 2: Selangor's government's clinical waste management process

Sharp objects are disposed in dedicated bins for sharp item while clinical wastes are disposed in yellow bags. In Malaysia, all healthcare establishments are expected to abide by a widely-adopted standard color coding system. The light blue bags are meant for incineration while clinical wastes, as aforementioned, are meant for yellow bags. On the other hand, general wastes are expected to be disposed in black bags. Before disposing the clinical waste ultimately, wastes requiring autoclaving are also expected to be autoclaved or treated using relevant and alternative procedures. Also, these wastes are expected to be stored in blue autoclave bags before the treatment process, with yellow bags used after treatment.

In the current system, Malaysia's clinical waste management experiences a challenge in the form of improper practices. In the study by Taiping et al [16], it was established that most of the private clinical fail to adhere to standard procedures of clinical waste disposal, collection, storage, and segregation. Some of the factors documented to contribute to this challenge include high costs of clinical waste management and the small quantity of wastes that are generated in most of the small-scale private medical clinics.

According to the Auditor General Report Malaysia (2007), most of the medical waste is disposed with general waste, causing additional costs and also increasing the amount of waste generated. Also, the report indicated that most of the bins with sharp objects tend to be kept for too long before being disposed; with the majority maintained poorly and some staying longer without being washed. Also, the report indicated that in some case, ambulances are used to transport medical wastes, failing to conform to the specifications outlined by the DOE. Additional studies avow that most of the waste water continues to flow and access public drainage systems without treatment. In the investigation by Omar et al. [24], it was established that clinical waste segregation fails to abide by the expected standards and rules. In the context of Hospital BatuPahat, findings demonstrated that the clinical waste disposed into yellow bins exceeded the expected quantity (three-quarters), suggesting that both the clinical waste bags and bins were tend to be misused. In the investigation by Hamadan et al. [25], results demonstrated that in the context of Hospital Sultanah Aminah Johor Bahru, clinical waste management conditions are poor. The figure below illustrates the clinical waste management practice in the Korean context.

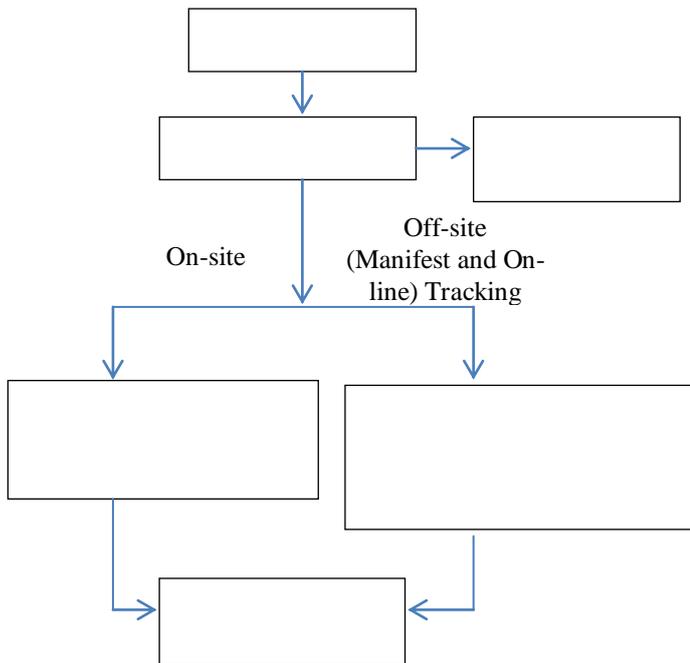


Fig. 3: Medical waste management pathways in Korea [26].

From the figure above, Korea’s state of clinical waste management reveals that medical waste segregation begins from the point where they (the wastes) are generated; a trend followed by a significant number of healthcare organizations [26]. Indeed, the rest of the wastes are directed into orange containers, a process achieved before transporting the wastes. It is also notable that the containers are expected to have universal biohazard signs, which applies to the majority of the countries. Mostly, the segregated wastes are transported in large medical waste containers and directed to storage zones. In turn, they are transported off-site to be treated before the final stage of waste disposal. It is also worth indicating that in Korea there exist medical waste management procedures such as disinfection with superheated steam, dry heat disinfection, chemical disinfection, microwave sanitation, steam sanitation or sterilization, and incineration. Indeed, the most common procedures for medical waste treatment include steam sterilization and incineration [21].

Obstacles and Recommendation for Improvements

Based on the current literature, several challenges face the practice of clinical waste management. In the investigation by Taiping et al. [16], findings demonstrated that major problems include the failure by private medical facilities to engage clinical waste management contractors, high charges imposed by DOE registered contractors, and lack of awareness regarding the practice. In another investigation, Razali and Ishak [17] stated that poor attitude among the concerned stakeholders hampers the effectiveness of clinical waste management in the country. Also, district health centers are yet to engage companies charged with clinical waste management, with most of the wastes ending up outside the fences of clinical waste storage facilities. This problem proves hazardous to animal and human health.

Another challenge involves the lack of adequate space in hospital facilities. Notably, clinical waste demands adequate space for processes such as the washing and drying o bins.

Hence, some bins have taken long without being washed, with others washed improperly. The aspect of high cost of clinical waste management compounds this challenge. Currently, the cost stands at RM5.20 for every kilogram of waste, with the problem projected to be more complex due to the increasing cost of transportation and raw materials for making materials such as bags and bins. The general waste and clinical waste is also mixed due to low public awareness in relation to waste handling or management. Due to the latter problem, the cost of clinical waste management increases. Also, the procedures and requirements for clinical waste management have proved lengthy, making it difficult for Malaysia’s environmental and healthcare systems to adhere to WHO specifications about environmental friendliness [19]. The challenges facing Malaysia’s state of clinical waste management are summarized below.

**Table 2
Challenges facing Malaysia’s state of clinical waste management**

Factors	Sources
<ul style="list-style-type: none"> • Mixing clinical waste with general waste • Lack of adequate monitoring, supervision, and control of clinical waste management • Lack of knowledge and awareness about clinical waste segregation • Lack of knowledge and awareness about environmental and health adverse effects of poor clinical waste management • Lack of adequate policies, rules and regulations • Poor attitude towards clinical waste segregation – among most of the public health workers • Lack of enough bin and bags for waste disposal • Financial constraint • Lack of adequate training programs among health care providers • Poor understanding of the concept of clinical waste • Poor definition of roles and responsibilities of the health care personnel • Lack of information on clinical waste handling • Lack of clinical waste management plans in healthcare facilities • High charges imposed by DOE registered contractors [16, 17, 24] 	[15]

Table 3
Recommendations for improving Clinical Waste Management in Malaysia

Area of improvements	Recommendations
Budget	<ul style="list-style-type: none"> Develop no to low cost effective practices of clinical waste disposal. Imposition of continuous segregation practices which are safely and cost-effectively managed
Policy	<ul style="list-style-type: none"> Underpinning legislation or guidelines or regulations. Simplified existing requirements and procedures for clinical waste management
Technology	<ul style="list-style-type: none"> Develop and applied safe and environmental friendly technology Should develop dedicated and trained waste management team.
Awareness and knowledge	<ul style="list-style-type: none"> Effective management application, training and certificate programs for the personnel involved in health-care waste management/handling should be started immediately.

IV. CONCLUSION

This review suggests that a cradle to grave principle characterizes the clinical waste management system in Malaysia; affecting procedures such as clinical waste disposal, treatment, transportation, collection, and storage. Whereas the government has embraced mechanisms aimed at ensuring that clinical waste management abides by rules and regulations governing environmental protection, the goal is yet to receive in-depth analysis and implementation. Form the majority of the previous scholarly studies, there is a dire need for the country to adopt and implement effective clinical waste management strategies. Some of the challenges facing the concerned stakeholders include financial constraint, lack of awareness regarding the importance of clinical waste management (and adverse effects of poor medical waste disposal), and inadequate training opportunities for health care practitioners. Therefore, this study recommends that Malaysia analyzes its current waste management practice comprehensively to ensure that improvements are achieved. Particularly, there is a need for feasibility analysis and cost-effective analysis to assure environmental friendliness without compromising the country's annual expenditure on health and environmental issues. In so doing, the citizens' quality of life might improve due to reduced risks of disease and environmental degradation.

REFERENCES

1. S. Hossain, A. Santhanam, N. A. N. Norulaini, and A. K. M. Omar, "Clinical solid waste management practices and its impact on human health and environment – A review," *Waste Management*, vol. 31(4), 2011, pp. 754–766. <http://doi.org/10.1016/j.wasman.2010.11.008>
2. M. A. Patwary, W. T. O'Hare, G. Street, K. MaudoodElahi, S. S. Hossain, and M. H. Sarker, "Quantitative assessment of medical waste generation in the capital city of Bangladesh". *Waste Management*, vol. 29(8), 2009, pp. 2392-2397. <http://doi.org/10.1016/j.wasman.2009.03.021>
3. S. A. Tamplin, D. Davidson, B. Powis and Z. O'Leary, "Issues and options for the safe destruction and disposal of used injection materials," *Waste Management*, vol. 25(6), 2005, pp. 655–665. <http://doi.org/10.1016/j.wasman.2004.07.007>
4. A. M. Hauri, G. L. Armstrong, and Y. J. Hutin, "Contaminated injections in health care settings", n.d.
5. S. N. Fajriyah, A. Udiyono, and L. D. Saraswati, "Environmental and Risk Factors of Leptospirosis : A Spatial Analysis in Semarang City," *IOP Conference Series: Earth and Environmental Science*, vol. 55, 2017. <http://doi.org/10.1088/1742-6596/755/1/011001>
6. B. Gonzenbach, and A. Coad "Solid waste management and the Millennium Development Goals Links that inspire action. 2007. <https://www.irwash.org/sites/default/files/Gonzenbach-2007-Solid.pdf>

7. A. N. Oli, C. C. Ekejindu, D. U. Adje, I. Ezeobi, O. S. Ejiofor, C. C. Ibeh, and C. F. Ubajaka, "Healthcare Waste Management in Selected Government and Private Hospitals in Southeast Nigeria," *Asian Pacific Journal of Tropical Biomedicine*, vol. 6(1), 2016, pp. 84–89. <http://doi.org/10.1016/j.apjtb.2015.09.019>
8. G. L. Williams, "Medical Waste Disposal Practices in some Hospitals and Clinical Laboratories in the Accra Metropolis (Ghana)," *Civil and Environmental Research*, vol. 3(11), 2013, pp. 90–98.
9. M. A. Patwary, W. T. O'Hare, G. Street, K. MaudoodElahi, S. S. Hossain, and M. H. Sarker, "Quantitative assessment of medical waste generation in the capital city of Bangladesh". *Waste Management*, vol. 29(8), 2009, pp. 2392-2397. <http://doi.org/10.1016/j.wasman.2009.03.021>
10. P. A. Abor and A. Bower, "Medical Waste Management Practices in a Southern African Hospital," *International Journal of Health Care and Quality Assurance*, vol. 21(4), 2008, pp. 356-364.
11. V. K. Goddu, K. Duvvuri, and V. K. Bakki, "A Critical Analysis of Healthcare Waste Management in Developed and Developing Countries: Case Studies from India and England", *Proceeding of the International Conference on Sustainable Solid Waste Management, Chennai, India, 2007*, pp. 134–141. <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.544.360&rep=rep1&type=pdf>
12. L. F. Diaz, G. M. Savage, and L. L. Eggerth, "Alternatives for the treatment and disposal of healthcare wastes in developing countries", *Waste Management*, vol. 25, 2005, pp. 626–637. <http://doi.org/10.1016/j.wasman.2005.01.005>
13. S. Ali, U. Mahmood, A. U. Malik, F. Aziz, R. B. Naghman, and I. Ahmed, "Current Hospital Waste Management Practices in Pakistan : Case Study and Curative Measures," *Public Health and Preventive Medicine*, vol. 1(3), 2015, pp. 125–129.
14. A. Z. Alagoz, and G. Kocasoy, "Determination of the best appropriate management methods for the health-care wastes in Istanbul", *Waste Management*, vol. 28(7), 2008, pp. 1227–1235. <http://doi.org/10.1016/j.wasman.2007.05.018>
15. M. Bakriishak, L. A. Manaf, and A. M. Abdullah, "Clinical Waste Segregation : Towards Implementation and Obstacles in Malaysian Private Clinics", *IOSR Journal of Environmental Science, Toxicology and Food Technology*, vol. 8(10), 2014, pp. 22–28.
16. C. Taiping, C. S. Tiong, and P. A. Latiff, "Medical Waste Management In Private Medical Clinics Taiping, Perak", *International Conference on Ecological, Environmental and Bio-Sciences, Pattaya, Thailand, 2012*, pp. 87–91.
17. S. S. Razali, and M. B. Ishak, "Clinical Waste Handling and Obstacles in Malaysia," *Journal of Urban and Environmental Engineering (JUEE)*, vol. 4 (2), 2010, pp. 47-54.
18. World Health Organization (WHO). Safe management of wastes from health-care activities - edited by CHARTIER, Yves et al. World Health Organization, 329, 2014.
19. World Health Organization (WHO). Preparation of National Healthcare Waste Management Plans in sub-Saharan countries. Guidance manual. Secretariat of the Basel convention and World Health Organization. 2005.
20. A. R. Ambali (2007), "Development-induced water pollution in Malaysia: Policy planning, instruments for protection and emerging issues," *European Journal of Social Sciences*, 2007, vol. 5(1), pp.10-27.
21. Y. C. Jang, C. Lee, O. S. Yoon, and H. D. Kim, "Medical waste management in Korea," *Journal of Environmental Management*, vol. 80(2), 2006, pp. 107-115.



<http://dx.doi.org/10.1016/j.jenvman.2005.08.018>

22. H. Abdul, "Human Rights to Environment in Malaysia," *Health and Environmental Journal*, vol. 1(1), 2010, pp. 59–64.
23. A. R. Ambali, A. N., Bakar, and F. M. Merican, "Environmental Policy In Malaysia : Biomedical Waste , Strategies And Issues", *Journal of Administrative Science*, vol. 10(1), 2013, pp. 1–17.
24. D. Omar, S. N. Nazli, and S. A. L. Karuppanan, "Clinical Waste Management in District Hospitals of Tumpat , Batu Pahat and Taiping," *Procedia-Social and Behavioural Sciences*, vol. 68, 2012, pp. 134–145. <http://doi.org/10.1016/j.sbspro.2012.12.213>
25. N. Hamadan, M. Sapri, A. H. Mohammed, M. Awang, M. S. A. Rahman, N. W. Rosli, and N. M. I. N. Lah, "The Implementation of Clinical Waste Handling in Hospital Sultanah Aminah Johor Bahru (HSAJB)," *Procedia-Social and Behavioural Sciences*, vol. 65, 2012, pp. 802–807. <http://doi.org/10.1016/j.sbspro.2012.11.202>
26. Y. C. Jang, C. Lee, O. S. Yoon, and H. D. Kim, "Medical waste management in Korea," *Journal of Environmental Management*, vol. 80(2), 2006, pp. 107–115. <http://dx.doi.org/10.1016/j.jenvman.2005.08.018>.

AUTHORS PROFILE



Afiza Abdullah Suhaimi is the Lecturer at Occupational Safety and Health Department, Faculty of Engineering Technology, University Malaysia Pahang. She earned her Master degree from University Teknologi Mara, (UiTM). She is specialized in Hazardous Waste Management, environmental and legal management. She is very active in writing journal in local and international related to environmental health field.



Niza Samsuddin is the Associate Professor at Biomedical Science, Kulliyyah of Allied Health Sciences, International Islamic University Malaysia .She earned her PhD from University Kebangsaan Malaysia in Public Health. She is very active in various public health research related activities as well as Certified as Specialist in Public Health by National Credentialing Committee and Academy of Medicine Malaysia (National Specialist Registry NSR:126182). She is very active in writing journal in local and international related to public health field.