Science on Natural Resources and Environment
Journal homepage: tapchikhtnmt.hunre.edu.vn

AN OVERVIEW OF MUNICIPAL SOLID WASTE MANAGEMENT IN QUANG BINH PROVINCE

Ton Hoang Ho[1], Truong Duc Canh[2], Nguyen Thu Huyen[2]
[1]Kien Giang University, Vietnam
[2]Hanoi University of Natural Resources and Environment, Vietnam

Received 08 July 2021; Accepted 14 December 2021

Abstract

In developing countries, urbanization and rapid population growth have resulted in a dramatic increase in Municipal Solid Waste (MSW) generation. Safe collection, transportation and treatment of MSW are among the major issues for Quang Binh province. Improper MSW management (MSWM) practices can have adverse effects on human health, the environment and climate change. This paper reviews the existing MSWM practices, challenges and provides suggestions to help improve the MSWM system in Quang Binh province. This study also presents an assessment of the existing situation of MSWM in Quang Binh province. The results show that the municipal solid waste collection network has not covered the major part of the concentrated residential areas. The daily collection rate is only about 78.56 % in the places where the collection network has reached. Landfills are currently the most common method of MSW treatment while most waste treatment plants (WTPs) have not generated electricity yet. Moreover, the amount of MSW sent to landfills just accounted for over 50 % of the waste brought to the WTPs. In order to improve the efficiency of solid waste management system and to optimize the operation of the waste collection vehicles following the conditions of the province, the use of information technology was proposed to apply to the collection management system. Conversely, in the long term, it is necessary to implement separation of waste at source to reduce the pressure on the WTPs and develop more associated technologies such as waste - to - energy technology. These technologies will enable the WTPs to enhance the flexibility of their treated products as well as introduce these products into the markets.

Keywords: Domestic solid waste; Municipal solid waste; Solid waste management; Quang Binh province.

Corresponding author. **Email:** nthuyen.mt@hunre.edu.vn

1. Introduction

Quang Binh is located in the North Central region of the country, forming the ancient and modern culture intersection area where the key economic, cultural and social values have met. Quang Binh has recently undergone numerous changes; by the end of 2020, the province has 61.72 % of communes meeting new rural standards, of which 15 communes meet the criteria of modern rural infrastructure

aligned with urbanization [4]. Industrial production has grown quite magnificently. Tourism has gradually been one of the key economic growth sectors in the province. The socio - economic infrastructure is step by step synchronous. Several crucial infrastructures are formed, such as Hon La seaport, Dong Hoi airport and Cha Lo international border gate [2]. Besides economic development, Quang Binh has faced numerous significant environmental challenges. The municipal solid waste (MSW) management in Quang Binh province still has many shortcomings since the MSW management has not caught up with the economic growth. This study aims to present the survey and assessment on the current situation of MSW management in the province and proposes suggestions to improve the efficiency of waste collection and transport.

2. Data collection methods

The primary data, including waste generation, waste composition, waste treatment, were mainly collected from the Department of Natural resources and Environment and Quang Binh Urban environment Joint stock Company. The data on population growth was from the economic growth and urbanization data from the Annual socio - economic report of the People's Committee of Quang Binh province (2019 - 2020). Furthermore, the survey also collected data from the 2019 National State of the Environment report. All the average daily collection rate data of MSW were from data recorded at Quang Binh solid waste treatment zones.

3. Results and discussion

3.1. Current status of municipal solid waste management

According to the survey results, up to now, the whole province has 121 above 159 communes, wards and towns, covered by the collection network (reaching the rate of 76 %) by the Management Board of public works or self - management team and environmental sanitation teams. Figure 1 shows the number of communes covered by the collection system. Therefore, Dong Hoi City and Ba Don town have achieved the coverage of the collection network to 100 % of the residential areas; the rest of the other districts have a coverage ratio of only 31.25 % to 89.2 %.

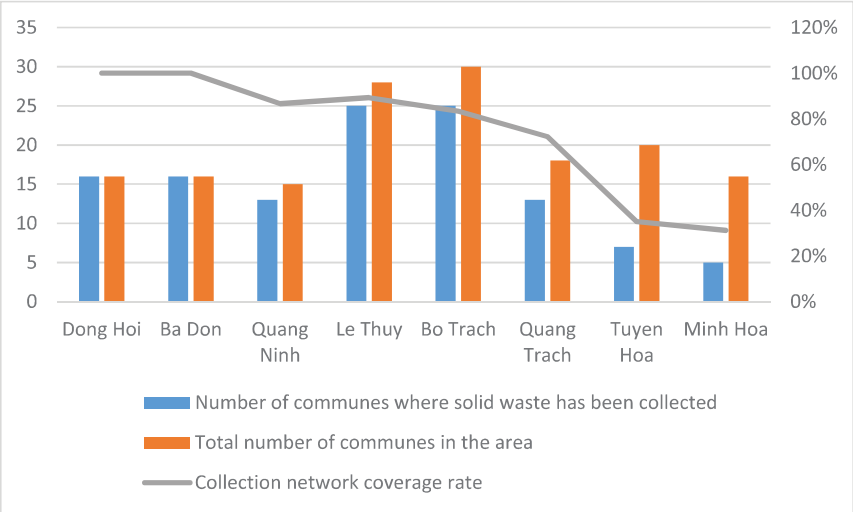
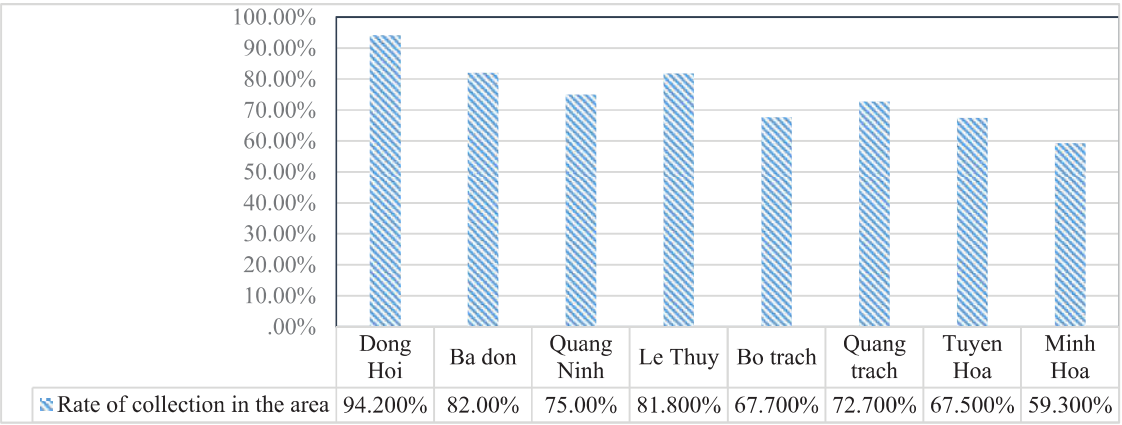


Figure 1: Number of communes covered with the municipal solid waste collection system

According to the survey, the total amount of domestic waste generated in Quang Binh province is about 466 tons/day, of which about 95 tons/day in Dong Hoi City; 55 tons/day in Le Thuy district; 40 tons/day in Quang Ninh district; 64 tons/day in Ba Don town; 55 tons/day in Quang Trach district; 90 tons/day in Bo Trach district; 40 tons/day in Tuyen Hoa district and about 27 tons/day in Minh Hoa district. Based on the calculation of the number of residents living in the area, the average rate of waste collection and treatment in the whole province of Quang Binh is about 77.4 %. Figure 2 below describes the collection rates of each district.



	Dong Hoi	Ba don	Quang Ninh	Le Thuy	Bo trach	Quang trach	Tuyen Hoa	Minh Hoa
Rate of collection in the area	94.200%	82.00%	75.00%	81.800%	67.700%	72.700%	67.500%	59.300%

Figure 2: The collection rate of domestic solid waste in Quang Binh by regional districts

The collected solid waste will be transported to 13 solid waste landfills, burned at the incinerator in Tien Hoa commune and disposed of at the waste sorting and treatment plants, producing biogas and organic mineral fertilizers.

Out of solid waste landfills, currently, only 08 are in operation; 05 landfills had stopped their operations. The active landfills include Dong Hoi landfill, Phong Nha landfill, Le Thuy district's landfill (without bottom lining), Tuyen Hoa district's landfill, Minh Hoa district's landfill, Cha Lo landfill (without bottom lining, in progress), Quang Luu landfill (additional burial compartments are under construction), Quang Ninh district landfill (in progress). There are three landfills closed, renovated and restored, including Cau Cup landfill in Loc Ninh commune, Dong Hoi city; Quang Long landfill in Quang Long ward, Ba Don town; Cua Truong landfill in Dong Le town, Tuyen Hoa district. Besides these, Canh Duong landfill in Canh Duong commune, Quang Trach district is submitting the closure plan to ensure compliance with regulations. Moreover, Thanh Trach landfill in Thanh Trach Commune, Bo Trach district has stopped working due to environmental pollution but has not arranged funds to close according to regulations.

There is a waste sorting and treatment plant (WSTP), producing biogas and organic mineral fertilizers in Ly Trach commune, Bo Trach district under Vietnam Project Development Limited Company and a waste treatment plant in Quang Tien commune. This project in Quang Tien commune has just completed the site preparation part.

The domestic solid waste incinerator in Tien Hoa commune has been operating since 2018. Currently, the incinerator is operating at about 60 % of its 330 kg/

hour capacity, treating domestic waste collected from the Tien Hoa commune and six villages of Chau Hoa commune.

At the WSTP, the treatment design capacity is 245 tons/day. Presently, the current treatment capacity of Dong Hoi city, Bo Trach district and Quang Ninh district is at approximately 158 tons/day, of which Dong Hoi city about 90 tons/day; Bo Trach district about 50 tons/day and Quang Ninh district about 18 tons/day.

The company deployed 02 modules of organic waste fermentation for power generation at the same time. The first module uses dry fermentation technology from organic solid waste after sorting, a technology of Input company from Germany, designed with a power generation capacity of 2.0 MW. This technology uses roughly 73.5 tons of organic waste from the sorting line, accounting for 30 % of the sorted domestic solid waste. The second module uses wet fermentation technology from agricultural waste, a Wehling company's technology from Germany, designed with a power generation capacity of 1.0 MW. This module uses about 70 tons per day of organic waste from agriculture.

Currently, because some working facilities have not been put into operation, the amount of solid waste after sorting is approximately 52 % of recycled scrap, stored at the factory to sell scrap. And the remaining 48 % of waste is disposed at Dong Hoi - Bo Trach landfill.

3.2. Evaluation of municipal solid waste management in Quang Binh province

In general, solid waste management in Quang Binh is facing some problems. The first problem is that the collection network has not been covered throughout the residential areas. Although there are many places in the province that has been covered by regular waste collection services, the collection efficiency is relatively low since the collection works have relied on small collection groups with rudimentary vehicles. On the other hand, the incidence of companies, cooperatives and environmental sanitation teams indicates that labor force shortages and low labor regimes are factors currently limiting their collection activities.

Another issue is that the solid waste treatment mainly focuses on the landfill method, but some landfills have not yet been operated due to the requirements of a sanitary landfill. Projects on solid waste treatment and energy recovery towards minimizing the amount of solid waste in landfills have not been adequately implemented. Thus, the amount of solid waste put into landfills is remaining abundant.

There are four main reasons for these limitations. First of all, the stretched terrain and diverse terrain with mountains, sea and plain have increased the difficulty in organizing the collection. Natural disasters like storms and floods often occur in the region, which is also a pressure for local collection activities. Secondly, due to the low economic conditions of the area, the people are not willing to pay for the collection and treatment system of solid waste, while the state budget to support losses is also limited. Thirdly, the management of the collection network is manual. Computer systems have not been applied and thus the current collection and transportation routes are just determined based on experts' experience. It shows that other critical factors such as the characteristics of the road (road width, road direction), residential characteristics

and others have not been evaluated and assessed appropriately. Therefore, the efficiency of the use of vehicles has not yet reached the optimal level leading to wasting fuel. Finally, waste treatment projects have higher actual treatment costs than their design cost. One of the reasons is that the cost of sorting solid waste at the plant is higher than its planning cost and recoverable products after handling such as electricity from the garbage cannot reach a suitable selling price for the business.

In order to improve the effectiveness of solid waste management, many short-term and long - term solutions need to be considered. For example, deploying the application of 4.0 technology on the solid waste management system of the province. Notably, Dong Hoi city has piloted a project which replaces the current handcart with small trucks in Dong Hai ward's garbage collection system. Small collection trucks take the solid waste to the waste transfer station and then transport MSW from the transfer station to landfills using compactors. Therefore, the application of Geographic Information Systems (GIS) on the collection system is essential. In the future, to reduce costs, it is possible to apply open sources software such as QGIS to develop maps that visualize a solid waste management system. In the long term, separation of waste at source should be implemented to minimize the pressure on the existing treatment system. At the same time, with WSTP, it is necessary to add treatment modules to RDF fuel pellets so that the finished product can be more flexible in use, reducing their operating costs for business.

4. Conclusion

Today, in Quang Binh province, the amount of domestic solid waste is about 492 tons per day, the collection efficiency reaches 78.56 %. The collection network is still rudimentary, not covering all residential areas. Solid waste after collection is mainly treated by the landfill method. Solid waste treatment plants have not generated power, it results in the amount of post-treatment landfill has just accounted for over 50 % of the waste sent to the plants.

In order to improve management efficiency, in the short term, it is necessary to apply information technology to the collection system to optimize the operation of collection vehicles [4]. In the long term, it is necessary to implement separation of waste at-source to reduce the pressure on the waste treatment plants, equip more treatment technologies and the waste - to - energy treatment to diversify finished products, increasing their flexibility and expanding them into the market.

REFERENCES

[1]. Awasare S., Sutar A (2015). *Review article: Solid waste management & GIS*. International Journal of Research in Environmental Science and Technology, 5(1), pp. 22 - 28.

[2]. The People's Committee of Quang Binh province (2013). *Regional construction planning of Quang Binh province to 2030*.

[3]. The People's Committee of Quang Binh province (2019). *Report on solid waste collection and treatment in Quang Binh province in 2019*.

[4]. The People's Committee of Quang Binh province (2021). *The Annual socio - economic report of the People's Committee of Quang Binh province, 2019 - 2020*.