Some solutions to improve the efficiency of domestic solid waste management in Cho Don district, Bac Kan province, Vietnam

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Abstract

The study has applied some traditional research methods to assess the current status of domestic solid waste (DSW) management and suggest solutions for DSW management in Cho Don district, Bac Kan province, Vietnam. The results showed that the main component of DSW is organic waste (72%); the total amount of DSW is 25 tons/day; the average emission factor is 0.51 kg/person/day; In the study area, only Bang Lung town has the largest DSW collection rate (95%). In most of the remaining areas, DSW has not been properly collected and treated. Cho Don district invested and built 01 Ban Tan waste treatment area operated by incineration and landfill technology and 03 incinerators (Dong Thang commune (0.3 tons/day), Binh Trung commune (Ban Dieng Village, Ban Ca Village)). Although the local government has made great efforts in the management of DSW, however the DSW management still has many shortcomings. To strengthen DSW management in the study area, it is necessary to apply a number of solutions synchronously, such as: Raise awareness of the community on how to identify types of waste and the importance of sorting DSW at source; perform DSW classification at source; collecting all DSW generated from households; effective use of existing incinerators and waste treatment facilities; additional human resources and increased capital mobilization for DSW management; expanding types of DSW treatment such as using biodegradable organic waste to produce fertilizers by biological methods; reuse of plastic or inorganic materials; enhance the inspection and supervision role of the residential community on the collection and treatment of domestic waste in the localities; strengthening socialization in DSW management. Improve the capacity of the unit that directly collects, transports and treats DSW...

Keywords: Solid waste, environmental management, waste, pollution, Bac Kan

I.Introduction

Urbanization and economic development often lead to increased resource consumption and solid waste generation rate per capita. Urban residents in developed countries generate six times more waste than in developing countries. It is estimated that in developed countries the amount of solid waste can reach 2.8 kg/person/day, in developing countries it is about 0.5 kg/person/day [1]. The average rate of domestic solid waste (DSW) generation worldwide is about 0.74kg/person/day; in which, the rate in the lowest country is 0.11kg/person/day and the rate in the highest country is 4.54kg/person/day. In 2016, the total volume of municipal solid waste generated globally was about 2 billion tons. In which, the largest amount of urban

solid waste is in the East Asia - Pacific region with 468 million tons; The lowest was in the Middle East and North Africa with 129 million tons [2]. In Vietnam, the amount of generated DSW is about 25.5 million tons in 2018, of which urban DSW is about 38,000 tons/day and rural domestic waste is about 32,000 tons/day [2]. DSW in urban areas currently accounts for more than 50% of the total DSW of the country and accounts for about 60-70% of the total amount of urban solid waste [2]. It is forecast that the amount of DSW in Vietnam will increase to 54 million tons by 2030 [3]. The average waste generation standard per capita for each type of waste is specific to each locality and depends on the standard of living, civilization and population in each area. However, regardless of the region, there is a general trend in the world that the higher the standard of living, the more waste is generated. According to a report by the World Bank, in big cities, the rate of solid waste generation in New York is 1.8 kg/person/day while in Singapore and Hong Kong it is 0.8 - 1.0 kg/person/day. In Vietnam in 2015, the total amount of DSW generated in cities was 38,000 tons/day. Estimation of DSW amount generated by 2030 will be 2.59 billion tons, and by 2050 it will be 3.4 billion tons [1].

In the world, there have been many studies on solid waste management such as:

"Analysis of solid waste collection and disposal in oversea, Nasarawa town, Nasarawa state" [4]; "Analyzing key drivers for a sustainable waste management system in Ethiopia: an interpretive structural modeling approach" [5]; Optimal management of solid waste in smart cities using internet of things" [6]; "Urban solid waste management in Chongqing: challenges and opportunities" [7]; "Waste management in Switzerland – Achievements and prospects" [8]; "Solid Waste Management Practices at a Private Institution of Higher Learning in Nigeria" [9]; "Assessment of Domestic Solid Waste Disposal and Management System in Tangail Municipal Area" [10]; "Analysis of Economical and Environmental Costs for the Selection of Municipal Solid Waste Treatment and Disposal Scenarios through Multicriteria Analysis (ELECTRE Method" [11]... However, there has been no research on the current status and solutions for domestic solid waste management in Bac Kan province.

Cho Don is a mountainous district of Bac Kan province, located in the west of Bac Kan province, with a total natural area of 91,135.65 hectares, accounting for 18.75% of the province's natural area (In which, the land is used for agricultural purposes is 85,307.78 ha, non-agricultural purposes is 4,829.04 ha and unused land is 998.83 ha)., which is divided into 20 commune-level administrative units (including 01 Bang Lung town and 19 communes). In recent years, Cho Don district has had many changes in all aspects, especially socio-economic development, so there have been many significant changes: good economic growth rate; people's living standards are improved; infrastructure and facilities are increasingly spacious and modern. Along with those positive aspects, environmental issues such as: The amount of domestic waste increases; waste has not been properly collected and segregated; many communes/wards do not yet have a domestic solid waste treatment plant. These problems have the potential to affect the quality of the natural environment and reduce the beauty of the area. Before that situation, topic" Some solutions to improve the efficiency of domestic solid waste management in Cho Don district, Bac Kan province, Vietnam" was implemented with the purposes: Assessing the situation of generation, collection, classification, transportation and treatment of domestic solid wastes and proposing appropriate solutions to improve the

efficiency of DSW management in the area. Furthermore, this will contribute to the improvement of environmental quality and landscape beauty in the study area.

II. Research subjects and methods

2.1. RESEARCH SUBJECTS

Focused research on household solid waste management in Cho Don district, Bac Kan province, Vietnam

2.2. RESEARCH METHODS

- Methods of data collection:

In this study, the authors collected information from books, newspapers, magazines, the internet. From there, the authors synthesized and analyzed documents and data related to the research content.

- Methods of actual investigation and survey in the study area:

The field survey method in the study area is used for the purpose of correcting information, verifying existing documents, adding missing or incorrect information, especially focusing on waste collection and treatment activities. The survey method is applied mainly by interviewing with a set of open-ended questions with prepared topics. The study has conducted field surveys in the study area to collect specific information and objectively evaluate the research problem such as DSW collection route, DSW classification at source, DSW treatment area... The actual survey areas are residential areas, solid waste collection points, collection routes, DSW treatment areas...

- Methods of statistics and data processing:

All collected documents must be processed, evaluated to check and detect possible errors, thereby taking measures to correct and supplement relevant documents in a timely manner. The data is processed by Microsoft Excel software.

-Expert interview method:

Interview with staff from the Department of Natural Resources and Environment of Bac Kan province to verify the results of the interview survey.

III. Results and discussion

3.1. STATUS OF HOUSEHOLD SOLID WASTE MANAGEMENT IN CHO DON DISTRICT, BAC KAN PROVINCE

Cho Don district has 20 commune-level administrative units, including 01 Bang Lung town and 19 communes (Ban Thi, Bang Lang, Bang Phuc, Binh Trung, Dai Sao, Dong Lac, Dong Thang, Luong Bang, Nam Cuong, Nghia Ta, Ngoc Phai, Phuong Vien, Quang Bach, Tan Lap, Xuan Lac, Yen My, Yen Phong, Yen Thuong, Yen Thinh). The population in 2019 is about 49,554 people. The population density is 54 people/km^2.

Research results show that DSW in the study area arises mainly from residential areas, schools and markets; The emission factor is 0.51 kg/person/day, the waste volume is 25 tons/day, the DSW component is mainly organic matter (68.5-72%), hazardous waste accounts for the lowest percentage (under

1%), plastic, nylon and paper account for the same proportion, ranging from 4.6% to 10.4%, metal accounts for the proportion from 2.8 to 4.4%, rubber and leather (3.1-4.2 %), glass accounts for the proportion from 0.6% to 2%, tissues (1.8-2.7%), inert accounts for the proportion from 14.2% to 23.2% depending on the research area.

In the study area, DSW is collected by hand trolley to the DSW collection area, then the DSW will be transported from the localities to the landfill for treatment by landfilling or incineration by trucks (2.5-3.5 tons) or specialized garbage compactor (5 tons). The amount of DSW generated in Bang Lung town is collected daily by Bac Kan Cho Joint Stock Company, transported to Ban Tan DSW disposal area for classification and treatment by burning or sanitary landfill method. In villages and hamlets far from the center of Bang Lung town (Ban Duong 1, Ban Duong 2, Na Pai), the population is sparse, the human resources of the collection unit are small, so the collection and treatment of solid waste at Centralized waste treatment area has not been implemented, but households often collect and treat their domestic waste by themselves.

In Bac Kan province, the proportion of communes that have not invested in treating domestic waste is 94%. In Bac Kan province, only 11% (corresponding to 12 communes) have environmental sanitation teams or teams in charge of DSW collection, the remaining 89% of areas, households dispose of their own DSW by burning or burying it in their garden [12].

Cho Don district has invested in building a Ban Tan waste treatment area according to combustion and sanitary burial technology, with a total area of nearly 2.18 hectares, a burial capacity of 38,804 m3, in order to treat the amount of solid waste in Bang Lung town and neighboring areas. Ban Tan waste treatment area has been officially put into use since January 2017 with an actual waste treatment capacity of 0.5 tons/day. This treatment area is managed and operated by the Management Board of Bang Lung town market.

The research results also show that the distance from the center of some communes to Bang Lung town is quite far, so the collection and transportation of DSW from the commune cluster centers to the Ban Tan DSW treatment area follows the general planning of the province faced a lot of difficulties and could not do it.

In order to do well in environmental protection and DSW treatment in the communes, in 2016, Cho Don District People's Committee also invested in building a DSW treatment facility in Dong Thang commune. The DSW treatment plant started operating in March 2017 with a design capacity of 100 kg/h, the average actual capacity of the treatment station is 0.3 tons/day. In Binh Trung commune, in two villages (Ban Dieng and Ban Ca) there is a centralized incinerator and workers collect and treat DSW with a frequency of once every 10 days. In other rural areas in Cho Don district, households collect and treat their own DSW by burning or burying it in their garden.

Although authorities at all levels have made great efforts in managing DSW in the study area, the percentage of DSW collected and treated is very low, DSW has not been classified at the source. There are many reasons leading to limitations in DSW management in the study area: the investment in infrastructure construction for the collection and treatment of DSW is still limited and has not met the actual needs; the

low awareness of a part of people in the collection and treatment of DSW, indiscriminate littering still occurs in some places. In some communes, the responsibility of the local government, especially the head, has not really paid attention to the collection and treatment of DSW, still allowing the situation of littering and indiscriminate dumping of waste, causing environmental pollution, degrading the landscape of the area; the central government does not have mechanisms and policies suitable for different regions on solid waste management…

3.2. SOME SOLUTIONS TO IMPROVE THE EFFICIENCY OF DSW MANAGEMENT IN CHO DON DISTRICT, BAC KAN PROVINCE

To strengthen the DSW management in Cho Don district, it is necessary to apply the following solutions synchronously:

- For the organizational structure of solid waste management: it is necessary to adjust the powers, functions, duties and responsibilities of each agency and unit in line with the National Strategy on Integrated Solid Waste Management to 2025, with a vision for the year 2050 to ensure consistency, appropriateness, avoid overlapping management, not knowing which party's responsibilities can easily lead to duplication or omission.

- Pursuant to national and provincial regulations on solid waste management. Cho Don district needs to be specific into district documents, suitable to local actual conditions but not against national documents.

- There should be specific encouragement, support and socialization documents to attract organizations and units to participate in DSW collection, transportation and treatment.

- It is necessary to have a policy on training and retraining on environmental protection work to thoroughly understand the processes, regulations and necessary contents related to environmental management in general and DSW management in particular. The training content focuses on the ability to develop a DSW management plan, communication skills to raise public awareness, environmental economics, and the ability to examine and evaluate DSW management. In addition, local authorities need to strengthen human resources with professional expertise in the field of environment.

- To ensure funding for DSW management, People's Committees at all levels, departments and agencies need to coordinate with Urban Environment Joint Stock Company to adjust the collection fee to suit the economic conditions of each locality.

- It is necessary to have a pilot model of “classifying DSW at source in the study area” in a specific commune, then summarize and evaluate the effectiveness, learn from experience and replicate the effective model.

- About equipment and means of transport DSW: DSW equipment and means of transport need to be upgraded to meet the classification of DSW at the source. Make a procurement plan, select equipment and facilities suitable to the budget as well as DSW handling requirements.

- Expanding types of DSW treatment such as using biodegradable organic waste to produce fertilizers by biological methods, saving costs for environmental protection, improving the economic efficiency of DSW, incinerating waste to energy harvesting, reuse of plastic or inorganic materials...

Some other solutions:

- Raise the responsibility of the leader in domestic waste management; Strengthening the organizational system for environmental protection from central to local levels according to the Law on Environmental Protection 2020 [13].

- Enhance the inspection and supervision role of the residential community on the collection and treatment of domestic waste in the localities;

- Commune-level People's Committees should promote the inclusion of domestic waste management in incense, a convention to mobilize community participation in waste management;

- It is necessary to maximize the role of mass and social organizations such as Farmers' Union, Women's Union, Veteran's Association, Elderly Association... to participate in DSW management in the area.

- There are preferential policies, calling for and creating favorable conditions for individuals, organizations and businesses to invest in the field of waste treatment, especially domestic waste.

- Mobilize all investment resources for solid waste management and treatment: State budget sources, environmental protection funds. In addition, it is possible to mobilize investment capital from domestic and foreign organizations and individuals.

- Propagating to raise public awareness about DSW co-management, contributing to environmental protection.

- Strengthening socialization in DSW management. Improve the capacity of the unit that directly collects, transports and treats DSW.

IV. Conclusion

The process of socio-economic development in Cho Don district, Bac Kan province has made the amount of DSW in the province tend to increase over the years, creating a lot of pressure on environmental management in the area. Research results show that DSW in the study area arises mainly from residential areas, schools and markets; The emission factor is 0.51 kg/person/day, the waste volume is 25 tons/day, the DSW component is mainly organic matter (72%). Cho Don district currently has 01 Ban Tan garbage treatment area operated by incineration and landfill technology and 03 incinerators (Dong Thang commune (0.3 tons/day), Binh Trung commune (Ban Dieng Village, Ban Ca Village)). The study results also show that Bang Lung town has a collection rate of DSW reaching 95%, the remaining areas of the district have a very low rate of DSW collection, there are many localities where DSW has not been collected and treated centrally. Although the local government has made great efforts in the management of DSW, however the DSW management still has many shortcomings: Human resources operating in the field of environmental protection are still lacking, professional qualifications cannot meet actual needs; Lack of funds to invest in the construction of concentrated DSW treatment facilities and operating expenses when they are put into use; Vehicles used in the collection and transportation of DSW are mainly handcarts, vertical trucks or trucks; Many villages and hamlets are far from the town center (Ban Duong 1, Ban Duong 2, Na Pai), the terrain is complicated, the population is sparse, the human resources of the collection unit are small, so the

collection and treatment of DSW at Centralized waste treatment area has not been implemented, but households often collect and treat their DSW by themselves. There are many reasons leading to limitations in DSW management in the study area: the investment in infrastructure construction for the collection and treatment of DSW is still limited and has not met the current actual needs; the low awareness of a part of people in the collection and treatment of waste, indiscriminate littering still occurs in some places; the central government does not have mechanisms and policies suitable for different regions on solid waste management... To improve the efficiency of DSW management in the study area, it is necessary to apply a number of solutions synchronously, such as: Raise awareness of the community on how to identify types of waste and the importance of sorting DSW at source; perform DSW classification at source; collecting all DSW generated from households; effective use of existing incinerators and waste treatment facilities; additional human resources and increased capital mobilization for DSW management; expanding types of DSW treatment such as using biodegradable organic waste to produce fertilizers by biological methods, saving costs for environmental protection, improving the economic efficiency of DSW, incinerating waste to energy harvesting, reuse of plastic or inorganic materials; enhance the inspection and supervision role of the residential community on the collection and treatment of domestic waste in the localities; It is necessary to maximize the role of mass and social organizations such as Farmers' Union, Women's Union, Veteran's Association, Elderly Association... to participate in DSW management; strengthening socialization in DSW management. Improve the capacity of the unit that directly collects, transports and treats DSW...

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