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Some Solutions to Strengthen Household Solid Wastes Management in Tu Son City, Bac Ninh Province, Vietnam

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ABSTRACT: The study has applied a number of traditional research methods to assess the current status of domestic solid waste (DSW) management and suggest some solutions to strengthen household solid wastes management in Tu Son city, Bac Ninh province, Vietnam. The results showed that the main component of DSW is organic waste; the total amount of DSW is 150 tons/day; the average emission factor is 1.16 kg/person/day; The DSW management in Tu Son city in recent years has achieved many positive results, but has not yet completely solved the amount of DSW generated. 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; Implementation of solutions for effectively and thoroughly DSW classification at source; Collecting all DSW generated from households; Strengthening waste treatment at source; Effective use of currently operating incinerators and speeding up the investment in building solid waste treatment facilities in localities

KEYWORDS*:* Solid waste, environmental management, waste, pollution, BAC Ninh

I. INTRODUCTION

Tu Son city has 12 administrative units including 7 wards (Chau Khe, Dinh Bang, Dong Ngan, Dong Ky, Dong Nguyen, Tan Hong, Trang Ha) and 5 communes (Huong Mac, Phu Chan, Phu Khe, Tam Son and Tuong Giang). The total natural land area is 61.33 km^2. The current population of Tu Son city is 174,988. Tu Son city is one of the two economic- cultural-education centers of Bac Ninh province, developed towards modernity, with many socio-economic indicators standing in the top of the province and the country. 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].

Along with the socio-economic development, the increase in domestic solid waste has become an urgent environmental problem in Tu Son city, Bac Ninh province. Many communes/wards do not yet have a domestic solid waste treatment plant. A lot of waste accumulated in waste gathering places near residential areas reduces the beauty and affects the environmental quality and human health in the area. Before that situation, topic" Some solutions to strengthen household solid wastes management in Tu Son city, Bac Ninh province, Vietnam" was implemented with the purposes: Assessing the situation of generation, collection, classification, transportation and treatment of domestic solid wastes and propose appropriate solutions to improve the efficiency of DSW management in the area.

II. RESEARCH SUBJECTS AND METHODS

Research subjects: The paper focuses on studying the situation of domestic solid waste management in Tu Son city, Bac Ninh province.

Research methods:

+ Method of inheriting documents: Collecting, processing and analyzing documents and data related to the research content of the topic.

+ Methods of actual investigation and survey at the research area: Conduct fieldwork to collect, add and edit the information, at the same time assess the status of DSW management in the studied area.

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III. RESULTS AND DISCUSSION

3.1. Status of household solid wastes management in Tu Son city, BAC Ninh province

Composition and origin of domestic solid waste

Domestic solid waste in Tu Son city is generated from many different sources including human daily-life activities in domestic settings, markets, commercial centers, institutions, educational, industrial and medical establishments ...The study showed that the total volume of DSW in Tu Son city is about 150 tons/day, the average emission factor is 1.16 kg / person / day and increases by about 10% every year [4].

The composition of DSW includes organic matter, paper, carton board, plastic, nylon, metal, glass... According to calculations by the World Bank, organic matter accounts for the largest proportion (50.2-68.9%), hazardous waste accounts for the lowest percentage (under 1%), Plastic, nylon and paper account for the same proportion, ranging from 3.3 to 10.6%, metal accounts for the proportion from 1.4 to 4.9%, Rubber and leather (under 5%), glass accounts for the proportion from 0.5 to 2%, tissues (1.5-2.5%), inert accounts for the proportion from 14.9 to 28.2 depending on the research area [3].

Current status of DSW collection and transportation

The results showed that all villages, hamlets have set up environmental sanitation teams to collect DSW, (3-5 people/team) and have been equipped with waste collection vehicles meet the standards. The frequency of collection is 2 days/time for rural areas and 1 day/time for urban areas. The amount of DSW collected from households to the transfer stations is estimated at about 98% [5]. The study also showed that in Tu Son city, there are 30 newly built DSW collection sites under the provincial support program and 28 traditional dumps. Most of these have promoted investment efficiency. Bac Ninh province currently has 08 units transported DSW from the transfer stations to the district-level centralized waste treatment areas with 31 specialized vehicles, all of that are equipped with GPS devices to monitor and control the collection route. The collection rate of domestic solid waste is over 90% [4], [6]. Thus, the collecting and transporting of DSW in Tu Son City, Bac Ninh province has been strictly implemented in accordance with the current Viet Nam´s Law on Environmental Protection [7].

DSW classification and treatment

In Tu Son City, Bac Ninh province has not been piloted any model of DSW classifying at source so the classification of DSW at source is still limited. Tu Son city does not have any centralized waste treatment plant yet. However, with the current socialized capital in Tu Son city, 4 localities have installed incinerators and are operating effectively (Dinh Bang Ward, Phu Khe commune, Chau Khe ward, Dong Nguyen ward). For localities that do not have incinerators, the amount of DSW is currently stored and temporarily treated at the gathering points. With these practical solutions, the rate of DSW treatment in the studied area is estimated at about 62%.

In general, the management of DSW in the studied area has achieved positive results, however, there are still shortcomings such as: Most of the gathering points of the localities that do not yet have centralized waste treatment area are overloaded, the waste spills out. Although local authorities have taken measures such as spraying probiotics and piling up to reduce the smell and increase usable area. The total amount of domestic solid waste remaining in the studied area is estimated at 30,000 tons [4]. The investment for DSW management is limited, not meeting the actual needs. Waste treatment efficiency in treatment areas is still low; solid waste classification at source is limited. The management of solid waste is not consistent with the trend of reuse and recycling in the world. The majority of recycling facilities are small in scale; the level of technology investment is not high; most technologies are outdated; old machinery and equipment, causing secondary environmental pollution.

The cause of this situation is due to the low awareness of people in maintaining sanitation in public places; a part of the people who do not support the investment of the concentrated waste treatment area in their locality has tried to obstruct, making it difficult for the implementation of the project. Many issues do not have specific provisions such as: The process of conditions and capacity allows organizations and individuals to collect, transport, recycle, reuse and dispose of solid waste in general and domestic solid waste in particular; regulations on appraisal of foreign-invested DSW treatment technology. Socialization of investments in solid waste treatment is limited. Lack of investment support policies for the field of waste treatment; lack of investment capital for waste treatment facilities;

3.2. Proposing solutions to strengthen domestic solid waste management in Tu Son city, BAC Ninh province, Vietnam

a. Raise awareness of the community

One of the most important solutions to improve DSW management in Tu Son city, Bac Ninh province, Vietnam is to raise awareness of the community on how to identify types of waste and the importance of sorting DSW at

source.Sorting DSW at the source will contribute to reducing the amount of solid waste to be transported and treated, improving the efficiency of waste treatment processes, and at the same time reducing the amount of waste released into the environment. Therefore, it will contribute to reduce the risk of environmental pollution; reduce the cost of collection, transportation and treatment of solid waste. In addition, sorting waste at the source also helps to improve the efficiency of waste treatment; increase reuse of organic waste, thereby creating a source of clean fertilizer for crops, reducing costs in agricultural production, and minimizing risks of pollution and diseases arising from waste; recover and recycle useful components in waste (paper, metal…). Vietnam's Law on Environmental Protection 2020, which took effect from January 1, 2022, has many new points that specify more clearly and specifically the responsibilities of each organization, each household and individual on the issue of increasing responsibility for environmental protection. Therefore, localities need to step up propaganda to raise awareness for the community on how to identify types of waste or provide each household with a poster with a list and illustrations of waste types (inorganic wastes, organic wastes and recyclable wastes). Posters should be posted on the wall near trash cans and garbage collection points in public places so that people of all ages can easily identify and conduct waste separation at source. In addition, it is necessary to promote education to raise awareness for the community about the importance of waste segregation at source. This will contribute to improving the efficiency of waste separation at source.

b. Implementation of solutions for effectively and thoroughly DSW classification at source

One of the weaknesses in the DSW management in Bac Ninh province in particular and the country in general is the waste classification at source. Waste will become a recycling resource to serve human life if the process of sorting - collecting - transporting and disposing of waste is done scientifically and thoroughly. An important step in this process is waste sorting at source. Domestic solid wastes can be classified into three main categories: organic wastes, inorganic wastes and recyclable wastes. Inside:

Organic waste: is easily decomposable and recyclable waste. They can be used for composting fertilizing crops and making food for animals. It is origined from uneaten or spoiled foods that cannot be used by human. For example: Damaged vegetables, tubers, fruits; Uneaten food, expired foods; Grass, leaves, plants, flowers, straw; Fruit peels and seeds; Tea residues, coffee residues; Animal carcasses...

Inorganic waste: is the type of garbage cannot be used anymore, is less recycled and often carried to landfill. For example: crockery, bricks, coal slag, nylon...

Recyclable waste: is waste such as newspaper, plastic, metal ... They will be transferred to facilities for recycling into new products.

In order for the classification of domestic solid waste at source to be effective, it is necessary to apply the following measures:

+ Require households to use three-compartment dustbins or three separate dustbins to store three types of different waste (inorganic, organic and recyclable waste). The nylon bags using for containing DSW inside each separate compartment/dustbin must be the same color with the compartment/dustbin to be convenient for the collection of different types of waste anywhere. Besides, it must be necessary to have pictures/letters to symbolize the types of waste in each compartment / dustbin so the waste classification at source will be easier and more effective.

+ The color of the bag / compartment / dustbin, and the pictures for each type of waste that need to be synchronized in all management areas are extremely important. Therefore, everywhere we will not be confused when implementing waste classification solutions at source.

+ There must be a handling and discipline for organizations and individuals that do not classify wastes at source.

The sorting of domestic solid waste helps to recover the types of waste that can be recycled and reused (heavy metals, plastics, paper ...); reduce the amount of waste generated in households. Therefore, it will reduce the amount of remained waste in localities that do not have incinerators or centralized waste treatment plants; reduce transportation costs and improve the operational efficiency of incinerators and waste treatment plants in the area.

c. Collecting all DSW generated from households

In order to thoroughly collect three types of waste separately classified at the source, the waste collection and transport vehicles must also have three separate compartments and the color of the waste collection device must be the same as the color of the compartments/dustbins placed at households/ public waste collection point. Or there must be three types of waste collection vehicles to collect three different types of waste (one kind of vehicle for organic waste collection, one kind of other vehicle for inorganic waste collection and one kind of vehicle for recyclable waste collection). Therefore, the DSW classification at source is really effective and useful. If the thoroughly DSW classification at source and collecting all DSW generated from households that are done well, the effectiveness of DSW treatment plants will be improved and the DSW management process will be greatly improved. DSW will certainly no longer pose a threat to regional health, environment and aesthetics but will be a valuable resource in the community.

DSW after collection will be transported to waste treatment and processing areas. For example: incinerator; compost processing plant from organic waste; factories manufacturing construction bricks from waste materials such as plastic bags, stones, gravel...; recycling facilities of paper, plastic, metal...

d. Strengthening waste treatment at source

Organic waste easily decomposes and is composted into compost right in the vacant lot of households. The treatment of organic waste in households aims to increase the reuse of organic waste, create a clean fertilizer for crops, while reducing the amount of DSW generated at the source, contributing to reducing transportation and handling costs.

e. Effective use of DSW transfer stations

For the amount of remaining DSW at the transfer stations, it must be neatly stacked, temporarily treated by the method of spraying biological products such as EM, SagiBio-1, ... to minimize odors and speeding up the process the organic waste decomposition at dumps and waste gathering places in Tu Son city, Bac Ninh province.

f. Effective use of currently operating incinerators and speeding up the investment in building solid waste treatment facilities in localities...

g. Research and develop technology to treat domestic solid waste in the direction of reducing the amount of burial solid waste, increasing the rate of recycling, reusing and recovering energy from waste; Promote the development of pilot models on recycling, reuse and recovery of energy from domestic solid waste in order to select suitable models for replication throughout the study area; Apply modern and environmentally-friendly recycling technologies to replace old and outdated technologies at recycling establishments.

h. Some other solutions

+ Study and formulate preferential mechanisms and policies, support and encourage the collection, transportation and investment of waste treatment facilities suitable to local socio-economic development conditions;

+ Promulgate preferential policies to encourage businesses to invest in equipment and technologies to treat DSW in the direction of environmentally friendly manner;

+ Strengthen the inspection and examination of DSW collection, transportation and disposal activities to prevent, promptly detect and handle violations;

+ Promote the dissemination of legal documents on waste and scrap management widely to all levels, sectors, communities, organizations and individuals; enhance exchange, visit and learn experiences in implementing waste management, focusing on feasibility and suitability when applying the same waste treatment model among localities;

+ Study to put the contents of environmental education including waste management into the main curriculum of general education levels; organize training courses for businesses about cleaner production, activities to minimize generation of solid waste at source.

4. CONCLUSION

The process of socio-economic development in Tu Son city, Bac Ninh province has made the amount of domestic solid waste in the province tend to increase over the years, creating a lot of pressure on environmental management in the area. The results showed that the source of DSW at the study area is mainly from households; the main component of DSW is organic waste; the total amount of DSW is 150 tons/day; the average emission factor is 1.16 kg/person/day. The DSW management in Tu Son city in recent years has achieved many positive results, but has not yet completely solved the amount of DSW generated, specifically: The classification of DSW at source has not been implemented; collection rate of DSW is about 98%; In the studied area, there is no centralized waste treatment plant yet, however, there are 6 small capacity incinerators that are operating stably in 4 localities ((Dinh Bang Ward, Phu Khe commune, Chau Khe ward, Dong Nguyen ward); The amount of treated DSW is estimated at about 62%; Many localities do not have waste treatment facilities yet, so the amount of waste remaining at the waste gathering places is quite large (about 30,000 tons), which reduces the beauty and affects the environmental quality in the region. 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; Implementation of solutions for effectively and thoroughly DSW classification at source; Collecting all DSW generated from households; Strengthening waste treatment at source; Effective use of currently operating incinerators and speeding up the investment in building solid waste treatment facilities in localities .

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