

## **Status of domestic 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 (research methods, inheritance of data documents, investigation methods, actual surveys in the study area, methods of data synthesis and processing) to assess the current status of domestic solid waste (DSW) management in Tu Son city, Bac Ninh province, Vietnam. 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 (3 incinerators), Phu Khe commune (1 incinerator); Chau Khe ward (1 incinerator), Dong Nguyen ward (1 incinerator)); 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: strengthening inspection and supervision, supplementing human resources; supplement guidance documents and public awareness raising about DSW classification at source; invest in more facilities to serve the collection, classification, transportation and treatment of DSW; encourage people to participate in environmental protection...

**Keywords:** Solid waste, environmental management, waste, pollution, Bac Ninh

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### **I. Introduction**

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” Status of domestic 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 waste in the locality; In order to provide more database, it is an important premise to propose appropriate solutions to improve the efficiency of DSW management in the area in the future.

## **II. Subject and methods of the study**

### **2.1. RESEARCH SUBJECTS**

The paper focuses on studying the situation of generation, collection, classification, transportation and treatment of domestic solid waste in Tu Son city, Bac Ninh province.

### **2.2. RESEARCH METHODS**

*Method of inheriting documents:*

Collecting, processing and analyzing documents and data related to the research content of the topic.

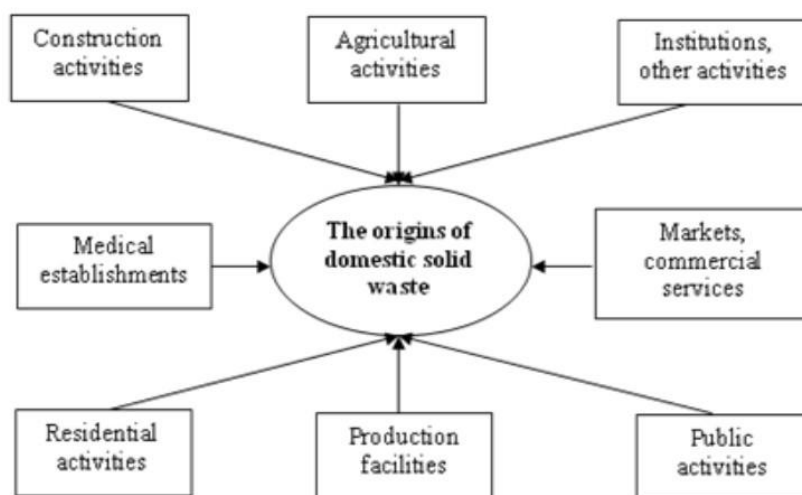
*Methods of actual investigation and survey at the research area:*

Conduct fieldwork to collect, add and edit the information, at the same time assess the status of DSW management in the studied area.

## **III. Results and discussion**

### **3.1. THE ORIGINS OF DOMESTIC SOLID WASTE**

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<sup>2</sup>. The current population of Tu Son city is 174,988 as of April 30, 2019. DSW in Tu Son city is generated from many different sources including human daily-life activities in domestic settings, markets, commercial and services centers, institutions, educational, industrial and medical establishments ... (Figure 3.1)



**Figure 3.1.** *The origins of domestic solid waste*

### **3.2. COMPOSITION AND VOLUME OF DOMESTIC SOLID WASTE IN TU SON CITY, BAC NINH PROVINCE, VIET NAM:**

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... (Table 3.1). According to calculations by the World Bank, organic matter accounts for the largest proportion, hazardous waste is negligible [3].

Table 3.1. Estimated composition of domestic solid waste

No	Waste component	% (by weight)
1	Organics	50.2-68.9
2	Plastic and nylon	3.4-10.6
3	Paper and carton	3.3-6.6
4	Metal	1.4-4.9
5	Glass	0.5-2.0
6	Inert	14.9-28.2
7	Rubber and leather	0.0-5.0
8	Tissues	1.5-2.5
9	Hazardous waste	0.0-1.0

### 3.3. CURRENT STATUS OF DSW COLLECTION AND TRANSPORTATION

The results showed that all villages, hamlets and neighborhoods 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. Typically as Dau Cau Dot dumping ground (Dinh Bang); Trang Liet and Binh Ha quarters (Trang Ha); the copper area of Loc Dang, Rich Gao village; the copper area of Nam Tan, Phu Loc village (Phu Chan); the copper area of Hao Ngoai, the copper area of the old Brick Kiln quarter (Tuong Giang); Chi hamlet, Duong Son village; Tay hamlet, Tam Son village; Phuc Tinh village (Tam Son commune); Cau Cao - Da Hoi area (Chau Khe ward) ...

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.

### 3.4. CURRENT STATUS OF 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 have a lots of restrictions.

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 including: Dinh Bang Ward (3 incinerators with a total capacity of 62 tons/day, handling 18 tons/day); Phu Khe commune (1 incinerator with a capacity of 750 kg/h, handling about 16.2 tons/day); Chau Khe ward (1 incinerator with a capacity of 48 tons/day, handling 20 tons/day); Dong Nguyen ward (1 incinerator with a capacity of 48 tons/day, handling an average of 18 tons/day).

For localities that do not have incinerators, the amount of DSW is currently stored and temporarily treated at the gathering points. These localities are also proposing the competent authorities to allow the survey of locations to set up investment projects and build DSW treatment facilities (Table 3.2) [7].

Table 3. 2. Survey locations for setting up investment projects and construction of DSW treatment facilities in localities in Tu Son city, Bac Ninh province, Vietnam

No	Communes/Wards	Location	Area (ha)
1	Dong Ky Ward	Nghe quarter	0.2
2	Trang Ha Ward	Trang Liet quarter	0.25
3	Tan Hong Ward	Noi Tri quarter	0.5
4	Phu Chan commune	Phu Loc village	0.28
5	Tam Son commune	Duong Son village	0.4
6	Tuong Giang Commune	Hoi Quan village	0.4

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 odor 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;

Therefore, in order to improve the efficiency DSW management in the study area, it is necessary to apply a number of solutions synchronously, such as: strengthening inspection and supervision, supplementing human resources; supplement guidance documents and public awareness raising about DSW classification at source; invest in more facilities to serve the collection, classification, transportation and treatment of DSW; encourage people to participate in environmental protection...

#### **IV. 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 (3 incinerators), Phu Khe commune (1incinerator); Chau Khe ward (1 incinerator), Dong Nguyen ward (1 incinerator)); 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: strengthening inspection and supervision, supplementing human resources; supplement guidance documents and public awareness raising about DSW classification at source; invest in more facilities to serve the collection, classification, transportation and treatment of DSW; encourage people to participate in environmental protection...

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