



## Domestic solid waste management status in Na Ri district, Bac Kan province, Viet Nam

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### Abstract

The study has applied some methods to assess the current status of domestic solid waste (DSW) management in Na Ri district, Bac Kan province, Viet Nam. The results showed that the total amount of DSW is 7,800 tons/year, the organic waste rate is 71.38%. The rate of collected and treated domestic solid waste is 5,402 tons/year, reaching 69.25%. The main method of treating domestic solid waste in the study area is burial or burning. Na Ri district currently has 03 incinerators (located in Yen Lac town, Con Minh commune, Tran Phu commune). The DSW management still has many shortcomings such as lack of human resources and equipment for collection and labor protection; many localities do not have DSW collection points and have not yet implemented environmental protection fees for DSW. The authorities of some communes have not given strong direction, inspection and supervision work is still limited, so the treatment of waste at the incinerators has not followed the correct process; Domestic solid waste has not been classified at the source, so the treatment and classification at the incinerator is very difficult; Funding to support the waste collection and treatment working group is still low.

**Keywords:** Solid waste, environmental management, waste, pollution, Na Ri

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### 1. Introduction

In recent years, household waste has become an urgent problem for the whole society. 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 and in developing countries it is about 0.5 kg/person/day<sup>[1]</sup>. The average rate of domestic solid waste 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<sup>[2]</sup>. 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<sup>[2]</sup>. 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<sup>[2]</sup>. It is forecast that the amount of DSW in Vietnam will increase to 54 million tons by 2030<sup>[3]</sup>. 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<sup>[1]</sup>.

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"<sup>[4]</sup>; "Analyzing key drivers for a sustainable waste management system in Ethiopia: an interpretive structural modeling approach"<sup>[5]</sup>; Optimal management of solid waste in smart cities using internet of things"<sup>[6]</sup>;

“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]; “Compliance with household solid waste management in rural villages in developing countries” [12]; “Improving urban household solid waste management in developing countries based on the German experience” [13]; “Household solid waste management practices and perceptions among residents in the East Coast of Malaysia” [14]; “Knowledge, attitudes and practices on household solid waste management and associated factors in Gelemso town, Ethiopia” [15]; “Household solid waste characterization in Tandil (Argentina): Socioeconomic, institutional, temporal and cultural aspects influencing waste quantity and composition” [16]; “Status of household solid waste in Bengaluru and its periphery: synergies and disjunctions between waste management practices and circular economy” [17]. However, there has been no research on the current status and solutions for domestic solid waste management in Bac Kan province, Vietnam.

Na Ri is a mountainous district in the Northeast of Bac Kan province, Viet Nam. Na Ri has a complex terrain, mainly hills and mountains with many limestone mountains, narrow valleys, steep slopes, belonging to the Ngan Son arc. The district is home to many ethnic groups such as Tay, Nung, Dao, Kinh, Mong... (the largest of which are Tay and Nung), with a slow urbanization rate and underdeveloped industrial activities. The economic life of the people is still difficult, the intellectual level is low, 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 “*Domestic solid waste management status in Na Ri district, Bac Kan province, Viet Nam*” was implemented with the purposes: Assessing the household solid waste management status. At the same time, it supplements the database for environmental management in the research area.

## 2. Research subjects and methods

### 2.1. Research subjects

Focused research on household solid waste management Na Ri district, Bac Kan province, Viet Nam

#### • 2.2. Research Methods

- **Methods of data collection:** In this method, some information collected 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 domestic solid waste collection route, domestic solid waste classification at source, domestic solid waste treatment area... The actual survey areas are residential areas, solid waste collection points, collection routes, domestic solid waste 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.

## 3. Results and discussion

### 3.1. Domestic solid waste management status in Na Ri district, Bac Kan province, Viet Nam

Na Ri is a mountainous district in the Northeast of Bac Kan province, with a total natural area of 85,299.76 hectares, accounting for 17.54% of the natural area of Bac Kan province, including 16 communes and 01 town (Yen Lac) with 222 villages and hamlets; located in geographical coordinates from about 210 55' to 220 30' North latitude, 1050 58' to 106018' East longitude. The North borders Ngan Son district. The South borders Cho Moi district and Thai Nguyen province. The East borders Binh Gia and Trang Dinh districts (Lang Son province). The West borders Bach Thong district. Na Ri has a complex terrain, mainly hills and mountains with many limestone mountains, narrow valleys, steep slopes, belonging to the Ngan Son arc. The district is home to many ethnic groups such as Tay, Nung, Dao, Kinh, Mong... (the largest of which are Tay and Nung), with a slow urbanization rate and underdeveloped industrial activities. The economic life of the people is still difficult, the intellectual level is low, and infrastructure such as roads, schools, national grid electricity, and commune health stations, despite the State's investment, still face many difficulties.

Domestic solid waste originates from many different sources, they differ in quantity, size, composition, spatial distribution... Domestic solid waste originates in personal activities as well as in social activities from residential areas, restaurants, hotels, companies, offices and industrial factories and from agricultural production activities...

Na Ri district currently has over 9,000 households (with a population of 42,513 people), 26 state administrative agencies and over 50 public service units located in the area. The average amount of DSW generated is 0.5 kg/person/day. The total amount of DSW generated in the area is about 7,800 tons/year, of which the amount of urban DSW is about 4,380 tons, the amount of rural DSW is about 3,420 tons.

The composition of domestic solid waste includes: inorganic substances (glass, ceramic, metal, paper, rubber, plastic, nylon bags, fabrics, electrical appliances, toys...), organic substances (discarded plants, fallen leaves, spoiled vegetables, leftovers, animal carcasses, animal manure...) and other substances.

Determining the composition of domestic solid waste is very

important in choosing processing equipment, processing technology, reuse as well as planning management programs for the domestic solid waste management technical system. The volume of domestic solid waste components is not the same due to different usage needs. The needs in the lives of households are different, so the composition of domestic solid waste from different sources is also different. The results of classifying domestic solid waste samples collected during the process of weighing domestic solid waste in the study area show that organic domestic solid waste accounts for the highest proportion (accounting for 71.38%), followed by inorganic waste at 28.38%, the smallest component is hazardous waste at 0.24% and the difference between the survey points is insignificant.

People in general are not aware of waste classification. The functional unit has collected and processed about 70-75 vehicles each month, each vehicle has a load capacity of 6 tons of waste, equivalent to about 5,402 tons/year, reaching 69.25%. In communes with collection points, the rate of waste collected and transported to the district's waste treatment area for treatment is about 90%. The main method of treating domestic solid waste in the study area is burial or burning.

In Na Ri district, there are currently 03 incinerators (located in Yen Lac town, Con Minh commune, Tran Phu commune). Domestic solid waste generated in Yen Lac town and neighboring communes is collected and processed at the waste treatment area of Yen Lac town; Urban solid waste is collected, transported and treated at incinerators located in Yen Lac town, while rural solid waste is collected and treated mainly at min incinerators, in many places waste is spontaneously burned and buried in the premises of households.

Currently, the waste treatment area of Na Ri district located in Po Chet village, Lam Son commune and Gia Dia village people's group, Yen Lac town has shown signs of overload, greatly affecting the environment and the lives of neighboring people. The waste disposal site of Na Ri district located in Yen Lac town was invested in and built in 2000, with an area of about 2,000m<sup>2</sup>. This is a freely dumped landfill, without any thorough treatment measures. All waste in Yen Lac town and some neighboring communes is gathered here, around the landfill area there are many households living and working. Because the landfill is located on high ground, the main treatment process is burning and burying, so the waste smells and on rainy days flows down the hillside to the residential and farming areas.

In response to this situation, Na Ri district has also invested in building a waste treatment area located in Khum Man village, Kim Lu commune, which has been completed and put into use on an area of 7.51 hectares; the total investment is nearly 15 billion VND, invested by the district People's Committee from the local budget. This is a large-scale project, including items such as a road leading to the landfill over 5km long and a waste treatment area including a waste treatment tank system, drainage system, garbage drying house, waste incinerator, waste treatment classification area, collection pipeline, operating house, biological lake... According to the design, the Na Ri district landfill project will process more than 10 tons of waste/day with an incinerator with a processing capacity of 500kg/hour, qualified to process waste from communes in the central area of Na Ri district such as: Kim Lu, Luong Ha, Lam Son and Yen Lac town, contributing to limiting the situation of widespread

waste and heavy environmental pollution at the district's temporary waste dump as it is now. Workers collect waste at the garbage collection sites, the waste is transported by truck to the landfill and processed according to the process.

### **3.2. Some solutions for domestic solid waste management in Na Ri district, Bac Kan province, Vietnam**

**Difficulties in the collection and treatment of waste in Na Ri district:** The DSW management still has many shortcomings such as lack of human resources and equipment for collection and labor protection; many localities do not have DSW collection points and have not yet implemented environmental protection fees for DSW.

- The authorities of some communes have not given strong direction, inspection and supervision work is still limited, so waste treatment at the incinerator has not followed the correct process;
- The amount of waste is large, the area for drying waste is narrow, the waste storage deck after treatment is small, not enough to meet the amount of waste generated daily that needs to be treated;
- Domestic solid waste has not been classified at the source, so it is very difficult to classify and treat at the incinerator; The funding to support the waste collection and treatment working group is still low;
- The collection and treatment of domestic solid waste is currently only carried out in areas near the district center. Some commune cluster centers with markets such as Cu Le, Xuan Duong, Lang San, Quang Phong... do not have a waste collection and treatment site.
- In addition, the environmental protection awareness of a part of the population is still limited, they are not proactive in collecting and classifying household waste, and in some places, waste is still thrown indiscriminately in public places;

### **Some solutions for managing domestic solid waste in Na Ri district, Bac Kan province, Vietnam**

- 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 [18].
- 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.

#### 4. Conclusion

Na Ri is a mountainous district in the Northeast of Bac Kan province, with complex terrain, mainly hills with many limestone mountains, narrow valleys, steep slopes, and many ethnic groups living there such as Tay, Nung, Dao, Kinh, Mong... (the largest of which are Tay and Nung ethnic groups), with a slow urbanization rate and undeveloped industrial activities. The economic life of the people is still difficult and the intellectual level is low. Na Ri district has a population of 42,513 people. The average amount of domestic solid waste generated is 0.5 kg/person/day. The total amount of domestic solid waste generated in the area is about 7,800 tons/year, of which the amount of urban DSW is about 4,380 tons and the amount of rural DSW is about 3,420 tons. The composition of DSW includes organic matter (71.38%), inorganic matter (28.38%) and hazardous waste (0.24%). The main methods of treating DSW in the study area is burial or burning. In Na Ri district, there are currently 03 incinerators (located in Yen Lac town, Con Minh commune, Tran Phu commune). Although local Party committees and authorities have focused on raising awareness of environmental protection among the people; providing partial financial support for households to build garbage pits and household waste treatment points; movements to prevent plastic waste; self-managed youth roads; self-managed women have been widely deployed... But local people are still not aware of waste classification. The rate of collected and treated domestic solid waste is 5,402 tons/year, reaching 69.25%. The DSW management still has many shortcomings such as lack of human resources and equipment for collection and labor protection; many localities do not have DSW collection points and have not yet implemented environmental protection fees for DSW. The authorities of some communes have not given strong direction, inspection and supervision work is still limited, so waste treatment at the incinerator has not followed the correct process; Domestic solid waste has not been classified at the source, so it is very difficult to classify and treat at the incinerator; Funding for garbage collection and treatment teams is still low.

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