



Household solid waste generation and characteristics in Cape Haitian city, Republic of Haiti

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ABSTRACT

Because of a lack of planning and of the poor HSW (household solid waste) management, the municipal authorities of Cape Haitian are unable to cope with the rapid growth of the city or to ensure a pleasant living environment for its residents. Indeed no HSW management plan has been drawn for Cape Haitian. The main difficulty in the development of a HSW management system lies in the lack of knowledge of the composition and the characteristics of the waste that is generated in the city as is the case of the whole country. HSW management is very poor and there is no valorisation policy. The objective of this study was to carry out a field survey of the HSW generation profile in the city of Cape Haitian in order to have relevant data enabling better management and valorisation of HSW. The city's residential wards have been categorized in three different types (I, II and III) representing high, medium and low socio-economic groups in the city respectively. HSW generation has been quantified and characterized by the ward's type. Results show that HSW generation rate is 0.21 kg/capita/day. The organic matter represents 65.5% of waste by weight. This is similar to the results from developing countries. With a moisture level of 55.6%, an LCV of 1395 kcal/kg and a C/N ratio of 31:1, composting of the HSW and applying it on the land seem to be the best HSW treatments for Cape Haitian in a sustainable development perspective. As there is no previous study of this kind in Haitian urban areas, this report may be taken as baseline for other Haitian cities.

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1. Introduction

As a result of rapid urbanization and changes in consumption of many cities in developing countries, waste generation has increased. However, the waste generated is, in most cases, not properly managed. Hence, this has huge consequences in terms of collection, disposal and the elimination of waste (Thonart et al., 2005; Moghadam et al., 2009). In almost all developing countries, city solid waste constitutes a hazard, be it from the ecological point of view or the public health point of view. Almost everywhere, there is a distinct lack of policy on efficient waste collection and a total absence of its treatment (Culot et al., 1999). Many experts from various cities in developing countries have expressed serious concerns about improper waste treatment and disposal in these countries (Berkun et al., 2005; Pokhrel and Viraraghavan, 2005; Barton et al., 2008; Chung and Lo, 2008; Imam et al., 2008; Sharholy et al., 2008). In most developing countries, solid waste management is undertaken by the local authorities. These services include waste

collection (either from households or district collection points) to final disposal. However, the low financial base and human resource capacity of these local authorities mean that in most cases they are only able to provide a limited service (Barton et al., 2008).

Inadequate management of solid waste in most cities of developing countries leads to problems that impair human and animal health and ultimately result in economic, environmental and biological losses (Wilson et al., 2006; Kapepula et al., 2007; Sharholy et al., 2008).

Haitian cities face many problems due to improper management of household waste (MDE, 1996). Indeed, even with the best of intentions, municipal authorities are unable to establish and implement an efficient management plan mainly because of the lack of understanding of waste generation and its characteristics. Authorities tend to implement management plans and use equipment which are not adapted to the realities of Haitian cities. This study is fundamental for producing data on the quantity and characteristics of HSW in Cape Haitian as well as developing adequate managing strategies. The main objectives of this study were to make a systematic analysis of household solid waste leading to quantification of the amount of HSW generated from studied area and to determine its composition so as to highlight some specific features capable of promoting research on recovery of Cape Haitian's solid waste. Furthermore, as far as the authors are aware in the relevant body

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Fig. 1. Location of the city of Cape Haitian in the Republic of Haiti.

of literature, this kind of study has not yet been reported from Haiti.

1.1. Data study area

This study was conducted in the city of Cape Haitian, located in the northern part of Haiti between latitudes $19^{\circ}43'$ and $19^{\circ}45'N$ and between longitudes $72^{\circ}10'$ and $72^{\circ}14'W$ (Fig. 1). With its population of 225,740 people (IHSI, 2007) and an area of 11.94 km^2 the city of Cape Haitian is the second largest agglomeration of the Republic of Haiti after the nation's capital (2,245,000 people).

Although situated in the Caribbean, the Republic of Haiti has many similarities with various African countries especially in terms of HSW management. Indeed, despite efforts put in place by the authorities several years ago in order to improve HSW management in Haitian cities, the situation remains alarming due to many limiting factors. These factors are of a technical, economical, social and cultural nature. In Haitian cities, the waste collection rate is not more than 50% (MDE, 2005). Non-collected waste is generally thrown in drainage canals, in open field and buildings under construction. Haiti, being regularly hit by torrential rains, this waste obstructs the drainage network, which consequently intensifies the destructive power of the rain waters (Thonart et al., 1999). Currently, there is neither a HSW recovery nor a recycling programme. The collected waste is thrown in discharges which are poorly managed. Burning the discharges is a common practice in Haiti (CWBI, 1999). HSW in Haiti has very little heavy metals. But in big cities of Haiti there are poor people who pick up the waste. These groups tend to stay closer or even on the discharges. These areas expose these groups to epidemiological and hygienic problems due to the biological activity of the discharges.

In addition to environmental and public health problems in Cape Haitian, poor HSW management paralyzes the city's economic development which has always been based on the tourism sector. In fact, Cape Haitian is a potential tourist city especially because of its

historical monuments, some of which are included on the UNESCO World Heritage list as universal symbols of liberty, as they are the first monuments to be constructed by black slaves who had gained their freedom (UNESCO, 2009).

Cape Haitian is facing great difficulties because of high rates of urbanization in Haiti due to rural exodus. The annual Cape Haitian population growth rate is about 5.1% (IHSI, 2007). In similar conditions, waste generation increased quickly in such a way that the city authorities were overwhelmed. On the other hand, when waste generated by a community is well managed, it can be converted into valuable resources (Ojeda-Benitez et al., 2003). Due to the lack of proper HSW management, burning waste in the backyard is a widespread practice in Haiti in general and in particular, in Cape Haitian. In the new high-income wards, some households try to compost the organic waste matter. However, it is on a very small scale and without appropriate techniques (MDE, 2005). In Cape Haitian, more than 72% of households are not concerned by official waste collection. In such circumstances, children evacuate HSW in the evening, throwing the waste anywhere and hence creating unauthorized dumps in the city. Most often, these unauthorized dumps are found close to markets, constructions (sites?) and drains. As there is no segregation of waste at the source and no efficient collection, no recovery is currently applied to HSW in Cape Haitian.

However, a good understanding of HSW stream (generation and characteristics) could allow local authorities to better plan waste management.

2. Methodology

Firstly, a study involving the assessment of documents and records relating to municipal solid waste in Haiti has been conducted. Census and economic planning data have also been studied to obtain background information as well as data to enable construction of a conceptual model on HSW management in Cape Haitian.

Table 1
Main characteristics of the three types of wards identified.

Characteristics	Type I wards	Type II wards	Type III wards
Population density	Less than 10,000 inhabitants/ km^2	From 10,000 to 25,000 inhabitants/ km^2	More than 25,000 inhabitants/ km^2
Economic level	High	Medium	Low
Direct access to public roads	All buildings	All buildings	Access to passageway of about 1 m wide (Koridò)
Access to utilities	Yes	Yes	No

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