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Integration of human excreta management and solid waste management in practice

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Abstract

In this paper, the possible integration of human excreta management and solid waste management is studied. We focus on integration options with respect to transport and processing, taking into consideration the sustainability aspects "technical/performance" and to a smaller extent "institutional/organisational". We do this for a case study in the Kirtipur Municipality of Nepal. Data gathered by interviews and field studies shows that different combinations of management systems were applied in rural, peri-urban and urban areas. Segregation or reuse of the waste is taking place on a very limited scale only; most of the waste is transported to the two municipal dump sites. Toilet waste is transported to the river through a sewer line, or collected in septic tanks or pit latrines. These are emptied manually or by pumping trucks, which empty into the river as well. With the current set-up, integration with respect to transport is not beneficial. In contrast, combined processing of both human excreta and the organic fraction of solid waste is considered to have high potential.

The study shows that integration possibilities are worth considering because mutual benefits can arise. Giving a one-fits-all guideline how to reach this is however not feasible. The first step in achieving sustainable integration has to be an intensive stakeholder and process analysis. When mapped well, this analysis has the potential to reveal the possibilities.

Keywords: Integrated solid waste management (ISWM); Organic waste; Human excreta; Co-composting; Biogas production; Integration

1. Introduction

Collection and sustainable disposal of municipal solid waste remain a big challenge for many developing countries. More often than not, there is no effectual

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management system to serve the population. In cities, due to the high population density, this problem is particularly present. In many cases there is some form of collection, often provided by the municipality. The private sector may have seen a business opportunity in getting involved in waste collection. However, the majority of cities cannot provide adequate disposal mechanisms for the waste for many reasons: lack of proper planning, lack of financial means, overwhelming over-urbanization (more people produce more waste and need more space, which may cause people to move in on the dump site). As a consequence, waste ends up in places where it does not belong (illegal dump sites in the middle of the city, causing a serious health threat and environmental pollution; in storm drains which are then blocked, with all possible consequences) [1].

The issue is amplified by the lack of waste segregation. Many waste streams have a considerable market value. Without segregation however, making money out of waste becomes difficult and strenuous. Moreover, unsegregated waste dumping minimizes the life span of a dump site. In order to make space, dump site managers are forced to practise open burning, causing a serious health threat for the neighbouring community as well as air pollution and greenhouse gas emission.

There are very good options for managing when segregated. waste streams. A number of waste streams form the input of a lively recycling industry: paper, glass, metal, rubber, plastics [2]. Organic waste can be composted aerobically into a valuable soil improver, or digested anaerobically in a biogas installation. Compost is a very valuable soil improver; biogasification has the ability to turn a waste stream into energy, producing only a minimal waste stream in the form of digested sludge and a nutrient-rich water stream that both can be used for agricultural purposes [3].

Organic waste typically forms the major part of waste in developing countries. Therefore, the biggest gain in terms of dump site life span extension can be made by segregating this particular stream. Households produce more organics than kitchen and garden waste alone because human excreta also form a type of organic waste. Biogasification or co-composting of human excreta together with the organic kitchen and garden waste (and animal dung when available), is practised in a growing number of cities and proves to be very efficient [3].

Combining a solid waste stream with the stream of human excreta seems rather straightforward on a technical level. For implementation of such an integration scheme there are however more factors involved. In the first place, the citizens have to accept this kind of solid waste and human excreta management (HEM), and should be willing to use and pay for the end products (compost, biogas) [4].

In this paper, we look at the possibility of integration of solid waste management (SWM) and HEM. We take into account sustainability concepts [4], and provide ideas on sustainable integration of organic municipal waste and HEM. We discuss this topic both in general and for a case study in the Kathmandu Valley in Nepal.

2. Background

2.1. Content of municipal solid waste and human excreta

For a sustainable solid waste strategic plan, it is important to know the composition as well as the quantities with a high certainty. General data about the composition of municipal solid waste can be found in scientific literature [5–8]. For a specific area, municipalities additionally will have a waste quantity and composition analysis carried out as a first step [6].

In Table 1, the generation per capita per day, the average fraction organic waste and the most common disposal methods are given for a number of countries on different continents. Noticeable points from Table 1 are:

- In industrial countries, the generation of municipal solid waste is larger, indicating a relationship between wealth and solid waste generation. We typically see an increase in waste generation everywhere in the world when the economy is improving. When solid waste generation has to be estimated, often a country-specific factor is used and multiplied with the Gross National Income.
- In developing countries the fraction organic waste within the total waste is generally higher.