Municipal Solid Waste Characterization and Recycling Potential in Phnom Penh City, Cambodia

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Municipal solid waste generation rate in Phnom Penh city is increasing as a main result of population growth and economic development. Current management approach is only just about collection and disposal into dumpsite; there is no treatment facility. Waste disposal to dumpsite is relatively increased. As of July 2014, it is 53,535.12 tons/month, or on average 1,726.94 tons/day. Organic (54.52%), plastic (21.23%) and textile (13.04%) are respectively shares the large portions in waste composition. In recycling activities, informal sector is playing important role, there are 300 scavengers scavenging for valuable materials and could recover about 607 tons/month.

Key words: municipal solid waste, Phnom Penh, dumpsite, scavenger, valuable material

1 INTRODUCTION

Phnom Penh city is proportional very highly to national economic development and population growth. The total population was 1.3 million in 2008 (MoP, 2009).

Municipal solid waste (MSW) generation is increasing annually while only 82.1% of daily-generated MSW is collected; it was equal to about 1,311.9 tons/day (Seng et al., 2013). There causes self-disposal and illegal waste pumping into open environment and burning (Kum et al., 2005; Seng et al., 2010).

A projection of Seng et al. (2013) shows that MSW generation in 2020 would be increasing to 2,783.9 tons/day. Consequently, this would cause serious problems where waste pre-treatment or treatment facility is not available.

In Phnom Penh city, mixed MSW is collected and transported directly to dumpsite (JICA, 2005; Kum et al., 2005; Seng et al., 2010; Seng et al., 2013). Valuable materials have been recovered through management stream by informal sector, especially scavengers. Moreover, there is a local non-governmental organization who is making compost of organic market waste. The compost production capacity is approximately 459 tons/year in 2011/2012 (CSARO, 2012).

The paper presents the review of MSW management, MSW characteristics, and recycling potentials in Phnom Penh city, Cambodia.

2 MATERIALS AND METHODS

Waste characterization took place in Dangkor landfill for one week from August 29 to September 04, 2014. Dangkor landfill is an open dumpsite for final MSW disposal in Phnom Penh and locates around 10 Km from the city central. The operation started in July 2009 (Seng et al., 2010) with expected lifetime of 6 years over 31.4 ha of land (JICA, 2005).

For MSW characterization, waste is sampled from collection trucks that represents each district of Phnom Penh city. After quartering, 250 – 300 Kg of sample was collected from a truck and sorted manually for specific composition. It was also to quantify recoverable materials that are valuable for recycling marketing (Table 1).

<table>
<thead>
<tr>
<th>Districts</th>
<th>Sampling amount (Kg)</th>
<th>MSW compositions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Makara</td>
<td>250 – 300</td>
<td>Kitchen and garden waste</td>
</tr>
<tr>
<td>Chamkamorn</td>
<td>250 – 300</td>
<td>Paper and cardboard</td>
</tr>
<tr>
<td>Doun Penh</td>
<td>250 – 300</td>
<td>Wood</td>
</tr>
<tr>
<td>Dangkor</td>
<td>250 – 300</td>
<td>Leather and textile</td>
</tr>
<tr>
<td>Meanchey</td>
<td>250 – 300</td>
<td>Plastic</td>
</tr>
<tr>
<td>Pouthisenchey</td>
<td>250 – 300</td>
<td>Metal</td>
</tr>
<tr>
<td>Russey Keo</td>
<td>250 – 300</td>
<td>Glass</td>
</tr>
<tr>
<td>Sen Sok</td>
<td>250 – 300</td>
<td>Ceramic and stone</td>
</tr>
<tr>
<td>Toul Kork</td>
<td>250 – 300</td>
<td>Others</td>
</tr>
</tbody>
</table>

Questionnaire survey was carried out to interview landfill scavengers to identify recyclables, marketing patterns, recycling quantity and economic benefits. Sample calculation was based on Yamane (1967) with 10% error level.

\[ n = \frac{N}{1+Ne^2} \]  
(1)

Where, \( n \) is total sample \( N \) is total landfill scavengers \( e \) is error level (10%)

By interview with Landfill Manager, currently there are about 300 scavengers scavenging in Dangkor Landfill. Therefore, the total sample for interview is 75 with sample random sampling.
3 WASTE CHARACTERISTICS AND RECYCLING POTENTIAL

On average, MSW disposal in the Dangkor Landfill was 1,072 tons/day in August 2009; but it was 1,726.94 tons/day in July 2014. Fig. 1 presents MSW compositions in Dangkor landfill as result of characterization. Organic (kitchen and garden waste) is the biggest portion (54.52%) followed by plastic (21.23%) and textile, leather and diaper (13.04%). It shows that these three compositions share almost four fifth of MSW in Phnom Penh while the remaining is paper and cardboard, stone and ceramic, glass, metal, wood, residues, rubber, batteries and medical waste. The recoverable materials include food waste, paper, cardboard, glass bottle, metal (aluminum can, ferrous can, electrical wire and other metals), plastic (plastic bag, sack, PET, plastic cup, foam plastic, PVC and other plastics), textile and leather. The characterization result show that 19.36% of disposed MSW in the landfill could be recoverable.

Fig. 1 MSW composition in Dangkor landfill, Phnom Penh city

As result of questionnaire of landfill scavengers, on average materials could be recovered approximately 2 tons/ person/month. In total 300 scavengers, monthly recovery rate would be 607 tons.

The recovered materials are valuable for recycling market to recyclers. Nevertheless, comparing increasing amount of disposed MSW, recovered materials contribute a few percentage. If pre-segregation of waste were undertaken at source, recovery rate would be higher and final disposal to landfill would be minimized.

4 CONCLUSION

MSW in Phnom Penh has major proportion of organic wastes, plastics and textiles. Scavengers are playing key role in material recovery. Upgrade system to ISWM is necessary. Pre-segregation should be implemented to advance feasibilities for treatment objectives. Regular study of MSW generation and characteristics would identify baselines.

Inadequate financial, human and equipment resources are challenges for MSW operation and maintenance. To deal with, it needs cooperation with national and international development partners, private sector and residents. Stakeholders have to be properly educated and incorporated into planning, and pre-treatment as they are very crucial driving forces in attaining technology transfers, financial security, market stability, etc.

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