Solid waste management and characteristics of coal fly ash in Myanmar

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1. Introduction

The rapid economic growth with urbanization and industrialization in Myanmar has led to significant challenges with the management of waste such as coal ash disposal and waste recycling. However, the lack of feasible statistical data about solid waste generation and characteristics, no effective solution has been revealed. On the other hand, Myanmar has faced significant economic growth and an increased electricity consumption since 2011. However, the power supply cannot keep up with the growing demand due to the lack of systematic efforts in power development and therefore the lack of electricity has prevented further economic growth. According to the Asian Development Bank, between 2000 and 2012, electricity demand in Myanmar grew by 9.8 percent every year and will continue to grow [1]. At the same time, the disposal of coal ash generated from a coal-fired plant has become a problem because still no appropriate disposal method is established and very few information about coal ash characteristics in Myanmar has been revealed. This paper discussed the current waste problems in Myanmar and the characterization of coal ash from a coal-fired plant.

2. Methods

The information about solid waste management in Myanmar was obtained from Yangon and Mandalay City Development Committee. The coal fly ash sample was collected from Tigyit coal fired-plant in Myanmar in 2019. In order to determine characteristics of the coal fly ash, leachability and content of heavy metals were investigated. The test for leachability was determined by Japanese leaching test No.46. 15 g of fly ash and 150 mL of distilled water were added to 250 mL of the plastic bottle. After shaking for 6 hours at 200 oscillations per minute, then the solution was passed through the filter (0.45μm). Elemental content was analyzed by Japanese content analysis No.19. For the analysis, 1.5 g of sample was put into a 250 mL plastic bottles approximately with 50 mL of 1M of HCl and shaken at 200 rpm. After shaking for 2 hours, the solution was passed through the filter (0.45μm). Concentrations of Se, As, Pb, Cd, Cr, Sb, Mo, and Ni in solutions were determined using Atomic Adsorption Spectrophotometer.

3. Solid Waste Management in Myanmar

3.1 Outline of solid waste management

Out of the total waste generation in the country, approximately 55% is generated by three major cities including Mandalay (955 tons/day), Yangon (1,981 tons/day), and Nay Pyi Taw (160 tons/day) in 2016. Myanmar's municipal solid waste is generated from households (60%), markets (15%), commercial (10%), hotel (2%), garden (5%) and others (8%). As shown in Figure 1, solid waste generation in Mandalay has been increased from 250 tons in 2005 to 900 tons in 2015, and from 1,300 tons in 2005 to 2,000 tons in 2015 in Yangon [2]. According to the World Bank's report in 2019, solid waste generation in Myanmar was 0.56 kg/capita/day [4]. Solid waste was expected to reach about 21 thousand tons/day with 0.85 kg/capita/day by 2025 [5]. Figure 2 shows a household waste composition in Myanmar. The waste was composed mainly of organic materials (77%), plastics (13%), paper (7%) and others (3%) [5].

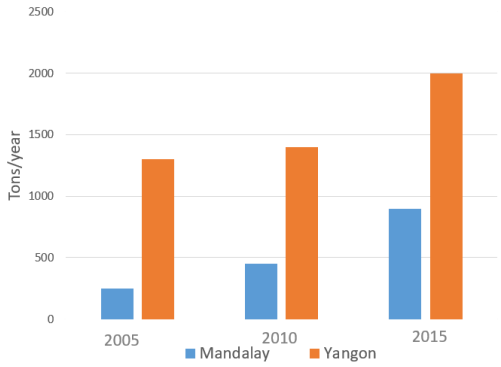

Fig 1. Amount of Waste Generation

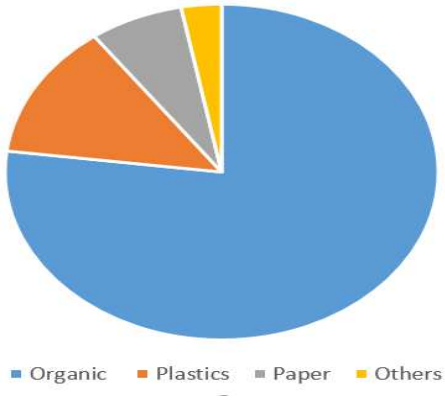

Fig 2. Household Waste compositions

3.2 Waste Collection

A solid waste collection system in Myanmar can largely be characterized as labor-intensive. The collection is conducted by municipalities (cities). Primarily the waste is collected from households door-to-door (bell collection) or collected at street dump yards. The collection is carried out by pushcarts or tri-bicycles and is carried to temporary sites. The secondary collection is carried out mainly by tipper trucks. At the collection stage, the waste is transported to final sites. Due to the escalating state of waste generation, Mandalay and Yangon City Development

Committees have prioritized solid waste management as issues of immediate concern [1]. Myanmar's first sanitary landfill with leachate treatment facilities is being built in Mandalay city planned for 2020. Methane gas from landfilled waste will be collected to produce 75 kilowatts of electricity. Moreover, tenders are being taken for a waste-sorting plant after ground levelling, which can sort 25 to 50 tons of waste per hour into eight different categories.

3.3 Waste Disposal

In Myanmar, there are two types of disposal sites such as temporary and final disposal sites. In Mandalay, there are two final disposal sites and in Yangon, there are six final disposal sites. There is no equipment in these disposal sites to prevent nuisance odor, fire, dust and landfill gas emissions [6]. According to the Myanmar waste scoping record in 2017, final disposal sites in Yangon and Mandalay received an average of 2,500 and 900 tons of solid waste per day, respectively [6]. At first the waste is dumped into the temporary disposal sites that are located near markets or residential areas and transported to secondary disposal sites.

3.4 Waste Recycling

At the temporary disposal sites, pickers sort waste [4] into paper, plastic, metal, and plastic bottles for recycling [8]. Sorted waste is stored and transported to recycling enterprises [3]. Approximately 400 small and medium-size recycling enterprises were operating in Yangon and Mandalay in 2017[7]. According to the data from the Yangon city development committee, only 5% of waste was recycled. The recovered waste plastics were recycled to produce plastic bags by private and government organizations. The recovered waste collected by recycling enterprises is transported to material recovery facilities located near the final disposal sites.

4. Coal Fly Ash Problem

In 2019, 2.1% of Myanmar’s electricity was produced from coal. Myanmar has planned to build coal power plants additionally for foreign-owned projects and industrial zones in the country and export the electricity to neighboring countries. Currently, one coal-fired power plant is operating in Myanmar since 2005. The plant has two 60 megawatt generating units and produces 600-gigawatt hour of electricity annually, using 640,000 tons of coal per year. Currently, from 100 to 159 tons of fly ash is generated per day [8]. At the beginning of operation, fly ash was dumped on the waste dumping site in the coal mine close to Laikhar and Taungpolar villages and the fly ash has been gradually spread on the local roads in these villages. Currently coal fly ash is stored in a warehouse. However, no treatment or recycling is planned.

4.1. Characteristics of Coal Ash

Table 1 shows the results of leaching test and content analysis of Se, As, Pb, Cd, Cr, Sb, Mo, and Ni. The leachability of Se and T-Cr exceed the value of Se (0.01 mg/L) and hexavalent Cr (0.05 mg/L) of Japanese soil contamination standard. Nowadays there is no regulation about soil contamination in Myanmar. In future, contamination from the coal ash disposal site might become a problem and appropriate recycling method should be established.

Table 1. Results of Content Analysis and Leaching Test

	Content Analysis(mg/kg)	Leaching test (μg/L)
Se	8.1	14.1
As	17.6	ND
Pb	1.8	ND
Cd	0.5	ND
Cr	47.5	462
Sb	3.5	ND
Mo	36.6	259
Ni	45.8	5.69

ND: Analytical limit of detection

5. Conclusions

The present study has examined a few problems of the solid waste management services in Myanmar. Currently, the coal ash is stored at the plant. It is needed to consider recycling of coal ash technology using environmentally methods.

6. References

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