

Solid Waste Management in Sri Lanka

Introduction

Solid waste can be described as the solid material discarded from human or animal activities, which do not have any economic value. A material which may be considered as a solid waste by one person or country may not be considered so by another person or country because of the differences of economic value to different persons or countries. In solid waste management, only those solid materials which are real wastes, i.e., those which do not have any economic value must be disposed of. Unfortunately, most countries including Sri Lanka do not practise proper management of solid wastes, and therefore, large quantities of valuable resources are disposed of as useless or unwanted materials.

With rapid growth of population and urbanisation, environmental pollution by solid wastes has become a serious problem all over the world. With the urbanisation and development, people have changed their consumption patterns and life styles resulting in generation of more wastes exceeding the assimilation capacity of the environment for natural decomposition. In Sri Lanka, absence of systematic collection and transportation of wastes and their intermediate treatment and final disposal by suitable methods have contributed to aggravate the environmental pollution caused by solid wastes. The present haphazard waste disposal practices in our country have caused an array of environmental problems endangering the people's lives and sustainability of ecosystems in addition to many social and economic problems associated with the absence of proper disposal of solid wastes. Therefore, proper management of solid wastes has become an important national issue needing urgent attention.

This article presents the problems created due to improper disposal of wastes, various options available for their management and the legal measures undertaken by Sri Lanka to minimise solid waste problem.

Main Problems Related to Solid Waste

The following are some of the important problems linked to solid wastes:

a. Air pollution

Air pollution is one of the main environmental problems related to solid wastes. Wastes are

naturally decomposed by aerobic and anaerobic microorganisms present in the environment. Aerobic microorganisms (living in oxygen-present environments) produce odourless gases while anaerobic microorganisms (living in oxygen-free/deficient environments) produce gases with unpleasant odour, making nuisance to residents of the surrounding areas. Because of the bad odour, even selection of a waste disposal site has become very difficult in many countries. Therefore, most developed countries take mitigatory actions for reducing odour in waste disposal sites.

In addition, methane gas (Biogas) produced during anaerobic digestion of solid wastes contributes to global warming. On the other hand, it is highly inflammable, and as a result, uncontrolled solid waste dumping sites could catch fire. Many chemical compounds which are produced during burning of solid wastes are very harmful to human and other living organisms. Dioxins and furans are the most hazardous chemical compounds produced by burning of solid wastes at low temperatures. These chemicals are not soluble in water, but are fat soluble and persisting in the environment for a very long period. Therefore these chemicals can be circulated within the food chains for a long period and can be accumulated in human bodies. Although these chemicals are produced by combustion of solid wastes at low temperatures, they need very high temperatures to decompose. Therefore, burning of solid wastes, especially plastic at low temperatures, is not an environmentally sound solution.

b. Water pollution

Water pollution is another severe environmental problem linked with solid wastes. Frequent blocking of drainage systems in main cities leads to creating breeding grounds for vectors such as mosquitoes which spread disease organisms making severe health risks.

Pollution of surface water and ground water resources is another major environmental problem linked with solid wastes. In Sri Lanka, there are number of solid waste disposal sites operated by local government authorities and private sector companies. Unfortunately, so far, they don't have any mechanism to control ground water pollution except for the landfill sites operated by the Nuwara Eliya Municipal Council and the Mawanella Pradeshiya Sabha. Therefore, urgent attention has to be paid to take actions to protect our water resources from disposal of solid wastes in haphazard manner.

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c. Soil pollution

Another environmental problem caused by solid wastes is the pollution of soil. Because of solid wastes, chemical and physical properties of the soil such as pH and soil structures could be changed, and thereby growth of plants and other important soil microorganisms could be badly affected. The long-term degradable material in solid wastes such as polythene reduces infiltration rate of storm water, and as a result, the ground water level could be lowered.

d. Health problems

As we know, various types of diseases such as Dengue, Encephalitis, Elephantiasis (Filarial) and Malaria could be spread by vectors such as mosquitoes, rats, flies which are living in uncontrolled solid waste dumping sites. In addition, germs which cause diseases could find access to disposal sites along with wastes and thereby diseases like dysentery could spread.

e. Destroying biodiversity

Due to improperly-managed waste disposal sites, surrounding ecosystems could be damaged seriously affecting its biodiversity. Haphazard disposal of solid wastes over large areas or in environmentally-sensitive areas would increase deaths of herbivorous animals by consuming solid wastes and this seriously affects the biodiversity.

f. Destroying scenic beauty

Haphazard waste disposal would destroy scenic beauty of the environment and makes it unpleasant for living.

g. Social and economic problems

Disposal of solid wastes is very expensive, and on average, most local authorities in our country spend more than fifty percent of their annual income for this purpose. On the other hand, uncontrolled solid waste disposal destroys scenic beauty and adversely affects the tourism industry.

Solid Waste Management

As evidenced in the forgoing section, any country must have a proper solid waste management system to avoid or minimise the adverse effects on the society, environment and the economy as a whole. Various options of waste management, i.e., strategies for avoiding or minimisation of wastes and extracting maximum benefits from waste material are shown in what is called "waste management hierarchy". These options of waste management include avoiding, reducing, reusing, and recycling of wastes, recovering value from wastes and final disposal of wastes.

Proper waste management system requires paying due consideration to the above-mentioned options from the point of waste generation up to the final disposal. They should be incorporated in different steps or components of waste management which are described in the following section. The main considerations of waste management are:

1. Waste generation
2. Collection and transportation
3. Intermediate treatment
4. Final Disposal

The activities involved in each component and the options in waste management hierarchy are explained below:

Waste generation

To avoid or minimise the problem of wastes, the first three options of waste management in the order of preference are strategies for avoiding, reducing and reusing the wastes.

a. Waste avoidance

We must pay more attention to avoid and reduce generation of wastes. If possible, avoiding waste generation is the most preferred option, because, then there will not be any waste problem. Waste cannot be avoided always, but attention must be paid to avoid wastes as much as possible.

b. Waste reduction

This is minimisation of waste generation. Consumption patterns and behaviours of people have a great influence on waste generation, and hence they should be considered in taking actions to reduce wastes.

In our market places, we can see most of our traders use bad or incorrect practices of transporting their raw food materials such as vegetables, fruits, etc. resulting in rotting, and

damaging the products, and hence increasing the amount of wastes at the market places. But, if those food materials are cleaned and rotten parts are removed at farms and if storage and transportation are done in a proper way, then, generation of such wastes can be reduced to a considerable extent.

At present, daily collection of wastes in Colombo Manning market is about 30 tonnes. The collected waste is transported to Sedawatta by Colombo Municipal Council for making which is then transported back to vegetable-growing areas. But, if a special tax system has been introduced by the local authorities, based on the amount or tonnage of the waste generated, the traders would be encouraged to reduce the amount of wastes that they transported to Colombo. Then the vegetable wastes can be composted within the vegetable-growing areas themselves, which will help to reduce the transport costs.

In the domestic waste management, waste reduction must be done by individual persons. If we bring home only the actual required quantity of vegetable for our day-to-day use, we will be able to reduce the amount of discarded food wastes due to rotting or expiry.

c. Waste reuse

Reuse is a very important step in the waste management. This option includes maximising reuse of waste material with minimum processing. The waste product could be used for the same purpose for which it was used previously or for alternative purposes.

Introduction of cheaper and attractive wrapping materials with most consumer goods results in accumulation of wastes in the market. Because of convenience, people have accustomed to use disposable goods, and normally consumers do not like to use reusable goods resulting in generation of large quantity of domestic wastes. Among these, plastic wastes rank the top as they are cheap and cannot be reused. In our day-to-day life, we can reuse certain products instead of using disposable materials. The use of reusable bags can avoid accumulation of shopping bags in our homes.

Waste collection and transportation

Wastes have to be collected and transported to for reusing, recycling, recovering value, or for disposal. For an efficient waste collection, the responsibility should be distributed equally among collecting institutes such as local authorities and persons who generate wastes.

Sorting or segregation of wastes at the source facilitates intermediate treatment such as recycling, composting for recovering value, etc. It is the

responsibility of every person to separate their wastes at the source and hand over separately. Most developed countries practise various types of source segregation methods for reducing the amount of wastes for dumping.

In Sri Lanka, some kind of good practices for source segregation have been introduced in some local authority areas and a special colour code for waste collecting bins has been introduced by the Ministry of Environment as follows:

- Blue colour for paper wastes
- Orange colour for plastic wastes
- Red colour for glass wastes
- Brown colour for metals and coconut shells
- Green colour for organic wastes.

At present, most local authorities in our country practise heap collection method. According to this method, residents are invited to dispose of or dump their wastes on road sides, and thereafter vehicles of local authorities carry those wastes to dumping sites. There is no particular time or regular procedure of waste collection, and therefore, such places are filled with waste throughout the day. This method is very inefficient, and has created many environmental problems. Therefore, in a proper waste collection system, waste collection method and collection time table must be regularised and getting public participation for it is important not only to reduce costs but also for successful implementation of the waste management system.

Normally, waste transportation is done by a local authority or a private contractor. In a waste transportation system, consideration should be given to the following:

- Selection of suitable vehicles
- Safe transportation
- Workers safety
- Suitable time selection
- Suitable route selection.

The type of vehicles used for collecting and transporting wastes is very important, and it depends on the type of wastes to be collected. Because of high bulk density of wastes, vehicles with compression devices cannot be used effectively in most developing countries. On the other hand, because of high maintenance costs, improved waste collection vehicles with compactor trucks are not affordable to most of the local authorities in our country. Therefore, selection of suitable waste collection and

transportation vehicles is very important in waste management.

Intermediate treatment of wastes

Prior to final disposal, procedures which are followed to minimise the volume and hazardous substances of wastes are called intermediate treatment. These include recycling, resource recovering (energy and material).

a. Recycling of wastes

Waste recycling is one of the major strategies of waste management. The process of utilisation of discarded goods after reusing to produce original raw materials is called recycling. When the waste is recycled, the same original material can be obtained. Therefore, waste recycling helps to protect the natural resources as well as the environment.

Compared to making something from scrap, recycling can substantially reduce the quantity of natural resources consumed in the production processes, in terms of both raw materials and energy (e.g., electricity and oil)

Paper, plastics, glass bottles, metals in waste stream can be recycled. The most effective way of recycling municipal wastes is separating materials before they become part of the waste stream. Contaminated and dirty solid wastes are more difficult to use as raw materials for the recycling industry. Before dirty wastes are used for recycling, they must be cleaned (or washed). Sometimes, it is not economically viable for some industries. Therefore, separations at the source, and collocation of wastes separately are very important for recycling in our country. Though the source separation of waste is not common in Sri Lanka, waste papers, glass bottles, plastics, metals are recycled to some extent, but most recyclables are directed to waste dumps.

b. Recovering value

Recovering value from wastes refers to converting the waste materials to a different product. For example, production of organic manure by composting, generation of biogas, etc. Recovering value allows to utilise the energy and material embedded in the wastes.

Production of organic fertiliser is a very good intermediate treatment system for wastes consisting of high percentage of organic materials. It is a good practice for reducing volume and harmful conditions of the wastes. On the other hand, organic fertiliser can be used as a good source of nutrients for agriculture. Organic fertiliser production can be done on

small scale at household level or on large scale. There are various methods available to produce organic fertilizer, and it is important to select the most suitable method according to the requirement.

Depending on the type of microorganisms used for manufacturing process of organic fertiliser, there are two methods, namely aerobic and anaerobic. Aerobic (oxygen-dependent) degradation process by which organic wastes are decomposed under controlled conditions. When organic fertiliser is produced under aerobic conditions (composting), oxygen must be supplied to induce the growth of aerobic microorganisms. During the composting process, decomposing waste generally loses between 40 and 75 percent of its original volume. Anaerobic method organic fertiliser production should be done in oxygen-free closed digester. When organic matter is digested by the anaerobic micro organisms, methane gas (Biogas) can be generated as a byproduct.

In developing countries, solid wastes consist of high percentage of biodegradable materials. Therefore, efficient composting methods can be used successfully for domestic and market waste management in developing countries like Sri Lanka. Organic waste converters or compost bins can be used successfully for domestic waste composting at household level.

c. Incineration

Incineration can be used as an intermediate treatment method in waste management. But because of high moisture content and low calorific value of the wastes, it is very difficult to use incinerators in our country. On the other hand, control of pollutants generated during incineration such as air emissions, bottom ash, fly ash and waste water is very expensive and it cannot be maintained easily. Incineration is not a true waste disposal method as at least 10-15% of residual ash must be disposed to the landfills after incineration of wastes.

Final disposal

Disposal of wastes is the final option if other options described above fails or inadequate, or inappropriate. Although, quantity of solid wastes can be reduced by applying various intermediate treatment methods, a part of it will remain for the final disposal. That cannot be avoided. Sanitary land filling can be used for final disposal of wastes. Incineration is also used as a method of final disposal of wastes

Sanitary land filling is a necessary option for waste management, since all management options produce some residue that must be disposed of through land filling. Land filling is the only true disposal option.

The purpose of sanitary land filling is to dispose of wastes hygienically through proper dumping and decomposing using natural metabolic processes. It is important to have a practical and viable method of disposal which can be decided upon by regional conditions and management and organisational situations. In making this decision, it is important to take into account the type, form, composition of wastes, location of landfill site, hydrological and climate conditions of the location, etc.

The main components of an improved sanitary landfill site include the following:

- Layers to prevent leachate being infiltrated in to soil or ground water
- Pipe system to collect the leachate
- Pipe system for exchanging gases
- Storm water drainage system
- Leachate treatment facility
- Covering soil materials.

Both construction and maintenance costs of sanitary landfills are very high. Therefore, low-cost sanitary land filling is the best option for countries like Sri Lanka.

In Sri Lanka, currently most local authorities have been facing a big problem for finding a suitable land for waste disposal facilities, particularly in urban areas. The problem is most severe in the densely-populated areas in the country. Most local authorities dispose of their solid wastes in to unsuitable sites such as lowlands and riverbanks, causing pollution of water resources and surrounding environment. The open dumping sites which have been operated in our country so far cannot be considered as proper sanitary land fill sites.

Current Status of Solid Waste Management in Sri Lanka

In Sri Lanka, the responsibility for solid waste management fully rests with local authorities (i.e., Municipal Councils, Urban Councils and Pradeshiya Sabhas) under the Local Authority Acts. Although most of the local authorities pay more attention to the improvement of physical resources coming under their purview, their concern towards solid waste management issues is low and the amount of resources allocated is inadequate.

Legal framework

Legal framework required for solid waste management has been adequately provided under Local Government Acts and the local authorities are responsible for the collection and

disposal of solid waste in the country. The sections 129, 130 and 131 of the Municipal Council Ordinance, the sections 118, 119 and 120 of the Urban Council Ordinance, and sections 93 and 94 of the Pradeshiya Sabha Act, have clearly and adequately provided the legal provisions for the management and disposal of solid wastes in the respective areas.

The provisions relating to solid waste management in Pradeshiya Sabha Act, Urban Council ordinances and Municipal Council Ordinance are as follows:

- a. All street refuse, house refuse, night soil or other similar matter collected by Local authorities under the provisions of this part shall be the property of the council, and the council shall have full powers to sell or dispose of all such matter.
- b. Every Pradeshiya Sabha, Urban Council and Municipal council shall from time to time provide places convenient for the proper disposal of all street refuse, house refuse night soil, and similar matter removed in accordance with the provisions of the law, and for keeping all vehicles, animals, implements, and other things, required for that purpose and shall take all such measures and precautions as may be necessary to ensure that no such refuse, night soil, or similar matter removed in accordance with the provisions of the law is disposed of in such a way as to cause a nuisance (MFE-

2000 National Strategy for solid waste management).

There are 311 local authorities functioning in the country of which 18 are Municipal Councils, 37 are Urban Councils and 256 are Pradeshiya Sabhas. About 2700 tonnes of wastes are collected by the local authorities daily in the country and out of which 60% is from the western province. It was also observed that per capita collection varies drastically from rural to urban areas. However, the Colombo district is found to generate 76% of total solid wastes in the western province. The composition of the municipal solid wastes in many urban areas is such that the perishable or biodegradable materials amount to more than 60%.

According to a data base published by Ministry of Environment and Natural Resources, annual collection of paper wastes in the country is about 71,175 tonnes which is worth about Rs.320 millions. Daily collection of plastic wastes in the country is about 65,700 tonnes worth of about Rs 1,314 millions. Therefore, still we are not utilising this valuable resource for the benefit of the country.

Since disposal of solid waste at present is done by open dumping in low lying areas by many local authorities in Sri Lanka, the general public has faced many problems including bad odour, pollution of surface and ground water resources, increased population of flies and scavenging animals, etc. Finding a solution to this problem of solid waste management has become a critical environmental issue at national importance.

Recently, in order to provide a long-lasting solution to this problem, the Ministry of Environmental & Natural Resources under the direction of Hon. Minister Patali Champika Ranawaka has launched a national-level programme, "**Pilisaru**", under the co chairmanship of the Ministries Environmental and Natural Resources, and Provincial Council and Local Government along with the participation of other government organisations, private institutions, non-governmental organisations & various technological specialists. The Central Environmental Authority serves as the implementation body of this project.

The main aim of the Pilisaru Project is to solve the solid waste problem in our country within the next 5 years. Under this Pilisaru programme, a national policy for solid waste management has been introduced in the year 2007, and it provides directions to improve the solid waste management in the country. One of the major areas that have been addressed by the national solid waste management policy is provision of environmentally sound waste treatment and residual waste disposal facilities.

Under this project, waste management will be carried out by reduction of waste generation by reuse, recycling and resource recovery to the maximum extent possible followed by appropriate treatment and finally the disposal of residual wastes in an environmentally sound manner.