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Solid wastes generation and its management in tourist destinations of Sri Lanka

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Abstract

In the recent decade (2009-2019), the tourism industry has become a major driving force Sri Lankan economy. It accounts for 12.6 % of the country's GDP and is considered one of the significant employment generators in the service sector. However, it is an industry that generates a decent amount of solid waste, but a few research findings rely on this to verify. Hence, this review study aimed to identify, quantify, and characterize different types of waste in major tourist destinations of Sri Lanka with adopted management strategies. Solid waste generation in touristic locations is varied between 1 to 12 kg per guest per day, which mainly depend on the tourist attributes, the season of the year, and the prevailing environmental legislation of the country. The management of solid waste in tourist destinations is particularly problematic due to climatic conditions, topography, financial restraints, planning issues, changing consumption patterns, transient population, and seasonal variations in solid waste quantity and composition. Improper waste management methods, lack of essential facilities, underestimation of actual waste generation rates, and inadequate management and technical skills are the key factors attributed to the poor waste management of developing countries like Sri Lanka. Overall, the literature concludes that the proper management of solid waste would enhance the sustainable development of the tourism industry and economy of Sri Lanka.

Keywords: Tourism; Environmental Pollution; Solid Waste Management; Sri Lanka; Sustainability

1. Introduction

Sri Lanka is one of the top tourist destinations in the world because of the natural beaches, hills, waterfalls, rivers, lagoons, plains, and ample sunshine (1,2). Tourism is considered one of the leading industrial sectors in the world, which is a source of earning currencies providing direct and indirect employment to countries (3). The tourism industry in Sri Lanka contributes 13.5 % of the country's GDP (4). Therefore, the Tourism industry is considered a major determinant of the economic development of Sri Lanka. However, waste generation creates massive environmental leftovers (5, 6).

Since 2009, the increased tourist influx in Sri Lanka has resulted in substantial waste, making the waste management process more complex. Tourist hotels are considered the primary consumers of resources and contribute heavily toward waste generation compared to others (7). Comparatively, the world hospitality sector of Sri Lanka brings out much food waste compared to the other solid waste types (8). Therefore, the hotel industry should adopt appropriate solid waste management practices to reduce waste generation by the tourism industry.

Lack of awareness among tourists, local communities, and government authorities on the proper solid waste management are critical factors contributing to the degradation of the environment and scenic beauty of tourist destinations. According to (9), The solid waste issues in the tourism industry become more complex due to the lack of suitable facilities like equipment & infrastructure, underestimation of the rate of waste generation, poor management

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and technical skills, inappropriate collection, and route planning are responsible for poor collection and transportation. Effective solid waste management strategies are essential for developing the tourism industry, preventing environmental pollution, and human health (10).

2. Tourism Industry in Sri Lanka

Tourism can be defined as activities related to individuals traveling to and staying in places outside the usual environment for not more than one consecutive year for leisure, business, or other purposes (11). Ceylon Tourist Board was established in 1966 to provide direction and leadership for developing the tourism industry (12). Sri Lanka has been ranked as one of the top tourist destinations endowed with a rich cultural heritage, a unique mixture of golden beaches, and abundant wildlife since the end of the separatist war in 2009 (13). According to the annual report of the Sri Lanka Tourism Development Authority in 2019, tremendous growth in international tourist arrivals can be observed in 2018 compared to 2017.

As one of the leading industries in Sri Lanka, tourism plays a vital role in the country's economy as the fourth largest foreign exchange earner. During the year 2011 to 2012 period, a decline in the national current account deficit from 4,615 to 3,915 million US dollars was observed due to the higher earnings in tourism & transportation and a significant increase in workers' remittances (14). Moreover, improvements to infrastructure, tax revenues, employment generation, business opportunities, etc. are other benefits of the tourism industry (15). However, the tourism industry has some detrimental impacts on the environment and communities, such as increased natural resource use, consumerism, solid waste production, etc. (16,17). Improper solid management practices like dumping litter on beaches & streets and garbage burning can cause environmental deterioration, loss of aesthetic appeal, and detrimental effects on local people and wildlife (18).

A clean environment is a vital component of the tourism industry. Therefore, it is essential to protect natural and cultural resources, reduce environmental deterioration, and maintain destination beauty to develop the tourism industry in Sri Lanka.

3. Solid Waste Generation in Tourism Industry

Waste generated in the tourism industry can be mainly categorized as solid waste and wastewater. Solid waste can be defined as unwanted, unused, useless, or discarded solid materials generated from human activities in residential, industrial, or commercial areas (19, 20). It can be biodegradable or non-degradable. Solid waste materials can be further categorized based on their origin or source (industrial, domestic, commercial, institutional and construction and demolition, etc.), hazardous potential (toxic, non-toxin, flammable, radioactive infectious, etc.), and type of waste generated (organic material, glass, metal, plastic, paper, etc.) (21).

The tourism industry generates approximately 35 million tons of solid waste annually (22), which is comparatively higher than the waste produced by residents (18,23). This has become an emerging issue in Sri Lanka with the development of the tourism industry. The amount of solid waste generated depends on tourist destinations, tourism-related activities, and the season (24). Additionally, tourism-related activities like business, entertainment, sport and festivals, and other cultural celebration are considered the leading sources of pollution globally because they generate large amounts of solid waste (25,26). The waste categories which initiate from hotels depend on the occupancy of the hotels, and some depend on the reception functions held in hotels (Kitchen waste generated after wedding functions, etc.). This may include municipal sludge and semi-solid food. A considerable volume of solid waste is generated in Sri Lanka during the Kandy perahera season and from December to April because more tourists are attracted to Sri Lanka during this season.

Uncontrolled conventional tourism causes potential threats to many natural areas around the world. In areas with high tourist attractions and high concentrations of tourist activities, solid waste disposal is a serious problem, and improper disposal of solid waste is a significant issue in the rivers, scenic areas, and roadsides. Further, primarily this industry is located adjacent to environmentally sensitive places such as virgin forests, beaches, and archeologically significant locations. Therefore, improper management of solid waste can cause adverse effects on these environmentally sensitive places. The primary solid waste materials generated in the tourism industry are water bottles, containers for juices and other beverages, plastic bags, food waste from restaurants, diapers, disposable plates, spoons, etc. (27). The majority of tourists carry polythene bags and plastic bottles during their visits which cause severe environmental issues. Moreover, trekking tourists generate a great deal of waste with oxygen cylinders and camping equipment in mountain areas (28).

Moreover, tourism can influence local solid waste management systems, causing landfills and sewage plants to overflow. The food waste disposed to the landfills results in the formation of leachates and explosive gases like methane which may cause detrimental effects on the environment and humans. Apart from that, it may cause problems to the surrounding communities in the form of odor, flies, litter, and noise (29).

Hotels located around the country are the major contributor to solid waste generated in the tourism industry. Hotels tend to produce a significant amount of solid waste, including plastic, paper, glass, wood, kitchen waste, old durables, electric and electronic equipment, green waste, clinical waste, hazardous waste, sands (from the filters of pools), dust, metals, packaging and waste packaging, batteries, solid waste from biological treatments, hazardous substances from funnels and especially from the kitchen funnels (29). The different types of solid waste and their sources generated in tourist hotels are shown in Table 1.

Table 1 Types and sources of solid waste generated in tourist hotels (30)

| Type of Waste | Sources of Waste |
|---|--|
| Organic waste/ Food waste | Kitchen, restaurants, bars, guests rooms, gardens |
| Plastic (bags, bottles, etc.) | Kitchen, restaurants, bars, guest room, administration |
| Glass (bottles, jars, flacks) | Kitchen, restaurants, bars, guests rooms |
| Metals (Tin cans, jar lids, soda cans, food containers, aluminum packing) | Kitchen, restaurants, bars, guest room |
| Clothes (Table cloth, bed-linen, napkins) | Kitchen, restaurants, bars, bathrooms, guests rooms |
| Oil (Frying, Mineral) | Kitchen, restaurants, Maintenance |
| Chemicals (Fertilizers, Pesticides, Cleaning) | Garden, Laundry |
| Fluorescent lights, neon tunes, long-life bulbs | Maintenance |

According to (31), food waste is the most prominent waste generated in tourism destinations. Many factors affect food waste generation in hotels, which can be classified as internal, intermediate, and external factors. Table 2 illustrates the different drivers of food waste generation in the tourism industry.

Table 2 Different drivers of food waste generation in the tourism industry adapted from (32)

| Internal Factors | Intermediate factors | External factors |
|--|--------------------------------------|---|
| Incompetent hotel management and policies | Insufficient awareness and education | Unsuitable food consumption patterns of the customers |
| Unavailability of facilities and food waste technologies | Lack of communication | Risk of raw food spoilage |
| Lack of skills in food preparation | | |
| Non-execution of waste audit and waste separation | | |

Food waste can be classified into two stages: before and after preparation (33). Before food preparation, food may spoil due to improper storage and handling (34). Additionally, after preparing food, there are several ways of food waste generation like over portioning, over-ordering, customers returning the food due to the unsuitable flavoring or over seasoning, radish tops, onion skin, and banana skins like food parts that are non-edible, etc. Service styles like buffet systems also generate significant food waste due to improper handling (35).

The hotels in the tourism industry tend to produce significant amounts of solid waste in the form of packaging materials, cooking and garden waste, old furniture and equipment, and potentially dangerous waste such as asbestos and solvents (8). The literature reports that a typical tourist produces 1 kg of solid waste in one night stay, resulting in thousands of tonnes of waste annually (36). For example, the United Kingdom (UK) annually produces 920,000 tons of food waste in the hospitality sector (37). Also, not only in developed countries, developing countries like the Maldives where tourism

is growing, produce a high amount of food waste annually. According to (38), the amount of food waste generated per capita per day was estimated to be 2.9 kg in resorts and other types of accommodations in the Maldives. Additionally, their resorts discard approximately about 54 metric tons per day of food waste, whereas safari vessels discard an estimated total of 6 metric tons per day of food waste.

Therefore, improper solid waste management can cause incredible strain on tourist destinations. It can cause landfills and sewage plants to overflow, and improper disposal of trash, sewage, and toxic chemicals by tourists and hotels can cause detrimental effects on the environment and humans. The growing solid waste heaps and lack of proper management in tourist destinations can lead to serious environmental and health problems and negative implications for the tourism industry. Hence, adopting appropriate solid waste management strategies in tourist destinations is crucial for mitigating the problem.

4. Solid Waste Disposal Practices in Sri Lanka

The solid waste management system is comprised of waste generation, collection, transportation, and disposal. This system should follow the principle of minimizing waste, recycling, resource recovery, and integrated waste disposal facility. Waste reduction and reuse are considered the main aspects of solid waste management. Besides, incineration, composting, anaerobic digestion, and landfilling are standard methods used in solid waste management (39). However, incineration, composting, and anaerobic digestion are preferred rather than landfilling (40). Further, several novel strategies for solid waste management have been initiated, including waste mapping and Best Practical Environmental Option (BPEO). These novel strategies are utilized to facilitate more efficient management.

Open dumping of solid waste is commonly practiced for the disposal of solid waste in Sri Lanka, causing an immense burden on the environment and the health of surrounding biota (41). Karadiyana, Gohagoda, and Buthgamuwa are well-known open dumping sites in Sri Lanka (42). None of the above open dumping sites are engineered to control or reduce the amount/number of pollutants released from the dumping site. Due to the factors like urban sprawl and severe public opposition to sifting landfilling facilities, the construction and finding a suitable place for a dumping site have become problematic.

There are many detrimental effects of open dumping of solid waste in an uncontrolled manner on the surrounding environment as contamination of soil, ground and surface water, air, loss of biodiversity, emission of greenhouse gases, etc. (40,43). Excessive leachate generation due to high moisture content in the solid waste causes numerous problems to the surrounding environment (44). The estimated methane emission potential from an open dump in a tropical country like Sri Lanka is about 72 kilograms per ton of waste. Further, it has been estimated that the levels of methane emission from Karadiyana, Gohagoda, and Buthgamuwa dumpsites are 208, 288, and 60 g/m² /day, respectively (45).

Besides that, many health issues arise from the open dumping of solid waste and exposure to scavengers, insects like mosquitoes, flies, etc. (46). These vectors can cause communicable diseases like plague, murine, typhus, malaria, histoplasmosis, dengue, West Nile fever, etc. (40). Further, open dumping destroys the natural scenic beauty and natural habitat in tourist destinations and negatively impacts the tourist's arrival to the country (47).

5. Institutional Involvement of the Solid Waste Management

Solid waste management is comprised of different sectors involving public and private sectors, non-governmental organizations, community-based organizations, resident welfare associations, and people (48). There are several institutions involved in waste management at various phases in Sri Lanka, including the National Solid Waste Management Support Centre, Ministry of Local Government and Provincial Councils, Ministry of Megapolis and Western Province Development, Ministry of Mahaweli Development and Environment, Central Environmental Authority, Urban Development Authority, Western Province Waste Management Authority, and Local Authorities (49).

The Ministry of Environment developed a "National Strategy for Solid Waste Management" in 1999 based on waste management from generation to the final disposal. Furthermore, this strategy suggests the formulation of policies to waste avoidance, reduction, reuse, and recycling, and after that, final disposal in an environmentally sound manner. However, these policies have not been adequately formulated yet (50). In addition, Solid Waste Management in developing countries like Sri Lanka is hampered by insufficient infrastructure, weak strategic planning, the absence of a legislative framework, employee capabilities, knowledge, and information-sharing systems, and inadequate financing (51).

6. Conclusion

The reviewed literature has shown solid waste management's present status in tourist destinations in Sri Lanka. The classification and quantification of solid waste in the tourism sector were addressed, and it was clear from the listed studies that food waste is the most critical component of tourism waste, about 40% of hotel waste and 60% of restaurant waste. The best possible options include prevention, reuse, recovery, and recycling for proper solid waste management in the tourism industry. The literature reveals that proper management of solid waste can lead to the sustainable development of the tourism industry, and it will directly affect the economy of Sri Lanka and diminish environmental pollution. Therefore, recommended discovering sustainable solutions with the involvement of all the stakeholders.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors wish to declare that they have no conflict of interest.

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