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An Environmental Protecting Approach through Waste Management Practices at Nehru Arts and Science College, Coimbatore, Tamil Nadu, India

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Abstract: ***Collection, transport, treatment and disposal of solid wastes, particularly wastes generated at educational institutions, have become a relatively difficult problem. To operate a permanent recycling provision in educational institutions is uneconomic and challenging to sustain. Objectives of the study is to evaluate the current practices related to the various waste management initiatives taken by the Nehru Arts and Science College, Coimbatore, Tamil Nadu, India for human wellbeing. As per the qualitative and quantitative audit requirements, most of the issues were in compliance with the scope and policies of the institute besides the National Standards. Solid waste and wastewater management facilities and implementation of government schemes are adopted in accordance with the requirements. Based on the on-site audit, specific suggestions and recommendations to improve the waste management activities are offered for judicious, need based adoption/application. So also, the study contributed an understanding about the various waste management initiatives/systems in the organization and to find out the timeline for improvement.***

Keywords: Solid waste management, wastewater recycling, plastic usage, Swachh Bharath Abhiyan scheme

1.Introduction

Waste management is a global environmental task but has always been neglected by the public. Improper waste management will create environmental issues viz., water- and air-pollution which lead to health problems (Tiew *et al*., 2019). In other words, the main reason for polluted environment is unawareness of consumers and poor legitimate initiatives. There is a huge scope to enhance the environmental health through waste management practices and sanitation facilities to be made available to all economic sections of the society. Ever increasing population rate and the improved life style of the people results in generation of solid wastes, in amplified amounts, irrespective of urban and rural areas (Agarwal *et al*., 2015). It has been estimated that 62 million tons of municipal solid waste and 38 billion liters of sewage is generated annually, that too, only from urban India. Municipal solid wastes increase at the rate of 1.0 to 1.3% annually and major proportion of the same is left untreated (Ramesh and Sivaram, 2016).

In order to protect the environment, the United States Environmental Protection Agency issued the guidelines on recycling the waste right from collecting, processing the waste to environmental friendly end products which could benefit the community. Developing a sustainable waste management programme is important to achieve the national targets which are need of the hour. In this context, Government of India launched a scheme, Swachh Bharath Abhiyan under Clean India Mission, a new initiative and a step towards sanitation, solid waste management and cleanliness to promote cleanliness across the country (Ramesh and Sivaram, 2016).

Implementation of Clean India Mission is not only the duty of rural and urban authorities; each and every individual are responsible to maintain clean environment. Never the less, as an organization, educational institutions are also responsible to maintain healthier environment. Waste management is one of the most important aspects to be considered within the educational institutions for the benefit of its stakeholders (Sales *et al*., 2006; Ioja *et al*., 2012). There are several educational institutions practicing sustainable habits and they claimed as “green campus”. A clean, safety and healthy environment promotes an effective teaching and learning processes and offers a conducive learning environment. Objectives of the study are to analyze the types of waste generated in the institution and how they manage to recycle/reuse the same besides their eco-friendly, waste management policies to safeguard the environment.

2.Materials and Methods

Waste management strategies play an important role in environmental audit (Gnanamangai *et al*., 2021). With regard to study area, the campus area of 35 acres of Nehru Arts and Science College, Coimbatore, Tamil Nadu, India situated at an altitude of 415 m above mean sea level, 76°58’21” E of longitude and 11°1’6” N latitude was undertaken towards the waste management practices followed and efforts taken to safeguard the environment. Considering the weather conditions, the campus experiences fairly warm or dry circumstances throughout the year. During summer, day temperature raises as high as 42°C and minimum (night) temperature recorded during winter lowered to ~18°C. The area receives ~ 85 cm rainfall during monsoon months between June and November.

An integrated waste management system is one of the greatest challenges for higher educational institutions (Zhang *et al*., 2011). Waste management assessment methods of an educational institutions mainly focused on qualitative evaluations/surveys and quantitative valuations on the basis of national standards (de Vega *et al*., 2008; Ghosh, 2016). International Standard Organisation (ISO) has formulated a series of standards (ISO, 2015) in the field of environmental auditing and these standards are basically intended to guide organizations and auditors on the general principles common to the execution of environmental audits. Educational programs on waste management and projects handled by the institutions which facilitate awareness on recycling of generated wastes are also deliberated in the audit.

Waste management audit covers (as an integral part of environmental audit) institutional policies on sanitation and hygiene, waste management and waste management initiatives. Qualitative survey encompasses the methods adopted for waste segregation and disposal, disposal methods (landfills, incineration, etc.), reuse, recycling in terms of production of vermicompost/organic manure and/or biogas. Availability of awareness signboards on plastic usage, awareness programs related to waste management and social responsible activities of the stakeholders were also given prime importance during audit (Gnanamangai *et al*., 2021). Survey site includes the laboratories, gardens, hostels, wash rooms, staff rooms and guest rooms, in other words whole campus, where the auditors observed available facilities and had discussion with concerned officials.

3.Results and Discussion

It may be noted that apart from the wastes, abandoned materials and materials intended to be recycled are also considered as wastes. It is important to understand the above concept because even though something is going to be recycled, it must be managed until it is actually recycled. Any organization should monitor periodically the available waste management facilities and activities which directly implies on execution of scope and amendments of waste management policy. Documents pertaining to proper waste disposal and tracking form is maintained by the institute which has been submitted to IQAC and NAAC teams for authentication. In Nehru Arts and Science College campus, certain wastes (chemicals, solvents, construction and laboratory wastes, kictchen, sanitary knapkins, paper wastes, sewage sludge, etc.) were disposed on-site (within the campus) and disposal data available with college engineering office or respective departments. The electrical and electronic wastes, food waste, garbage, glass, plastic items, trash, etc., were disposed through Coimbatore City Corporation for recycling as per the policy.

Bio-degradable and Non-degradable wastes

Nehru Arts and Science College campus has a very good solid waste recycling unit which operates a few vehicles to collect wastes using compostable bags across the campus. Both degradable and non-degradable items are being collected from different departmental laboratories, canteens, cafeteria, stationary shops and hostels every day and dumped in the place which is subsequently segregated based on the nature of degradability. Segregated items are neatly packed in eco-friendly covers and subjected to degradation without harming the environment. For the purpose of segregation of wastes, as organic, recyclable, non-recyclable and e-waste, at source and collecting points 'Waste Bins' are placed in the College campus.

Figure 1: Biowaste management facilities at Nehru Arts and Science College

[A. Different types of Dustbins kept for collection of food wastes, B. Plant wastes, C. Plant Waste Recycling process]

Plastic waste

Irrespective of the urban and rural areas due to ever increasing "use and throw" concept, non-degradable components like plastics and packaging were increasing day-by-day. It may be noted that plastic waste management is very important because plastic is not only pollute the environment; it destroys the food chains in the ecosystem. Management of Nehru Arts and Science College has considered the plastics as non-degradable solid waste and the plastic waste generated were sent out through certified companies for recycling purpose. However, College has taken sufficient attempts not to use

plastics in the campus and displayed a slogan ‘say no to plastics’ in places like canteen, hostel dining halls, seminar halls, corridors, etc. to create awareness among the students, parents and public which resulted in “no hangings of plastics” in the campus. College management insisted to use eco-friendly bags made from organic materials like plant fibres. These efforts are very much essential to keep the environment neat and clean to conserve nature.

Biogas plant

Installing biogas in educational institutions and industries help in the waste management process and the biogas generated can be used for cooking. Thus biogas facility fulfils dual purposes by saving energy and facilitates waste management. Nehru Arts and Science College has a well established biogas plant in the campus (Fig. 2) in which biogas is generated and being used for hostel and canteen purposes.

Figure 2: Biogas facilities at Nehru Arts and Science College Vermicompost / Organic manure production

Plant waste such as fallen leaves, stems, fruits, nuts, seeds and other plant parts should be used to make green manures. A concrete or ground level green manure production unit and vermicomposting units will help to convert all the plant and animal based wastes into green/organic manures. This will be a healthy way of solid litter waste management in the campus. Nehru Arts and Science College has a well established vermicompost unit in the campus (Fig. 3) in which Biowastes are being decomposed significantly and being used for plant manuring purposes. The most of biowastes are recycled properly and reused for gardening as soil and water reclamation.

Figure 3: Vermicompost / Organic manure production facilities at Nehru Arts and Science College

Wastewater recycling

The College is taking enough attempts to manage wastewaters that are coming out from various departmental laboratories, hostels and canteens. The wastewater treatment plants were established and maintained adequately and recycled water used properly. Campus has a very good wastewater treatment facility covering primary, secondary and tertiary water treatments for elimination of excess salts along with harmful pathogens. Wastewaters are treated with both chemical and biological treatment methods using activated-sludge, UV light and chlorination. There is a proper connectivity and channels for the discharge of wastewaters from various sources to wastewater treatment plant. The wastewaters are purified considerably and reused for gardening as water reclamation (Fig. 4).

Figure 4: Wastewater treatment facilities at Nehru Arts and Science College
[A-C. Wastewater Recycling Process, D. Purified Water Storage Tank]

Hazardous waste

The College campus has taken pioneering efforts to dispose the hazardous waste properly that are generated from various Department laboratories. Chemical wastes must be disposed safely without affecting the environment and it cannot be treated as regular trash. Certain laboratories of the College are handling hazardous chemicals, solvents and reagents which need careful handling/disposal. It may be noted that the College has formulated certain protocols / procedures to dispose chemical waste as well as expired chemicals properly. But there is no proper record for disposing of expired chemicals, acids, solvents, reagents, carcinogenic and hazardous chemicals as per the rule of Central Pollution Control Board which issue needs immediate attention.

Disposal of e-Waste

In compliance to the e-Waste Management Rules, 2016, Government of India, e-waste materials were collected from Nehru Arts and Science College campus are being segregated and then sold to Authorised Agencies which are approved by the Pollution Control Board for handling e-waste. Due to this e-waste disposal activity, the e-waste pollution is significantly reduced in the college campus. However, a proper in-house method of e-waste disposal should be carried out in collaboration with State Pollution Control Board as per prevailing e-Waste Management Rules.

Implementing Swachh Bharath Abhiyan scheme

Swachh Bharath Abhiyan under Clean India Mission is the new initiative and a step towards sanitation, solid waste management and cleanliness to promote hygiene across the sub-continent, India. This scheme is implemented at Nehru Arts and Science College campus to create a safe pollution free environment, eliminate the open defecation and improves solid waste management besides improve sanitation and refining drinking water quality to the stakeholders. The students of the College in collaboration with NCC and NSS units, conduct more awareness programmes on cleanliness, reduce the use of plastics, solid waste management and sanitation and importance to protect the environment among the rural people across the various Districts of Tamil Nadu state. The students created awareness among the rural and urban people to keep the surroundings clean and hygiene. Number of programmes are conducted time to time on the occasion of 'Independence Day', 'Republic Day', 'World Environmental Day' and 'Biodiversity Conservation Day'

events.

Waste disposal tracking form

As an integral part of the environmental management plan, solid waste monitoring (frequency) should be carried out at monthly interval where solid waste quality, quantity, disposal method, reuse/recycle and solid waste treatment should be documented in compliance with Environmental Laws and Legislative policy. Similarly for wastewater management, primary, secondary and tertiary pollutants and their recycling, waste minimization, storage and handling, reuse and treatment before disposal should be documented at monthly intervals in compliance with legislative laws which in turn minimize water pollution and to provide quality water as per Central Pollution Control Board. Apart from the waste management policy, Nehru Arts and Science College administration following the waste disposal tracking form wherein waste type, approximate quantity/units disposed, disposal location (whether on-site or off-site) and authorised company responsible for recycling were documented. These documents serve as reference materials for the employees when planning and/or performing above activities in the campus.

Main limitation in the study is difficulty in systematic quantification of waste and this is mainly due to the absence of a waste quantity monitoring system in the majority of educational institutions (Ioja *et al*., 2012). A study conducted in 2013 by 'M/S Hand in Hand India Ltd. had quantified mean daily wastes which revealed out of total waste generated food waste accounts
~37% while recyclable- and organic- wastes registered 27% and 36%, respectively (Report, 2013). Study demonstrated that the solid wastes needs to be professionally handled and the solid wastes collected from different places within the campus segregated as bio-degradable and non-degradable and subsequently subjected to recycling and degradation processes. Data generated during environment audit, particularly waste management practices are elaborated here under with specific subheads.

A major proportion of solid waste materials in an educational institute can be reused within the campus while remaining portion of the waste can be recycled only at specific sites. Degradable organic waste, plant liters, etc., can be disposed on-site with composting facility or on-site burial pits. Any organization that reduce the landfill materials up to 15% through reduce, reuse and recycle process, then it can be considered as a good management practice; where 45% of the waste may sent to gasification plant and/or composting plant and remaining 40% may be recycled (Ramesh and Sivaram, 2016). Biodegradable waste generated was subjected to preparation of organic compost while non-degradable/recycling wastes disposed off-site where certified companies are being engaged for this purpose. Considering biowastes (Fig. 1), food wastes, a portion was pulverized and utilised in the biogas digester while remaining portion sent to piggeries. Organic wastes like dry leaves, vegetable cuttings, etc. were sent for biocomposting process.

As per the Central Pollution Control Board report, our country generates unimaginable quantum of plastic waste per day, out of which 60% of plastic is recycled (CPCB, 1998). Most of the plastic items are considered as solid waste and enhance the unwanted animal choking, water pollution, blockage of channels, rivers and streams, and landscape disfigurement. It impacts all organisms in the food chain from tiny species to huge ones. And hence, reduction of plastic usage is the need of the hour to protect at least the present day natural resources.

It has been reported that more than 40% of the world's population live in the region where the demand for water exceeds its supply. The imbalance between supply and demand, along with persisting issues such as climate change and population growth, has made water reuse a necessary method for conserving water; recycled waste water can be used for irrigation of food crops and other purposes (Fatta-Kassinos *et al*., 2016). Wastewater recyclers are important features in any organization or Industry.

Construction and demolition waste management / monitoring is not a routine in an educational institution. However, Ministry of Environment, Forest and Climate Change, Government of India notified the Construction and Demolition waste management rules, 2016 exclusively for construction waste management is applicable for any organization/industry. Accordingly, the local authorities need to ensure proper management of construction and demolition waste. As indicated by Gayakwad and Sasane (2015) construction and demolition waste can be applied to use, reuse and reprocessing like making tiles from crushed construction debris. One of the best construction waste management practice is rebuilding/laying pathway road, which has certainly been followed at Nehru Arts and Science College campus.

Sanitation and solid waste management are two important strategies of Swachh Bharath Mission. Success of the mission will depend on the implementation of the laid down procedures, periodical monitoring and follow up action based on the monitoring results. Menstrual hygiene management is an indispensable part of Swachh Bharath Mission Guidelines for adolescent girls and ladies which insisted safe disposal of used napkins and dirty materials (Ramesh and Sivaram, 2016). Nehru Arts and Science College management is implementing the safe practices of disposing of napkins using small scale incinerators in ladies hostels. Availability of incinerator facility and disposal structures with proper directions connected to menstruation indicated their substantial attention on sanitary waste disposal.

4.Conclusion

In India, Nehru Arts and Science College, Coimbatore, Tamil Nadu, India is one among well-established Educational Institute with respect to academic activities and continuously offering an eco-friendly atmosphere to the students, research scholars, parents and staff members.

As per the qualitative and quantitative audit requirements, most of the issues were in compliance with the scope and policies of the institute. For example, wastewater treatment, waste disposal, solid waste management, incinerator facilities and implementation of government schemes are adopted in accordance with the environmental audit requirements. Eco Club, Nature Club along with NSS units actively conducting number of awareness programs related to environmental protection. The organization implemented Swachh Bharath Abhiyan scheme effectively to promote cleanliness of the surrounding environment. It is needless to say production of waste to be minimized to ensure the sustainable environment of any organisation. From the on-site inspection, a couple of issues to be given more attention in order to reduce waste generation. Quantification of generated wastes and proper maintenance of recycling/disposal records and establishment of composting plant and biogas facility may be created on priority basis in conformity with International standards besides digital/modern techniques to reduce the use of resources needs attention.

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