International Journal of Engineering Technology Science and Research
IJETSR
www.ijetsr.com
ISSN 2394 – 3386
Volume 2, Special Issue
September 2015

Temple Waste Utilization and Management: A Review

Isha Yadav*, Shelja K. Juneja and Sunita Chauhan*****
*Research scholar, Environmental Science, The IIS University, Jaipur
**Head and Associate Professor, Environmental Science, The IIS University, Jaipur
***Scientist, Kumarappa National Handmade Paper Institute, Jaipur

Abstract

In India, worshiping is the way of living and people offer various offerings to the deities which mainly consist of flowers, leaves, fruits, coconuts, clothes *etc.* out of which floral offerings are found in huge quantity. Thus, temple waste has a unique share of flower waste in the total waste. After fulfilling their purpose, flowers along with other waste, find their way into the garbage or are discarded either into some water bodies or left up on the open places as a waste causing various environmental problems. The majorly offered flowers in temples are rose, jasmine, marigold, chrysanthemum, hyacinth, hibiscus, etc. This floral waste can be utilized in different ways to produce valuable products and can thus help to save environment from pollution caused due to improper disposal of flower waste. Techniques like vermicomposting, composting, dyes extraction, extraction of essential oils, making of holi colours and bio-gas generation can be used. Moreover, this flower waste can also be used for making incense sticks besides using them for some art and craft techniques. Petals of different flowers can also be utilized for handmade papermaking by extracting the pulp or by mottling them into the readymade pulp. In this paper, we have reviewed the ways by which temple waste can be utilized and managed to get valuable products which will lead to a healthier and waste free environment.

Keywords: Floral Waste, Vermicomposting, Incense Sticks and Handmade paper

Introduction

Environment is defined as the sum total of all the conditions and circumstances and the living and non-living things around an organism, which affects its life. Human and environment are closely interwoven with each other, to maintain a balance or equilibrium in nature. With the increase in population and development, there is a tremendous increase in the pollution levels which leads to environmental degradation. The primary causes of environmental degradation are exploitation of natural resources, industrialization, urbanization, etc. Pollution of all sort like air, water, land along with solid waste and its disposal eventually degrade the environment as well as human health.

Waste (also known as rubbish, trash, refuse, garbage, junk, litter and ort) is unwanted or useless material. Waste includes all the items that people have no use any longer and which they either intend to get rid of or have already discarded. Additionally, wastes are such items which people need to discard.

Waste gets generated from each and every activity of humans, which eventually degrades the quality of human health and accelerates the environmental degradation at an alarming rate. Wastes according to Kimenju and Groote; (2008) are discarded substantial products of human activities that are regarded as unwanted or useless. Wastes are substances or objects which are disposed or are intended to be disposed or are required to be disposed of by the provisions of national laws.

Apart from leading to various environmental issues, the waste also leads to number of problems in economically developing nations, as they are facing challenges in treating the waste generated. India is a developing country and is facing waste disposal crisis, but solutions are not impending. Since, it is being realized that waste can be used in industrial processes and also for the generation of energy, appropriate waste management is being explored. Today, management of waste is a challenge accompanied by numerous factors adding constraints and complexity to the process (The Expert Committee, Ministry of Urban Development, Government of India, 2000). Therefore it is generally understood that proper waste management helps to protect health, environment and also preserves natural resources.

Flowers come as waste from various sources like hotels, marriages, gardens, temples, churches, *Dargah* and various other cultural and religious ceremonies. In India, religion is a path of life. It is an intrinsic element of the entire Indian culture. People worship God and are accustomed to go to the temples offering flowers, fruits, coconuts and sweets, *etc.* The bulk of the flowers, leaves of different plants, coconut shells, milk and curd are piled up and then disposed off exclusively in water bodies (Singh and Singh, 2007).

Everyday, these flowers are offered by devotees in temples and are left unused and therefore become waste. India is a country of festivals and many occasions are celebrated round the year that eventually leads to generation of solid waste. This proportion of waste is generally neglected and requires due consideration. Because of our religious beliefs, many of us avoid throwing flowers and other items that are used for prayers in the garbage, and instead put them in the plastic bags and throw them directly in the water bodies. Apart from this; flowers are also kept under the sacred trees and thus there is no suitable mode of disposal. For instance, Banaras, one of the holiest cities of the country, has no policy for disposal of the tonnes of waste that comes from its many temples. Each day waste material weighing 3.5-4 tonnes is left behind in the city of temples (Mishra, 2013).

Degradation of floral waste is a very slow process as compared to kitchen waste degradation (Jadhav *et al.*, 2013). Therefore, there is a need for proper and ecofriendly process of floral waste treatment. Management and utilization of flower waste has been carried out in some studies. One such example is the Kashi Vishwanath temple which draws maximum devotees all round the year, especially in the month of *Shravan*. It has its own system for disposal of hundreds of kilograms of waste resulting from offerings by devotees; the floral waste generated in the temple is converted into manure (Mishra, 2013).

To avoid ill effects caused by disposal of these offerings, they can be used to make some valuables. Like burning of incense sticks produces smoke (fumes) which contains Particulate Matter (PM), gas products and many organic compounds, therefore flower petals obtained from temples can be used to make herbal incense sticks. Flowers like *genda* are used to make incense sticks, while roses are converted to rose water. Besides incense sticks and rosewater, the flowers can also be incorporated into herbal products such as herbal colours, natural dyes etc. (The Hindu, Jan., 2013).

Another case where floral waste management has yielded good pay offs is that of Ajmer *Sharif Dargah* of *Khwaja Moinuddin Chisht*i where nearly 15 to18 Quintals of flowers, offered each day were used to be dumped in a well. Now, the flowers are not only recycled, but also generate employment for local women. With technical assistance from Central Institute of Medicinal and Aromatic Plant (CIMAP)**,** Lucknow, the *Dargah* Committee has established a rose water distillation plant at the outskirts of Ajmer (Indian Express, May, 2010).

Temple waste mainly consists of organic waste like flowers, leaves, coconut shells, residues of inscence sticks, fruits *etc*. which find their way ultimately into bins or some water bodies and thereby result in the pollution and hygiene problems. Thus, the present paper has reviewed various methods reported for the utilization of temple waste.

UTILIZATION OF COCONUT SHELLS

Coconut is one of the extensively used offering in the temples and after removing its edible portion, the shell is generally thrown into the dustbins. These shells ultimately find their way into some water body or on some open areas/places thereby causing environmental problems. There is a vast scope of using the coconut shell as a potential or a replacement material in the construction industry. This will have double benefits of lowering the cost of construction material and solving the disposal problem.

Properties of concrete with coconut shell (CS) as aggregate replacement were studied by Yerramala and Ramachandrudu; (2012). They prepared controlled concrete with normal aggregate and coconut shell concrete with 10-20-% coarse aggregate alternate with CS. Parameters like compressive strength, split tensile strength, water absorption and moisture migration were examined for different CS replaced concretes and controlled

concrete. Their data showed that the CS aggregate can be used in place of normal aggregate, however, performance of CS aggregate concrete is little lower than normal aggregate concrete.

Ahlawat and Kalurkar; (2014) undertook a study with the aim to produce a concrete by substituting granite with coconut shell. They made forty five cubes and their compressive strength and workability were assessed on 7, 14 and 28 days. The compressive strength of concrete was reported to be reduced as the percentage replacement increased. Concrete produced by 2.5%, 5%, 7.5%, 10% replacement attained 28 days compressive strength of 19.71,19.53,19.08,18.91 respectively. Thus it was reported that Coconut shell concrete can be used in reinforced concrete construction and its utilization is cost effective and eco friendly also.

Nagarajan *et al;* (2014) worked on the utilization of coconut shell in place of cement in concrete as cement emits large amount of CO_2. The collected coconut shells were burnt in open air (uncontrolled combustion) for three hours and the acquired product was incinerated in muffle furnace at 800° C for 6 hours to produce coconut shell ash. They concluded from their studies that the ash thus obtained can be used as partial replacement of cement.

UTILIZATION OF FLOWER WASTE

Apart from coconut shell, the foremost used offering in temples is flower. After fulfilling their purpose, these flowers also become environmental menace just like the other offerings. Such flower waste can be used in different manners to produce valuable products and thereby may also contribute towards saving the environment from pollution caused by inadequate disposal of flowers offered to the deities.. Techniques like vermicomposting, composting, dyes extraction, extraction of essential oils, making of holi colours and bio-gas generation have been reported in the literature.

Vermicomposting

Vermicomposting of temple waste (Nirmalya) obtained from Ganesh temple, Sangli, Maharashtra was done by Gaurav and Pathade; (2011). They used effluent produced from biogas digester and mixed it with temple waste and cattle dung which was then allowed to decompose for a period of 30 days at 30°C. The prepared vermicompost was also used to for pot culture study as a fertilizer with five flowering plants. Good growth parameters were obtained in terms of height, flowering time as well as number of flowering time and the number of flowers produced as compared to the control sets, which were not treated with vermicompost. Hence, vermicomposting of flower waste is an excellent and eco-friendly method of flower waste management.

Shouche *et al*; (2011) used various processes like composting followed by vermicomposting to manage floral waste. They used different proportion of mixtures of cattle dung and floral wastes to prepare vermicompost. Various parameters like temperature, pH and moisture content, which showed some periodic changes in the beginning were found stable in the end.

Jadhav *et al*; (2013) have reportedly developed a microbial consortium for the effective degradation of flower waste generated from temples. They collected soil samples from the areas near and around the temples and isolated bacterial cultures from them. Flower waste collected was dried and mixed with agar medium and streaking was performed with selected soil samples for isolation. It was observed that microbial consortium enhanced the digestion of the waste and the bio-manure consortium was found to have good quality without posing any harm to the environment.

Sailaja *et al*; (2013) collected flowers from temples to convert them into vermicompost. In their study, they also examined nutrient status and microbiological enumeration of vermicompost prepared. They concluded that growth rate of plants grown in vermicompost was more as compared to the respective control. Vermicomposting contains plant hormones like auxin and gibberellins and enzymes which believed to stimulate plant growth and discouraged plant pathogens. Thus, vermicompost resulted into good plant yield.

In the study conducted by Singh *et al*; (2013), management of flower waste was done by using vermicomposting technology which was then compared with kitchen waste and farm yard waste vermicompost. The physico-chemical analysis of the flower waste vermicompost showed better result in comparison to both the other waste composts. Along with it, plant growth parameters were also studied for the above mentioned vermicompost which revealed that temple waste vermicompost should enhance the growth parameters of plants.

Tiwari, (2014) carried out a research with the aim to utilize and manage floral waste obtained from ten popular temples of Jaipur city. To reduce the floral waste, vermicomposting technology was used. Marigold (floral waste) was collected, segregated and composted in earthen pots in different ratios. Various parameters like pH, temperature, moisture content, organic carbon, available phosphorus, *etc.* were evaluated for the vermicompost obtained. It was proved from the study that flowers can be very well used as substrate for vermicomposting.

In Thoothukudi, numerous dry flower industries are situated, which process flowers and export them to many countries. The waste produced from these industries contain large amount of organic waste, which mainly consists of flower waste. Silvuai and Aneeshia; (2014) worked on the making of valuable compost of this waste. They used the fungal cultures viz. *Ganoderma incidum, Pleurotus sapidus* and *Pleurot flabellatus. Pleurotus* species was found to be very effective for decomposition of waste and producing cost effective compost.

Makhanial and Upadhyay; (2015) did a study with the aim to explore the physico-chemical parameters throughout the composting of floral waste collected from various temples of Surat city. Parameters like temperature, pH, electrical conductivity, moisture content and volatile solid samples were analysed. They measured maximum temperature at 4th day of heap composting and also proved that composting is effective "zero –waste" method for treating of organic waste like flowers.

Extraction of Dyes and Essential Oils

Khan and Rehman (2005) worked on the extraction and analysis of essential oil of *Rosa* species, they evaluated various parameters like oil yield, colour and other physical and chemical properties of two different species of rose that are *Rosa demascena* and *Rosa centifolia*. They concluded from their study that there was quantitative and qualitative difference in chemical composition, aroma constituents of essential oil of two species.

Vankar *et al* ; (2009) had also reported that enormous amount of flower waste is produced in temples of India which can be utilized in making dyes for dyeing of cotton, wool and silk on industrial scale. They used (marigold) *Tagetus erecta* petals which mainly consists of carotenoids-lutein and flavonoid-patuletin, these colorants have been identified, isolated and used for dyeing textiles. Pretreatment with 1-2% of metal mordant and 5% of plant extract was found to be satisfactory and showed very good result to dye cotton, wool and silk.

A survey was conducted by Perumal *et al* (2012) in and around five temples of Chennai, Tamil Nadu to evaluate the amount of flowers offered there. Around 2350 kg of flowers were offered every day and the common flowers were rose, marigold, chrysanthemum and jasmine. Out of all flowers they collected rose petals and shade dried them to extract essential oils from them by using steam distillation process. The chemical components of rose oil were analyzed by GC-MS technique. 54 compounds were recorded out of which phenyl ethyle alcohol (23.19%) was recorded as major component followed by octadecane (10.49%), hexadecane (7.76%), phenyl ethyl decylester (5.77%) and tetra methyl trisilocen decanol (3.45%).

As the awareness among people for using natural dyes is being increased due to some toxic effects and allergic reactions associated with synthetic dyes., Teli *et al* (2013) had undertaken a study with the aim to isolate natural dyes from the flowers of hibiscus and marigold and applied them on the cotton and cotton/silk blended fabric with the help of different natural mordents like alum, harad and ferrous sulphate. They concluded that the dyes thus extracted show a very good potential to dye cotton and cotton/silk blended fabric.

Ravishankar *et al*; (2014) have reported that around 1450 tonnes of flowers are being offered to the deities in various temples all over the country.. Rose, jasmine, marigolds, chrysanthemum, hyacinth, hibiscus and

tuberose are the major flowers being offered in Indian temples. Disposal of these flowers becomes a problem when dumped without any preventive measures. Therefore, they reported a study on the utilization of flower waste by extraction of dyes and essential oils from them. For the extraction of dyes, flowers were dried and grinded and were dissolved in solvents such as ethanol, methanol and hexane. While for the extraction of essential oils, soxhelt apparatus was used. Mixture of fresh flower and suitable solvent were heated and put in soxhelt apparatus and the distilant obtained gives the desired product. They reported that the dye thus extracted gives satisfactory results and can be used on clothes.

Bio-gas generation

Shri Mahakaleshwar temple is from one of the 12 Jyotirlingas in India and produces around 3 tonnes of organic waste which mainly consist flowers. Agarwal; (2011) commenced a study to produce energy from the temple waste. He used flower and kitchen waste to produce bio gas and vermicompost from them. At Mahakaleshwar, mahakumbh takes place every 12^{th} year, therefore he tried to develop a system there to generate energy from that waste.

Kumar and Swapnavahini; (2012) had reported a study which intended to produce biogas and analyze nutrient reduction potential of rose residue by anaerobic digestion in a batch reactor. They used a 2.5 L batch reactor which was filled with rose residue and allowed for digestion for 30 days retention period at room temperature. Various parameters like Total Solids (TS), Volatile Solids (VS), Chlorides, Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD) and Total Kjedal Nitrogen (TKN) were analyzed at 5 days interval. The process could remove up-to 73%, 45%, 82%, 42%, 58% of TS, VS, chloride, BOD, TKN respectively along with the production of biogas.

Singh and Bajpai; (2012) worked on anaerobic digestion of flower waste for methane production. Gas chromatographer was the device used to determine the quality of gas produced and the experiment was conducted in cold atmospheric conditions in Lucknow. They reported that the process eliminated the pollution effects caused due to flower disposal and also removed pollutants like BOD and TS along with biogas production.

This type of work was further carried out by Ranjitha *et al*; (2014) where they used vegetable waste (brinjal, cabbage, carrot, ladies finger) & flowers waste (jasmine, sunset flower, Roselle, African wattle, Nile tulip flower, silk tree mimosa) to generate bio gas. Study was carried out in a 1L capacity anaerobic digester in a laboratory with cow dung as inoculum. The results obtained showed that flowers had given higher yield of biogas *i.e.* 16.69 g/Kg then vegetable waste *i.e.* 9.089 g/Kg and the digestion period of flowers was also less. They also concluded that flowers which are abundantly available in India are very good feed stock for biogas production and generation of bio gas from these flowers upholds the concept of waste to wealth in enhancing the sustainability.

CONCLUSION

Thus the exhaustive review of various methods of utilizing temple waste for one or the other useful product like vermicompost, biogas, dyes, incense sticks, concrete aggregate replacement etc. suggest that the temple waste can not only be disposed safely in an environmental friendly manner but can also be utilized for making diversified products. This study will propose an alternative approach to waste management since the waste will neither be land filled nor burnt but would be used as a resource that will be recycled. It will throw light on reducing volume of temple waste which would eventually generate additional revenues for temples. Floral waste utilization would eventually be beneficial to the society as people would get to live in a cleaner and a healthier environment. The “green temple concept” can prove to be helpful in Government policy formulation for waste management and in promoting sustainable development approach towards temples.

REFERENCES

- Agarwal, S. (2011) Report on demonstration of renewable energy system at Shri Mahakaleshwar Temple Complex in Ujjain. Ministry of new and renewable energy, New Delhi. 1- 4.

- Ahjawat, D. and Kalurkar,L.G.(2014)Coconut Shell as Partial Replacement of Coarse Aggregate in Concrete.*Journal of Mechanichal and Civil Engineering.*61-64.
- Arlosoroff, S. and Bartone, C. (1987) Assisting Developing Nations. *BioCycle.* **28 (6)**, 43-45.
- Gaurav, M.V. and Pathade, G.R. (2011) Production of Vermicompost from Temple Waste (Nirmalya): A Case Study. *Universal Journal of Environment and Research Technology*.**1 (2)**, 182-192.
- Jadhav, A.R., Chitanand, M.P. and Shete, H.G. (2013) Flower Waste Degradation Using Microbial Consortium. *Journal of Agriculture.* **3(5),** 1-4.
- Khan, M.A. and Rehman, S.U. (2005) Extraction and analysis of essential oil of rose species. *International journal of agriculture and biology.* **7(6),** 973-974.
- Kimenju, S.C. and De Groote, H. (2008): Consumer willingness to pay for genetically modified food in Kenya. *Agricultural Economics.* **28 (8)**, 35-46.
- Kumar, M.S. and Swapanavahini, K. (2012) Nutrient reduction and biogas production of rose residues by anaerobic digestion in a batch reactor. *International Journal of Advanced Research in Science and Technology.* **1(2)**, 125-129.
- Makhanial, M. and Upadhyay, A. (2015) Study of Flower Waste Composting to Generate Organic Nutrient. *International Journal of Innovative and Emerging Research in Engineering*. **2(1)**, 145-149.
- Mishra, N. (2013, August 17): Temple Waste, A Concern. Times of India. Retrieved from http://www. *timesofindia.indiatimes.com*
- Nagarajan, V.K., Devi, S.A., Manohari, S.P. and Santha, M.M. (2014) Experimental Study On Partial Replacement of Cement With Coconut Shell Ash in Concrete. *International Journal of Science and Research.* **(3)3**, 651-661.
- Perumal, K., Moorthy, T.A., and Savitha, J.S. (2012) Characterization of Essential Oil from Offered Temple Flowers *Rosa damascena* Mill. *Asian Journal of Experimental Biology and Sci*ence. **3 (2)**, 330-334.
- Ranjitha, J., Vijayalakshmi, S., Vijaya, K.P. and Ralph, N.P. (2014) Production of Bio-gas From Flowers and Vegetable Wastes Using Anaerobic Digeston. *International Journal of Research in Engineering and Technology.* **3(8),** 279-283.
- Ravishankar, R., Raju, A.B., Abdul, B.M., Mohpatra, A.K. and Kumar, M. (2014) Extraction of useful products from temple flower wastes. *Journal of Chemical Engineering and Research*. **2(1)**, 231-239.
- Recycling Flowers Empowers Rural Women (2013, January 13). The Hindu. Retrieved from www.thehindu.com
- Sailaja, D., Srilakshmi, P., Shehanaaz., Priyanka, H., Bharathi, D.L. and Begum, A. (2013) Prepration of Vermicompost from Temple Waste Flowers. *International Journal of Science Innovation and Discoveries.* **3(3),** 367-375.
- Shouche, S., Pandey, A. and Bhati, P. (2011) Study about the Changes in Physical Parameters during Vermicomposting of Floral Wastes. *Journal of Environment and Research.* **6(1)**, 63-68.
- Singh, S.K .and Singh, R.S. (2007) Study on Municipal Solid Waste and its Management Practices in Dhanbad–Jharia coalifield. *Indian Journal of Environmental Protection.* **18(11),** 850–852.
- Singh, P. and Bajpai, U. (2012) Anaerobic Digestion of Flower Waste for Methane Production: An Alternative Energy Source. *Environmental Progress and Sustainable Energy*. **31(4)**, 637–641.
- Siluvai, C. and Aneeshia, K. (2014) Fungal degradation of dry flower industrial waste and evaluation of dye level by HPLC. *Journal of Microbiology and Biotechnology Research.* **4(3)**, 40-50.
- Swapnavahini, K., Srinivas, T., Pinapathruni, L.K., Manjethi, S.K. and Lakhshmi, T.(2010) Feasibility Study of Anaerobic Digestion of *Ocimum sanctum* Leaf Waste Generated from *Sanctum sanctorum*. *Bioresource and Technology*. **5 (1)**, 389-396.
- Teli, M.D., Valia, S.P. and Kolambkar, D. (2013) Flower waste from temple for dyeing of cotton and cotton/silk. *Journal of the Textile Association.* 210-214.
- Tiwari, P. (2014) *Utilization and Management of Floral Waste Generated in Popular Temples of Jaipur City*: The IIS University, Jaipur.
- The Expert Committee, (2000) Manual on Municipal Solid Waste Management, The Ministry of Urban Development, The Government of India. **1(2)**, 789.
- Vankar, P.S., Sanker, R. and Wijayapala, S. (2009) Utilization of Temple Waste Flower- *Tagetus erecta* for Dyeing of Cotton, Wool, Silk on Industrial Scale. *Journal of Textile and Apparel Technology Manage.* **6(1),** 1-15.
- Yerramala ,A. and Ramachandurdu,C. (2012) Properties of Concrete with Coconut Shell as Aggregate Replacement.*International Journal of Engineering Inventions.***(1)6,**21-31.