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FLOWER WASTE FOR VALUE ADDED PRODUCTS- A REVIEW

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Abstract:

A significant rise in municipal solid waste generation has been verified globally. The conversion of biodegradable waste into various options like anaerobic digestion, composting, vermicomposting and biomass gasification are being practiced everywhere. Flower waste which is a part of biodegradable waste can be converted into various appropriate technologies to convert them into valuable products for the society. An attempt was made to study and gather the information related to various floral waste management and conversion options.

***Index Terms* – floral waste, biodegradable, conversion, information.**

I. INTRODUCTION

Waste management is one of the biggest challenges that the world faces every day. It is well known that the municipal solid waste includes household waste, commercial and market area waste, slaughter house waste, institutional waste, horticultural waste, waste from road sweeping, silt from drainage, and treated biomedical waste (Isher Judge Ahluwalia and Utkarsh Patel,2018).

The amount of MSW is expected to increase by the year 2020 due to improved industrialization (Shikha Saxena et al.,2010; Shekdar et al., 1992; and CPCB, 2004). The world cities generate about 1.3 billion tonnes of solid waste per year. This volume is expected to increase to 2.2 billion tonnes by 2025. Moreover, the municipal solid waste is classified into organic and inorganic. Low-income countries have an organic fraction of 64% compared to 28% in high-income countries (Daniel Hoornweg and Perinaz Bhada-Tata, 2012). MSW generation rates are influenced by economic development, the degree of industrialization, public habits, and local climate.

Industrialization becomes very significant for developing countries like India having large number of population. Rapid increase in urbanization and per capita income lead to high rate of municipal solid waste generation. Various study reveals that out of total solid waste, 80% can be utilized again either by recycling or reusing (Abhishek Nandan et al.2017).

Organic solid waste includes municipal and urban wastes, animal wastes, farming wastes, horticulture wastes, domestic refuses and other agro industrial wastes. In India, about 960 million tonnes of solid waste is generated annually as by-products during industrial, mining, municipal, agricultural and other processes. Further it is refined as the organic wastes from agricultures are 350 million tonnes and nearly 290 million tonnes are inorganic waste from industrial and mining sectors and 4.5 million tonnes are hazardous (Asokan Pappu et al., 2007).

These municipal solid wastes include flower wastes. In India, specifically at religious places large amount of solid waste is generated in functions, worships, ceremonies and festivals (Nisha Jain,2016). These wastes are thrown on the roadsides or on to the rivers. Degradation of floral waste is a very slow process as compared to kitchen waste degradation (Jadhav A. R. et al.,2013).

The high collection cost and waste generation rate are one of the major problems faced by the developing countries. In some cities, the organic wastes are dumped haphazardly which results in pollution and unhealthy environment. Biological processes such as vermicomposting can be followed to convert floral waste in useful organic fertilizer would be of great benefit (Shobha Shouche et al,2011). These flower wastes, instead of discarding in rivers and land, can be used for making valuable products. Thus, in the review various methods for utilization of flower wastes were discussed.

Nisha Jain,2016 carried out an experiment on vermicomposting of temple floral waste and observed its effects on soil and plant growth. The flower wastes were collected from temples which was first air dried and pre-composted for the period of about 10 days. Further, the vermicomposting process was conducted by using Eisenia foetida earth worm species in the order of 2.5 kg per square meter of composting bed. Various proportions of floral waste and cattle dung were taken for the experimental work with Group 1 as Control (Garden Soil), Group 2- 50:50: (50% flower waste + 50% cow dung+ earthworm), Group 3- 60:40: (60% flower waste + 40% cowdung + earthworms) and Group 4- 70:30: (70% flower waste +30% cow dung + earthworms). It was found that the tomato plant growth in 50:50 gave high value bio-fertilizer with maximum height 42 cm, 146 number of leaves, length of roots as 24 cm and maximum diameter of stem as 0.8cm in four weeks.

Singh.P et al, 2017, studied the extraction of valuable products from temple floral wastes and presents the natural dye recovery from various biodegradable temple and household wastes. Flower waste was collected, washed, dried and crushed. The natural colours were extracted by ultrasonication process, and dried in spray drier. These natural colours were characterized by FT-IR and UV-Vis Spectrophotometers. They were used to dye fabrics such as cotton, silk, and wool. It was found that the residue left after dye extraction, was rich in nutrients, hence, it could be further used as the resource material for vermicomposting and bio char production.

Priyanka Tiwari and Shelja K Juneja 2016, conducted experiment on vermicomposting of floral waste generated from temples of jaipur city. Different proportions of flower waste and cow dung were prepared (50:50, 60:40, 70:30, 80:20 and 90:10) and were filled in 9 earthen pots. Eisenia foetida, commonly known as red worm was used. The amount of Organic Carbon, Potassium and Phosphorus was found to be more in vermi compost and proved that flowers can be used as substrate for vermicomposting.

Jadhav A.R. et al, 2013, developed microbial consortium for degradation of flower waste. Soil sample and flower waste was collected from nearby temple. The flower wastes were dried, crushed and streaking was done. Eight bacterial isolates of different combination were prepared. Out of these, combination showing rapid degradation was selected for microbial consortium preparation. It was found that the N, P, K content in the degraded material was high and the prepared microbial consortium reduces the time to degrade large amount of flower waste rapidly.

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Ravinder Kohli and Hussain, 2016 worked on Vermicomposting process with Eudrilus eugeniae earth worm species. Portable HDPE vermi beds were used with 200 earthworms and the moisture content was maintained at 60%. At the end of 45 days of vermicomposting process, parameters like C/N ratio, pH and electrical conductivity(EC) were determined. It was found that the reduction of pH from alkaline to neutral condition, EC increased on 15^{th} day and reduced on 35^{th} and 45^{th} day of composting and C/N ratio decreases and shows enhanced mineralization efficiently.

An experimental work on anaerobic digestion of flower waste and vegetable waste for the production of biogas was done by J Ranjitha et al, 2014.The flower wastes and vegetable wastes were collected, Oven dried and powdered. Cow dung was used as an inoculum.1 L batch-type reactor was used for anaerobic digestion and different concentration of feedstock of 5%,7% and 10% were prepared. It was operated in 1:1 ratio of substrate to inoculum and the biogas generated was analyzed and observed that the rate of production of biogas from flower waste is faster than vegetable wastes.

A.S.M. Raja et al, 2012, carried out the experimental study on Extraction of Natural Dye from Saffron Flower Waste and observed that it can be used to dye pashmina fabric. The petal part of saffron flower was dried in shadow and powdered. The dye was extracted by aqueous method at boiling conditions. With two different pH of pH 4-5 and pH 7-8 with and without using mordant was dyed on pashmina fabric. Satisfactory results were found that at acidic pH without the use of mordant showed antimicrobial property against Staphylococcus aureus.

An experiment was done by Mitali Makhania and Amita upadhyay, 2015 to generate organic nutrients by flower waste composting. It mainly focused on the physio-chemical parameters during the composting process. Heap type composting method was adopted at room temperature and the parameters like Temperature, pH, Electrical Conductivity, Moisture Content, Volatile Solids were analyzed. It was found that the temperature was raised during 4-5 days and then decreased gradually. The pH decreased within 7-8 days and increased within 12 days. Minor fluctuations were observed in electrical conductivity. The moisture content increased within 7 days and then started to decrease. The volatile solids decreased significantly during 4-6 week. It was also observed that covering the heap with polythene sheet helps in fungal growth and increase in temperature.

An experimental study was carried out by M. Aslam Khan and Shoaib-Ur-Rehman (2005) on Extraction of oil from Rosa species and analysis on physical and chemical properties like oil yield, colour, refractive index, acid number and specific gravity for two different species *Rosa centifolia and Rosa damascene*. It was found that the oil yield of *Rosa demascena* is more than *Rosa centifolia* with yellow and yellowish brown colour respectively. The Refractive index and specific gravity of the oil were nearly same for both the species and the aroma constituents were present in different quantities for both the species.

Shobha Shouche et al, 2011, studied the changes in physical parameters during vermicomposting of flower wastes. Flower wastes were chopped to finer pieces and different proportions of flower waste and cattle dung was filled in plastic bins. Variation of parameters like moisture content, temperature and pH were observed. It was concluded from the study that the parameters changed in the beginning and it became constant at the end of composting.

Vermi compost of flower waste was experimented by Sailaja, P et al, 2013 where the flowers were dried and powdered. Different proportions of flower powder and coal powder were mixed within the soil.100 to 200 worms were added and maintained 40-50% of moisture, pH of 6.3 to 7.5, and a temperature of 20-30 degree Celsius. It was observed that vermicomposting proved the enhanced germination, plant growth and crop yield. Addition of cattle dung improved soil structure, soil moisture holding capacity, possibility of seed bed preparation for root growth, vegetative growth and crop yield. It was concluded that vermicomposting with cattle dung showed high yield of plants.

Nilesh U. Jadhao and Suresh P. Rathod, 2013 carried out an extraction process of patuletin dye from French marigold flower and observed that it has antioxidant properties. It was found that the extracted patuletin dye showed good antioxidant properties in sulphuric acid medium, nitric acid medium and in hydrochloric acid medium and concluded that patuletin dye has no hazardous effect, easily degradable, pollution free and used in antioxidant treatment.

Prasad V et al ,2011 conducted a study to utilize flower waste for the production of biogas by anaerobic decomposition. The flower waste was made to fine paste. Three lab scale anaerobic digester model were used with proportions (5%,10%,12.5%) of flower waste and cow dung as inoculum. pH, temperature, retention time, moisture Content and C/N were kept in control during the process. The production of biogas was achieved in 10 days and the pressure of biogas was $0.44 kg/cm^2$.

M. Sumanth Kumar and K.Swapnavahini, 2012 worked on production of biogas and nutrient reduction potential from rose residue by anaerobic digestion in a laboratory scale digester of 2.5 L capacity in which the rose residue was fed and digested for a retention period of 30 days. Parameters such as total solids (TS), volatile solids (VS), chlorides, Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total Kjeldhal Nitrogen (TKN) were analyzed and found that the process removed up to 73%, 45%, 82%, 42%, 58% of TS, VS, chlorides, BOD, TKN respectively, along with biogas production. It was also reported that the gas production was reduced and this may be due to pickling of the reactor.

An experiment by Akanksha Singh et al, 2013 was carried out by using vermi technology method and studied its impact on seed germination and plant growth parameters and compared with kitchen waste and farmyard waste vermi compost. Eisenia foetida worms were used and the worm biomass at 40 and 120 days was maximum in temple floral waste vermi compost as compared to kitchen waste and farmyard waste vermi compost. It was concluded that the temple waste vermi compost exhibits good seed germination, plant growth and better seedling growth of chickpea at lower concentration as compared to kitchen waste and farmyard waste vermi compost.

Padma S.Vankar et al, 2009 used temple flower waste to dye cotton,wool and silk on industrial scale. Here Tagetus erecta flower was used which mainly consists of carotenoid-lutein and flavonoid-patuletin. It was found that innovative dyeing showed good result on textiles. Pretreatment with 1-2 % metal mordant and 5 % of plant extract showed good fastness properties in cotton,wool and silk.

M.B.Kulkarni and P.M.Ghanegaonkar, 2018 used different techniques like novel alkaline pretreatment, solar heating of the digester and co-digestion with food waste and flower wastes. It was found that the biogas yield increased by 106% in novel alkaline pretreatment using sodium carbonate and sodium bicarbonate. Solar heating of the digester increases the biogas output by 122%. Co-digestion of the floral waste with food waste developed the biogas output by 32.6% and at the same time, raw biogas from floral waste showed 57% methane.

Kamran Javed Naquvi et al ,2013 analyzed the volatile oil obtained by hydro distillation of the petals of Rosa damascena Mill using gas chromatography and gas chromatography/mass spectrometry method. It was observed that variation occurs in hexacosane, octacosane, octadecanol, nonadecane, patchouli alcohol and t-cadinol. The variation of oils depends on their genetic variations, geography, time of collection, stages of plant growth and seasonal and environmental factors.

CONCLUSION

Through various literature reviews, it was observed that the exploitation of the floral waste from temples and flower markets can be converted into valuable products. Floral waste has to be disposed safely and at the same time, it may be converted into more valuable and varied forms. However, the conversion of floral waste into manure through vermicomposting process will be a viable one. Awareness on floral waste into manure to the entrepreneurs and flower vendors will reduce the heap of floral waste load in the society.

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