

Waste Utilization in Flower Crops

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Floriculture has been associated with culture and heritage since very ancient time in our country. According to Tata Energy Research Institute (TERI), the waste generation rate in India is increasing at the rate of 1.0 -1.33 per cent annually. In most of the developing countries like India, the floral waste generation occurs largely during worships, festivals, ceremonies etc. from temples, mosque, flower market, flower exhibition and wedding halls find their way into the garbage as a waste causing various environmental problems. Hence proper and eco-friendly process for floral waste treatment are required. Some flower merchants dump flower wastes in the street which might lead to outbreak of serve endemic diseases as the garbage attracts pests. During rainy season, the condition becomes worse with mosquitoes and flies breeding on the waste. Also there is a serious issue of the leachate production from the flower waste, which ultimately if mixed with river water or well water will cause health issues. Hence the management of floral waste should be done by converting them into wealth, i.e., many value-added products

Methods for proper disposal of flower wastes

There are some standard disposal and treatment options, land filling; incineration which is controlled combustion of waste materials to a non-combustible residue or ash and exhaust gases. In USA and Europe, incineration is preferred for many organic hazardous and toxic waste streams. In land treatment final state of the waste is disposed by making intimate contact with the soil. The land treatment exploits the natural capacity of the soil to return substances to a condition forthcoming the unique state from which they were won by a process of extraction and purification. Volatilization method is also used for the treatment and disposal of wastes. It is effective for the removal of volatile compounds from soil by using commercial units that heat up the soil to between 100 and 500 A C

Problems due to improper disposal of floral waste

In developing countries, the increasing rate of waste generation and their high collection cost are creating problems (Wijayapala, 2013). In India, approximately 8,000,000 t of flower waste are dumped into rivers each year, choking them to death. Pesticides and chemical fertilizers used in cultivation mix with river water, making it highly toxic and polluting soil fertility, lowering the land's aesthetic value. Toxic gases are released into the atmosphere when waste flowers are not completely burned. The floral waste generated gives a filthy look to the streets and roads and also distorts the image of ghats along the rivers.

Approaches in utilization of Flower Wastes

Vermicomposting

This method can be successfully utilized in temples as a solid waste management strategy with flowers as the major organic waste which will help by reducing volume of temple waste and at the same time generate additional revenue for the temples and can also be used as an alternative to chemical fertilizers to enhance the growth and yield of various plants (Sailaja *et al.*, 2013).

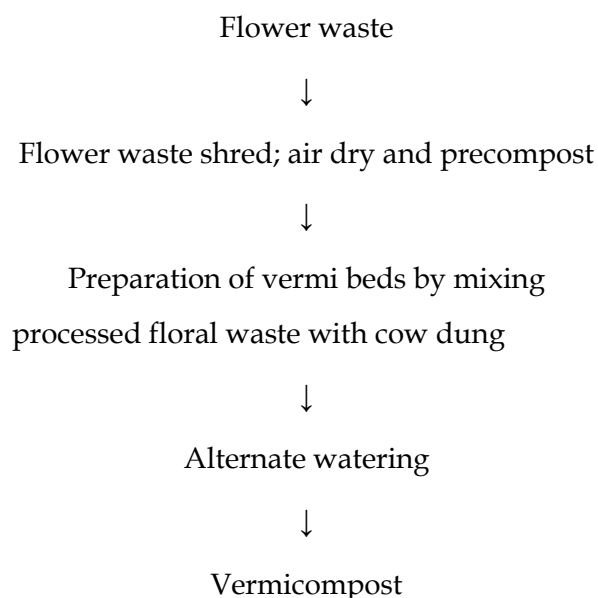


Fig 1: Flow sheet showing vermicompost from the floral waste

Bio-gas generation

When compared to other waste treatment technologies, anaerobic digestion has the following advantages: low sludge output, cheap cost, great energy efficiency, and process simplicity. Furthermore, because it combines waste stabilisation with net fuel generation and permits the effluent to be used as fertilizer and also for electricity generation, it has a beneficial environmental impact (Patel and Madamwar, 2001).

Natural Dye

Due to the harmful effects and allergic reactions connected with synthetic dyes, people are becoming more aware of the benefits of utilizing natural dyes. Teli *et al.*, (2013) studied to isolate natural dyes from hibiscus and marigold flowers and with the help of different natural mordents like alum, harad and ferrous sulphate showed a very good potential to dye on cotton and cotton/silk blended fabric. Because of their eco friendliness, low cost of manufacturing and easy waste management, natural dyes derived from rose residue have a wide range of commercial applications in dye-sensitized solar cells (Eren *et al.*, 2015)

Essential Oil

The flowers which were offered to deities in temples were available around 1450 tonnes as temple waste among this rose recorded as 50%. Steam distillation was used to obtain rose oil (0.14 %) from the offered temple flower *Rosa damascene*

Incense Sticks and Rose Water

Through the use of science and technology, the 'Mission Sakshama' initiative, established by CSIR's flagship institute Central Institute of Medicinal and Aromatic Plants (CIMAP), Lucknow, has opened the way to empower rural women in Lucknow while simultaneously mitigating pollution in the area. In Ajmer, with technical assistance from CIMAP, the Sharif Dargah committee has installed a rose water distillation plant at the outskirts of Ajmer to extract rose water from offered flowers (Indian Express, May, 2010). Incense sticks are made from flowers such as genda (*Tagetes*).

Biosorption

Studies Heavy metals are extensively used in industries like batteries, electroplating, steel works, paint pigments, electrical accumulators etc. These metals are generally disposed of in water because they cannot be degraded biologically into innocuous compounds. Biosorption is a promising method for removing heavy metal ions that makes use of lowcost biosorbents

Floral waste used in biosorption experiments (Waghmode *et al.*, 2018)

Source	Application	Bibliography
Red Rose	Biosorption of Co(II) and Pb(II)	HAQ <i>et al.</i> (2011)
Carnation, Daisy and Rose	Biosorption of acid blue 9	EchavarriaAlvarez and Hormaza Anaguano (2014)
Biomass derived after color extraction of Hibiscus, Portulaca and Canna	Removal of chromium from aqueous phase	Vankar <i>et al.</i> (2010)

Organic Acids, Dyes and Pigments

In India, major raw material for oxalic acid is sugarcane. In view of the occurrence of more sugar in mahua flowers, it constitutes an alternate potential to oxalic acid production. Oxalic acid is largely used as a preservative and chelating agent. There is a report where marigold, Saffron, Hibiscus and rose flowers have been used for the preparation of dyes. Biodegradable dyes have emerged as important alternative to synthetic dyes. The main advantage of floral dyes is that they are very eco-friendly and have no allergic action on skin. Also, flowers are cultivated widely; easily available and inexpensive, which facilitates their use for dyeing paper at the level of small and medium enterprises as well as larger commercial scale. Flowers have colours due to Carotenoids, Betalains and Anthocyanins pigments. Extract of marigold flowers is used commercially as an additive to poultry feed to improve the bird and egg yolk pigmentation Carotenoids, in particular the xanthophylls, Lutein and Zeaxanthin are the

compounds of interest in the marigold flower extract for poultry pigmentation. There is a report on utilization of waste flower *Tagetes erecta* for dyeing of cotton, wool and silk on industrial scale

Conclusion

Therefore, the collection and utilization of floral waste from different sources are reducing the ill effect on environment and also they are used for production of several value added products which are ecofriendly, sustainable alternative form of using waste is making compost and incense sticks which are mostly preferred, easy choice and also shows a new path for income generation and employment opportunity.

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