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Experimental Analysis of Biodegradable Temple Waste for the Recycle and Reuse

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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.

KEYWORD:-Floral Waste, Vermicomposting, Incense Sticks.

I. INTRODUCTION

Civilization began & developed around river banks. Things were manageable at those times as people lived in harmony with nature. Industrialization changed everything. At the end of the 19th century the industrial revolution saw the rise of the world of consumers. Concentrated population packets developed at and around industrial area. Rapid Urbanization process posed many challenges before planning authorities. Government, local administration tried & is trying their level best to provide all basic amenities to this population. While doing so, one difficult challenge before administration is to manage waste generated by this large population. Solid waste generation is a continually growing problem at global, regional and local levels.

Solid wastes are those organic and inorganic waste materials produced by various activities of the society, which have lost their value to the first user. Improper disposal of solid wastes pollutes all the vital components of the living environment (i.e., air, land and water) at local and global levels. The problem is more acute in developing nations than in developed nations, as their economic growth as well as urbanization is more rapid. There has been a significant increase in SWM (municipal solid waste) generation in India in the last few decades. This is largely because of rapid population growth and economic development in the country. Due to rapid growth of urban population, as well as constraint in resources, the management of solid waste poses a difficult and complex problem for the society and its improper management gravely affects the public health and degrades environment. The population of Nagpur grew from around 40.68 lakh in 2001 to 46.54 lakh in 2011, registering a growth of around 14.39 %. On the other hand, SWM generated in the city increased from 1100 tonnes per day to 1200 tonnes per day in the same period registering a growth of around 67% (CPCB 2000).

Solid waste can be defined as any solid or semi-solid substance or object resulting from human or animal activities, discarded as useless or unwanted. It is an extremely mixed mass of wastes, which may originate from household,

commercial, industrial or agricultural activities. Solid waste is a broad term, which encompasses all kinds of waste such as Municipal Solid Waste (SWM), Industrial Waste (IW), Hazardous Waste (HW), Bio-Medical Waste (BMW) and Electronic waste (E-waste) depending on their source & composition. It consists of organic and inorganic constituents which may or may not be biodegradable. On one hand, the recyclable components of solid waste could be useful as secondary resource for production processes. On the other hand, some of its toxic and harmful constituents may pose a danger if not handled properly. Source reduction, recycling and composting, waste-to-energy conversion facilities, and land filling are the four basic approaches to waste management.

The 21st century has been called the "Century of the Environment" with the current society facing the adverse effects caused by climate change, itself a product of global warming and increased environmental pollution. A healthy and sustainable future is expected to be constructed by proper policies, education, innovation in Green technology, and compatible relationships between the Governmental and Industrial sectors of a country. Waste management is the most debatable issue in the globalized field of research, a trend that seeks the most outcome.

While examples of domestic, organic, temple, and agricultural wastes such as rotten fruits, peels from vegetable processing, flower trimming, agriculture residue, etc. are biodegradable, if not managed properly, it causes severe nuisance like water and land pollution through its decomposition and nutrient leaching. The appropriate management of such waste could provide as resource materials for a range of processes in industries like biochar from agricultural waste color extract from domestic and temple waste. This waste could serve as a source for the extraction of natural dyes for textile-dyeing operations and biochar based fertilizers.

II. AIM AND OBJECTIVE

Utilization of temple floral waste for extraction of valuable products.

Survey of selected popular temples of Nagpur city to gather information about the waste generated and the methods of disposal used.

- └ Quantification and estimation of the proportion of biodegradable and non-biodegradable waste generated in the selected temples
- └ Segregation of the floral waste generated in the temples in the city.
- └ Proximate analysis of the segregated floral waste.
- └ Development of a simple method of recycling the floral waste for making handmade paper.
- └ Optimization of pulping procedure for floral waste.
- └ Physicochemical analysis of the effluents generated during the process of paper making.
- └ Proposal of alternative eco-friendly methods for waste disposal in temples to promote "Green Temple Concept" so as to prevent the un-ecofriendly methods of waste disposal at temples.

III. MATERIALS AND METHOD

MATERIALS :-Marigold, Rose, lily etc. Incense Sticks

PLACE OF COLLECTING WASTE :-Ganesh Tekadi Temple Nagpur And TajbaghTaj Baba Dargah Nagpur

IV. METHOD

Marigold flower, Rose, lily, waste was collected from various temples of Nagpur, India (Tajbagh, Taj Baba Dargah & Ganesh Tekadi Nagpur). All other chemical, used in this study, were in analytical grade, purchased from Merck Chemicals India. In order to get dye powder from the extract spray driers were used.

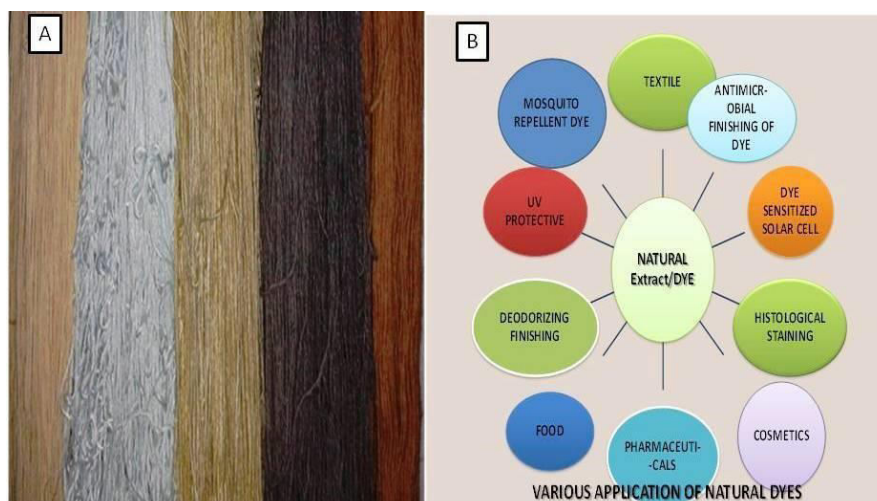


Fig. 3.1.(A) Coloured fabric from the extracted dye, (B) Various applications of natural dye.



Fig. 3.2. (A) Extract of natural colorant from waste marigold flowers, (B) Floral waste from a temple

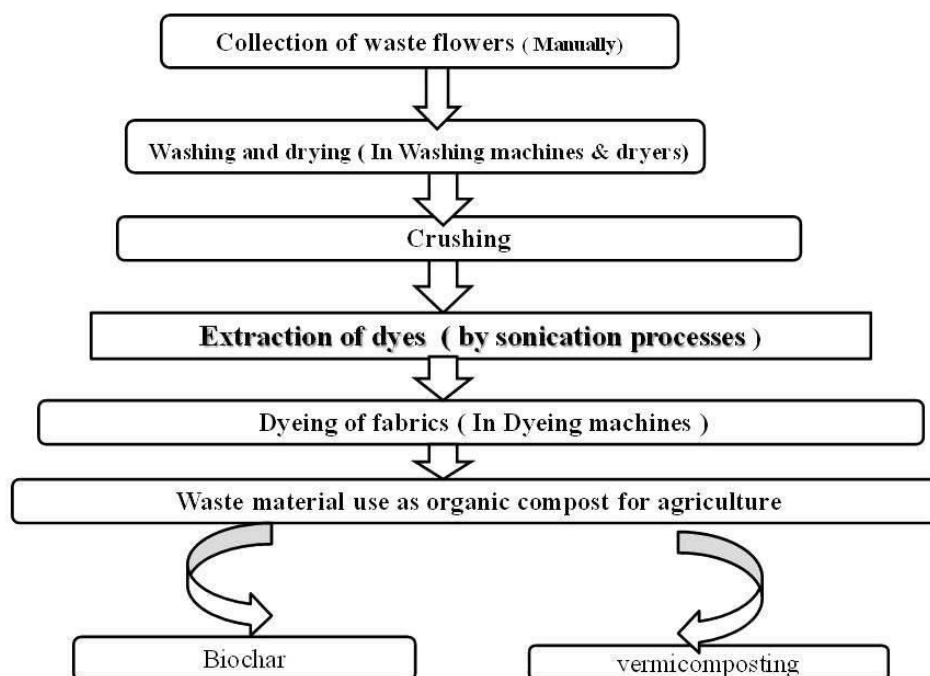


Fig. 3.3. Illustrative representation of sustainable utilization of floral and vegetable wastes

Collection of waste flowers

Marigold flowers, and other flower types like rose, lil, etc. were collected from “TAJBAGH TAJ BABA DARGAH AND GANESH TEKADI NAGPUR” temple waste bins. The collected materials were segregated and the flowers were washed and dried in a hot air dryer at 50°C. Other materials such as plant leaves are typically used to prepare biochar and compost, along with the waste, released from extraction. Figure 3.2 shows the whole process.

Characterization of waste

The total waste will be characterized into bio-degradable and non-biodegradable waste, the degradable portion will further be characterized into flowers, cotton, food items, incense sticks *etc.*

Segregation of flowers

Non-biodegradable part will be removed and flowers will be segregated from the biodegradable waste.

Significance of the study

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.

Sustainable technology like handmade paper making can be successfully applied in temples and help for safe disposal of the floral wastes and hence promote zero waste management.

Handmade paper formed could be used for making of hand bags, envelopes, cards *etc.*

The study 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.

V. RESULT

UV-V is spectrum of natural dye from marigold (segregated from temple waste) flower was obtained and analysed at the wavelength of 370 nm by AU-2701 double beam UV-VIS Spectrophotometer



Colorant extraction Ultrasonic assisted extraction : Solvent extraction

In colour extraction process, various techniques have been used such as soxlet extraction as stated in earlier reported literatures. However, we used ultrasonic assisted extraction: The flowers were crushed in the crusher. Methanol (10 ml/g of crushed materials) was added in the crushed flower petals and then the pH was adjusted at 2.0 by using diluted NaOH and/or HCL to attain maximum colour extraction (Mishra , 2012). The beaker was then placed in the ultrasonic bath to be sonicated for 40 min. After sonication, the beaker's content got filtered through various sieves so that the solid materials would be removed. The filtrate colour liquid was vacuum-evaporated in a rotary vacuum, maintaining only half of its original volume. The concentrated liquid was spray dried. The inlet and outlet temperature were kept at 110 and 70°C, respectively at an aspiration speed of 1200 rpm (Mishra et al., 2012;

Gravimetric analysis

After spray drying process, the samples were taken and dried in hot air oven for 10–15 min to remove the moisture, then to be cooled in desiccator and weighted so that the extract's weight could be determined. The weight of the colorant extract obtained per gram of the plant materials was calculated. As for the yield,

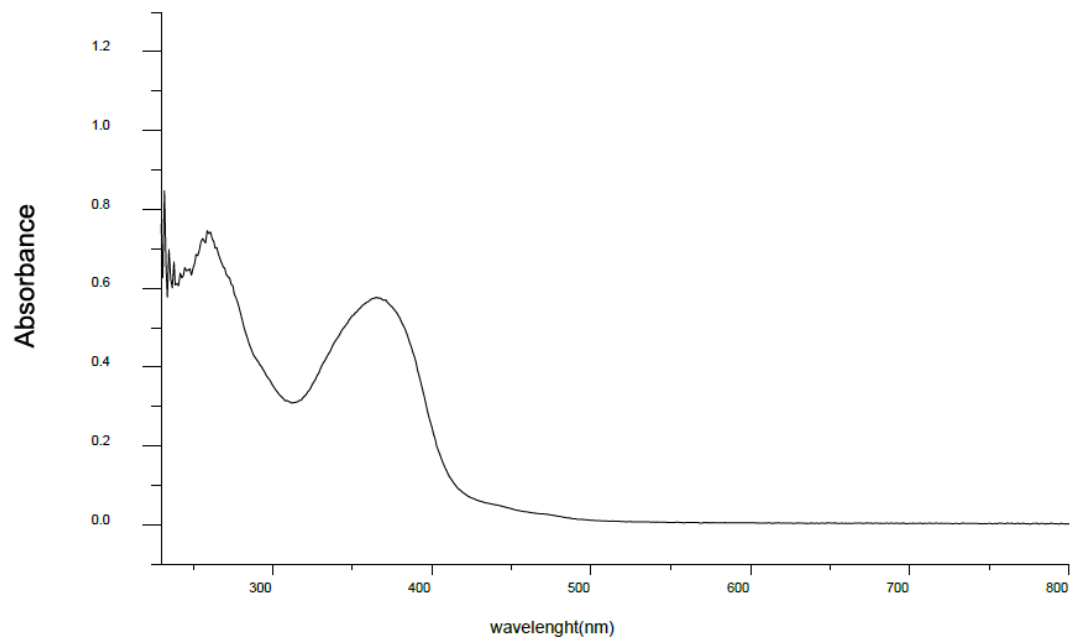
Characterization and Analysis of colour

The colours, extracted via ultra-sonication processes, were further characterized by UV–Visible adsorption spectra, recorded on double beam spectrophotometer (SYSTRONICS AU-2701 double beam UVVIS Spectrophotometer) ranging between 220-800 nm (Fig. 4). The FT-IR spectra (Thermo NICOLET 5700, USA) of the dye were obtained by means of KBr pellet method in a spectral range of 4000-500 cm⁻¹ (Fig. 4.1). The fastness property of the dyed fibres was measured with the test method ISO 105-X for colour fastness to rubbing: ISO 105 CO2 for colour fastness to washing and ISO 104-B02 for colour fastness to light (Mishra , 2012; Tiwari , 2010 ; Gurav and Pathade, 2010).

FT-IR analysis gives important characterizations of the samples in order to identify the functional group on the marigold extract's dye surface. In the dye analysis, the distinct peaks were revealed at 3355, 2926, 1655, 1379, 1076, and 514 cm⁻¹ (Fig. 4). The broad and strong peak, located at 3355 cm⁻¹, indicates the presence of aliphatic C-H stretching from CH₂- group. The O-H stretching vibration can be assigned to the band that appears at 2926 cm⁻¹ (Mishra 2012).

Dyeing Processes

The wool yarns were washed with 1% nonionic soap at 50°C for 20 minutes and then the fibre was washed with water and dried at normal temperature. For moderating purposes, alum and sodium-potassium were used, as described by Mishra (2011). The dye solution got prepared with M:L ratio, being equal to 1:15, and pH=6.0, the latter adjusted by diluted acetic acid. A sum of 5 g of the prepared fibre was used with mordant and the temperature was raised to 90°C and continued for 30 min. After the dyeing process, the fibre was washed with cold water and non-ionic soap show the dyeing processes.



4.1. UV-Vis spectra of Marigold dye at 370 nm

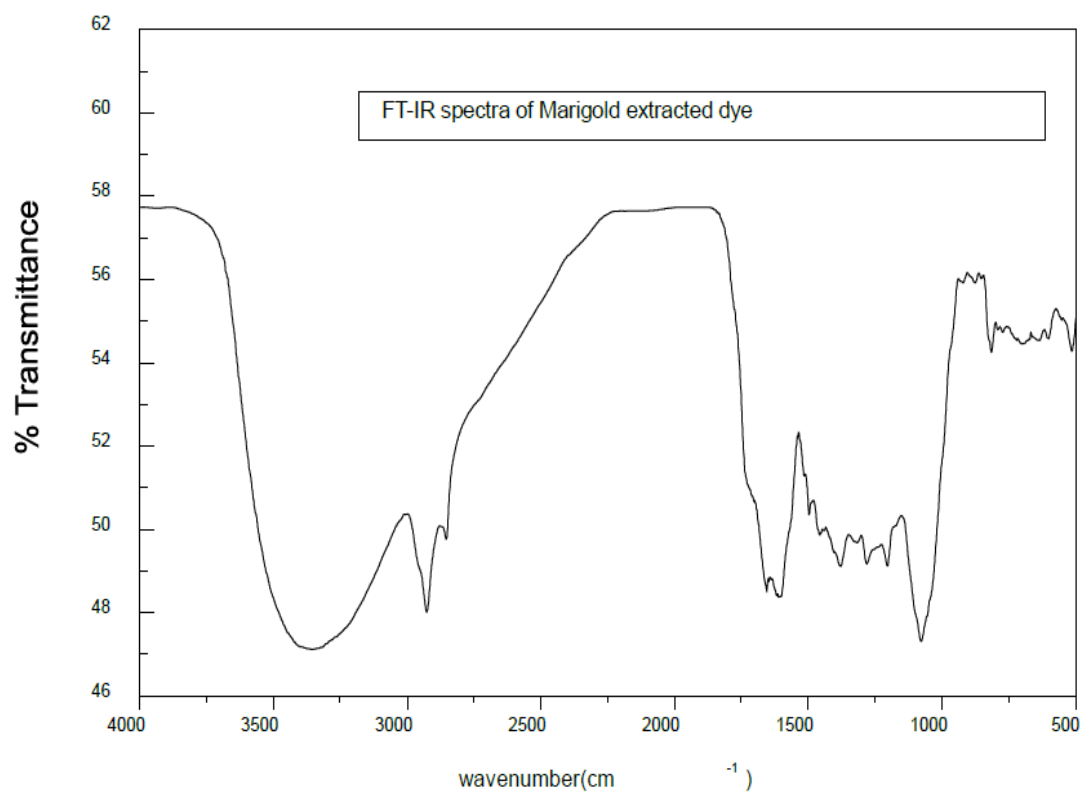


Fig. 4.2. FT-IR spectra of marigold extracted dye

VI. CONCLUSION

The present study has shown the potentiality of temple floral waste for extracting various valuable products. Natural colour, extracted from floral waste, can be used to dye fabric at an industrial scale. The waste, generated after colour extraction, is also a potential source for vermicomposting and can be further used as a fertilizer in crop fields. We have also proposed bio-char synthesis via pyrolysis process of floral waste, which can be used for various applications such as soil amelioration being an adsorbent for the removal of pollutants from waste water (i.e. dye, heavy metals, and other organic compound). Due to their high organic content, temple wastes mixed with kitchen one can be used to generate biogas. This study also presented the complete recycling and total utilization of floral waste in diverse sectors, ranging from agriculture to dye industries and finally in waste water treatment application. Considering the hazardous impact of improper waste disposal on the environment, the present study aimed to extract valuable natural dye at industrial scale, thus properly managing the wastes, regarding it as a source of wealth which by means of total recycling leads to environmental sustainability.

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