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DEGRADATION OF FLOWER WASTE USING MICROBIAL CONSORTIUM: AN APPROACH TOWARDS ENVIRONMENTAL SUSTAINABILITY AND WASTE MANAGEMENT

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ABSTRACT

India is one of the largest flower producing countries in the world. According to the estimates of the national horticulture board, in 2021-2022 the production is 341.63 million tonnes across the country and according to the statistics, floral waste is one of India's biggest pollution, accounting for nearly a third of all solid waste in the country. Floral waste degradation is an extremely slow process compare to degradation of kitchen waste, thus no suitable modes for disposal of this significant organic solid waste. In nature microorganisms do not live isolated, they co-exist with microorganisms establishing relationship that makes the highly complex organic compounds into simpler forms. The present study was taken to develop efficient microbial consortium to degrade the flower waste. Soil samples were collected from different places in which the flower waste were dumped. The isolation and screening of microbes that are capable of degrading the flower waste is performed with the help of flower extract media. A flower-based media was used to develop a microbial consortium for degrading flower waste instead of conventional microbial media. The different enzymatic test was performed to find out the enzymes produced by the organisms to degrade the flower waste. One chamber was created with inoculation of the microbial consortium along with flower waste and another chamber with flower waste without the microbes. Degradation was checked at different time intervals and it showed that the microbial consortium helped in degrading a large amount of flower waste faster.

KEYWORDS: Flower waste, degradation, flower based media, microbial consortium.

1. INTRODUCTION

Waste is described as undesired, useless stuff that is thought of as being of no utility. The primary problem of society is waste disposal. If it is not disposed of correctly, the ecosystem will suffer. Different sources of trash creation include industrial, commercial, agricultural, and household. India is one of the top countries in the world for flower production. Floral waste is one of India's greatest sources of pollution, There are several sources that produce floral waste, including temple garbage, wedding ceremonies, hotels, and a variety of other cultural and religious ceremonies. Every day, flowers used in ceremonies or rituals or presented as offerings to deities go wasted or are thrown away, becoming a significant portion of municipal solid waste (Singh *et al*., 2013). making up over a third of the nation's solid waste, according to data and the national horticulture board's forecasts for 2021–2022. The production is expected to be 341.63 million tonnes nationwide. Water contamination results from the majority of this floral waste being ignored and dumped into bodies of water. When compared to the breakdown of kitchen waste, the degradation of floral waste is a relatively sluggish process (Jadhav *et al.*, 2013). By taking this into account, we tried to create microbial consortiums with the capacity to breakdown floral waste.

2. MATERIALS AND METHODS

2.1 SAMPLE COLLECTION

Floral waste was collected from various places,where the flowers are dumped. The collected floral waste was brought to laboratory in polythene bags. In the collected floral waste, all the non biodegradable parts were removed and only biodegradable parts were used. Soil samples were also collected from above mentioned areas for isolation of microorganisms capable of degrading the floral waste.

2.2 EXTRACT FROM FLOWER WASTE

After collecting floral debris from various places, the non-biodegradable components, such as plastic, paper, thread, and other waste materials, were manually sorted out, and the biodegradable components, such as garlands and flowers, were separated,then 10g of flower waste was soaked in 100ml of distilled water for 48 hours, then the muslin cloth was used to filter the mixture. The filter that was produced was referred to as a flower extract.

2.3 PREPARATION OF FLOWER BASED MEDIA

Original pH of the floral extract was 4.7, being too acidic, it was not suitable for cultivation of common microbes, so pH was adjusted to 7.2 in order to support the growth of bacteria respectively. For solidification of media, 3.0 g/ 100 ml of agar powder was added in the floral extract, followed by media sterilization at 15psi 121^{0}C for 30 minutes (Yogini Mulay *et al*., 2020).

2.4 SCREENING OF FLOWER WASTE DEGRADING MICROORGANISM

The soil that was collected from various areas were serially diluted and was spread on the flower based media and was incubated at 37^0 C for 24 hours, different types of colonies were observed on the plate. After the colonies were formed to know the nature of the isolates gram staining was performed.

2.5 HYDROLYTIC ENZYME SCREENING AND ASSAY FROM ISOLATES GROWN ON FLORAL WASTE AGAR

Each isolate's capacity to generate various hydrolytic enzymes was examined. To determine the activity of amylase, cellulase, protease, chitinase, and pectinase, all of the isolates were grown on the appropriate substrate (1%, w/v, starch, cellulose, casein, colloidal chitin & pectin) on an agar plate. After 5 days, the plates were examined to look for enzyme activity. The establishment of a halo zone around the colony on starch agar after adding gram's iodine indicates a positive amylase test. After adding 0.1% Congo red and 1M NaCl solution, cellulase activity could be seen. Isolates that are protease positive display the establishment of a halo surrounding the colony. Colloidal chitin agar was used to measure the activity of chitinase. By adding iodine solution to pectin plates, pectinase positive bacteria were found. (Naif *et al*., 2019).

2.6 DEVELOPMENT OF CONSORTIA

Four bacterial isolates were created into a combination and utilised to decompose floral waste. A loopful microbes was inoculated in broth made from floral waste using 24-hour-old bacterial cultures. 48 hours of incubation at 28ºC. After using this mix culture as a consortium, 25% (v/w) of this consortium was put to the floral waste as inoculums (Pindi and Satyanarayana, 2012).

2.7 DESIGNING OF DEGRADATION CHAMBER

All organic wastes in the form of flowers were gathered. Flowers disintegrate quickly, therefore they don't need to be cut into extremely little pieces. Two chambers with measurements of 10.5 x 10 x 5.5 cm were chosen. Then, to maintain aerobic conditions, a first layer of 2 cm thick coconut coir was created at the bottom of the chambers. Garden soil (2 cm) was used to cover the coconut coir layer. Utilizing floral waste mixed with 20% consortium, the third layer was created. Alternative soil and flower waste layers that had been mixed with consortium. Using floral waste and the same process, a second chamber was created as a control chamber. (Boraste A. *et al*., 2009; Gurav M. V. *et al*., 2011).

3. RESULTS AND DISCUSSION

For the consortium combinations, four distinct colonies grown on flower waste media were chosen. The preparation of the consortium was chosen from a combination of four isolates that grew quickly on flower based medium. Degradation of floral waste can be effectively caused by a few specific bacteria. To make floral extract, flower debris was gathered and employed. Diluted soil sample was applied to flower waste agar medium fig1, which had been made using floral waste extract. Plates were examined for colony presence after being incubated at 28^0 C. Four isolates were chosen for the creation of microbial consortia and

screening of the microorganism was done, by performing gram staining and hydrolytic enzyme screening was done that is mentioned in table 1. With this result we concluded that the selected isolates have the potential to degrade organic biomass present in the floral waste with the help of hydrolytic enzyme. This hydrolytic enzyme helps in the formation of compost as they convert complex organic matter in to simpler one kind of study was carried out by Gopinath *et al*., (2014) in order to explore the potential of consortium for effect degradation of organic waste. Degradation chamber was created (fig 2) one with the microorganism and another without the microorganism. Measurement of the chamber was recorded everyday to know how fast the degradation is done with the microbes that indicates in Table 2. A graphical representation shows the flower degradation effective is faster with the microbes.

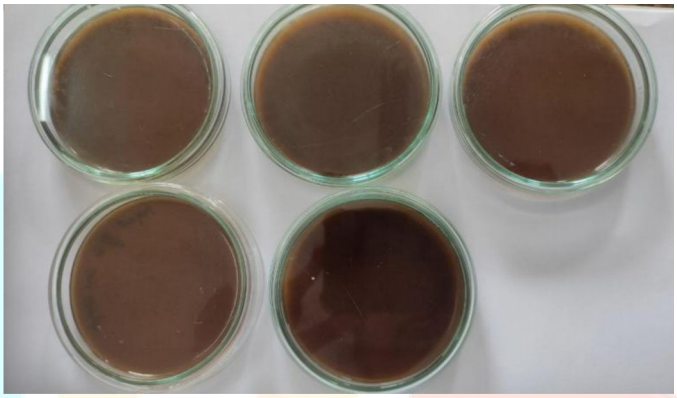


Fig: 1 Growth of microbial isolates on media prepared by using floral extract (Dilution plates - 10^{-2}, 10^{-3}, 10^{-4}, 10^{-5} & control plates)

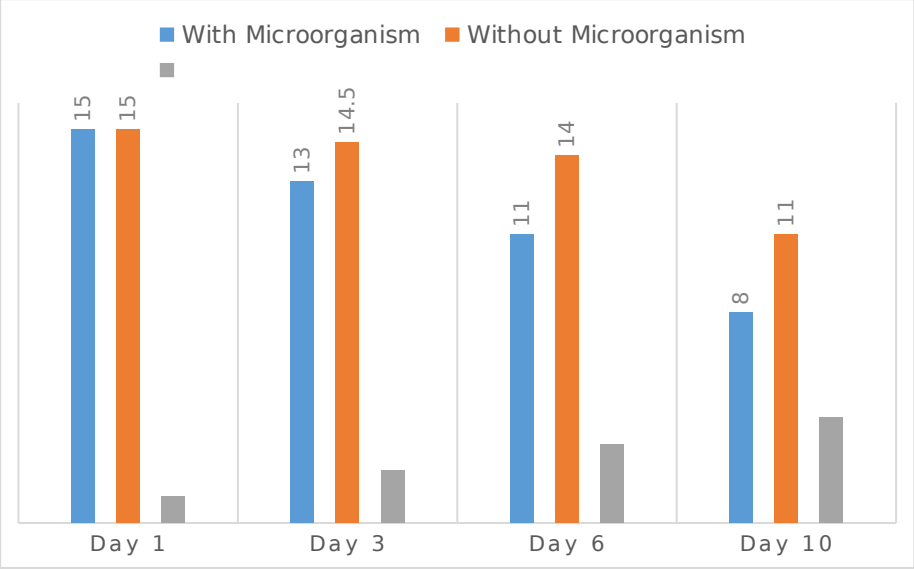
Table:1 Screening of microbes and hydrolytic enzymes

SL.NO	Isolates	Grams nature	Morphology	Hydrolytic enzyme screening
01	Isolate 1	Gram positive	Long rods	Pectin
02	Isolate 2	Gram positive	rods	Pectin
03	Isolate 3	Gram positive	Long and slender rods	Casein
04	Isolate 4	Gram positive	Cocci and clusters	Cellulose

Fig: 2 Flower waste degradation chamber

Table: 2 Flower waste degrading chamber

Day	Chamber with Microorganism (in cm)	Chamber without Microorganisms (in cm)
01	15	15
02	14	15
03	13	14.5
04	12	14.5
05	11	14
06	11	14
07	10	13
08	9.5	12
09	9	11
10	8	11



Graph 1 shows the flower degradation

4. CONCLUSION

Flower waste is one of the major pollution in our country, so this attempt to degrade the flower waste faster with the help of the microbial consortium, this method of degrading the waste is pollution free, eco friendly and cost effective method to degrade floral waste. Thus it can be promoted as potential mechanism to maintain the environmental sustainability at wider scales.

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