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Original Research Paper

Microbiological Media from Temple Waste: An Ecofriendly Approach of Waste Management

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ABSTRACT

The temple wastes consist of vegetable material (mainly flowers, leaves, fruits, sugar, jaggery, etc.), milk and milk products, grains and water most of which are biodegradable and contain elements required for growth of microorganisms. Temple wastes are released in water bodies or dumped on the available places of land creating severe environmental pollution and health hazards, hence, it was thought to attempt use temple waste for preparation of microbiological media to cultivate common microorganisms in the microbiological laboratories. In the present study, temple waste extract was used to prepare microbiological nutrient media for cultivation of common bacteria (at pH 7.4 of medium) like *Bacillus subtilis, Bacillus megaterium* and *Staphylococcus aureus,* and fungi (at pH 5.4 of medium) like *Aspergillus niger, Penicillium chrysogenum* (molds), *Saccharomyces cerevisiae* and *Torulla* (yeasts). For bacteria, the standard control medium used for comparison was nutrient agar, while for fungi it was Sabouraud's agar. The results were highly encouraging where more luxuriant growth of both bacteria and fungi was obtained on the temple waste microbiological media in comparison to standard controlled media. Thus, temple waste based microbiological nutrient media can be used to cultivate common microorganisms, which will be highly economical as compared to costly standard and commercial microbiological media.

INTRODUCTION

According to customs in different religions, worship of deity includes use of various materials like flowers, leaves, fruits and also food items such as milk, honey, curd, ghee, oil, sugar, jaggery and different cereals, etc. (Table 1).

All this material offered to the deity during daily worship becomes 'Nirmalya' next day, which is then disposed off in natural water bodies (Fig. 1) or on land. During good old days, when human population was limited and there were few temples in cities, this practice of disposal of small quantity of the temple waste in river or lakes created insignificant pollution. In fact, it was good means for providing food to beneficial aquatic animals. Today, however, increased human population and number of temples in cities with trend of collective worships rather than domestic activity, has caused generation and accumulation of massive quantities of temple waste every day. Disposal of such waste in natural water bodies along with disposal of domestic and industrial sewage has caused tremendous pollution of water bodies in and around the cities in India.

Hence, there is a need to create awareness about temple waste disposal in the mind of common man. There is a need of communication by expert persons to deal this problem by keeping all the human ethics and feeling unchanged to solve this problem through ecofriendly ways.

The practice of disposal of temple waste directly into rivers or lakes can be stopped by developing ecofriendly and ecological alternative ways such as composting, vermicomposting, biogas generation, etc. In the present study, an innovative way was attempted to use this waste for the production of general microbiological growth media. The temple wastes contain almost all the nutrient requirements of microbiological media (Table 2). General media produced using above waste are found to be cost effective, and can drastically reduce expenses in the laboratory in cultivation of common bacteria and fungi.

MATERIALS AND METHODS

The methods followed in the study were of Deshmukh (2001), Cruickshank et al. (1975), Booth (1971) and Bridso & Brecker (1970). Waste material collected from temples was brought to the laboratory in polythene bags. After removing hard material such as shells of nuts, etc. the material was crushed into paste in mixer-grinder to make approximately 200 mL of paste. 100 mL of distilled water was mixed in this paste and the mixture was homogenized again in mixer-grinder. The mixture was allowed to stand in flask for a couple of hours to get supernatant free of debris, having all nutrients extracted in it. Supernatant was filtered through cotton and transferred in another flask.

The liquid was found to be acidic in nature (pH 4.0).

Table 1: Major constituents of typical temple waste (local survey).

Sr.	Category	Common Name	Botanical Name
A1	**Flowers**	Zendu	African marigold (different varieties)
2		Shevanti	*Verbesium gignala*
3		Lily	*Hymenocallis festalis*
4		Sadafuli	*Catharanthus roseus*
5		Rose	*Rosa demascena* (different varieties)
6		Lotus	*Nymphaea pubescens*
7		Hibiscus	*Hibiscus rosa-sinensis*
8		Anant	*Tabernaemonatana coronaria*
9		Chapha	*Pulmeria rubra*
10		Tuberose	*Polian tuberose*
11		Kanher	*Nerium oleander*
12		Dhotra	*Dhatura inoxia*
13		Parijat	*Nyctanthes arbortristis*
14		Rui	*Calotropis gigantica*
15		Mogra	*Jasminum pubescens*
16		Kewada	*Panadanus odoratissimus*
17		Joohi	*Jasminum auriculatum*
B1	**Leaves**	Banana	*Musa coccinea*
2		Mango	*Mangifera indica*
3		Dawana	*Conyza stricta*
4		Tulsi	*Ocimum gratssimum*
5		Bel	*Aegle marmelos*
6		Kardal	*Canna hybridia*
C1	**Fruits**	Banana	*Musa coccinea*
2		Apple	*Pyrus malus*
3		Grapes	*Vitis vinifera*
4		Lemmon	*Citrus* spp.
5		Coconut	*Cocus nucifera*

After suitable pH adjustments (pH 7.4 for the bacterial medium and pH 5.4 for fungal medium) with 1N NaOH solution, total volume of the clear liquid was adjusted to 100 mL. 2.5-3.0 g of agar powder was added to 100 mL of the liquid as a solidifying agent. Media were then sterilized in autoclave at pressure15 lbs for 15 minutes, cooled and plates were poured.

Various common bacterial cultures (*Bacillus subtilis*, *Bacillus megaterium* and *Staphylococcus aureus*), and fungal cultures (*Aspergillus niger*, *Penicillium chrysogenum*, *Saccharomyces cerevisiae* and *Torulla species)* were then tested on respective media for their growth along with growth on standard nutrient agar and Sabouraud's agar as control. Results were noted after the incubation at room temperature for 24 h-48 hours for bacteria and 96-120 hours for fungi.

RESULTS AND DISCUSSION

The results were highly encouraging where luxuriant growth of both bacteria and fungi was obtained on the temple waste microbiological media in comparison to standard controlled media used as evident from Figs. 2, 3 and 4. On temple waste agar test fungal (mold and yeast) growth was luxuriant with mycelium, but on the Sabouraud's agar though there

Fig 1: Temple waste disposal in water bodies.

was luxuriant growth, the sporulation (indication of scarcity of nutrients) in case of *Aspergillus niger* was observed, indicating more nutritive value in temple waste medium where such sporulation was not observed. Thus, it was observed that temple waste media are more nutritive than standard microbiological media (Cruickshank et al. 1975, Deshmukh 2001).

Many by-products (useful wastes) used in the media formulation are of agricultural origin like different components of plant or animal origin. Some components are present in pure form that provide only one nutrient while some are by-products which provide carbon as well as nitrogen source and also provide trace elements, growth factors, etc. for the growth of organisms, e.g. cane molasses, and accordingly different media are categorized (Cruickshank 1975).

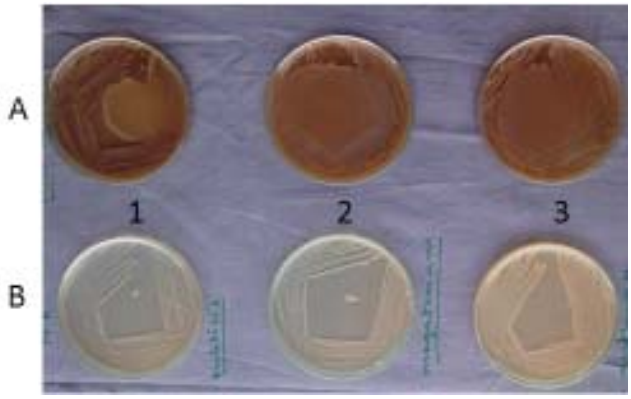
It is recommended by many workers to supplement nutrient media with minerals, phosphorus, energy source and all those essential factors like proteins. It was shown that it contains proteins, amino acids and chemical constituents like milk. Latest investigation reported coconut water as a good source of vitamins B_1 and B_2. Green coconut water has ionic balance and pH close approximately to human blood plasma. The World Heath Organization has suggested its use as an oral rehydration solution (ORS) (WHO 1970).

Kulkarni et al. (2002) has used the coconut water agar for the growth of actinomycetes from the ponds and lakes. The Unit of Biology, Philippines in their laboratory techniques have suggested the use of coconut water as a substitute to nutrient broth. They also suggested that, with the fastidious organisms, other compounds may be added to the nutrient broth or coconut water in order to meet the need of specific microorganisms (doctornutritionist.com).

Vegetables like potato, tomato, onion, etc. are commonly

Table 2: Comparison of the nutrients in temple waste and that used in microbiological culture media.

Type of nutrient	Origin of different ingradients of common microbiological media (Bridso & Brecker1970, Cruickshank et al. 1975)			Comparative ingradients in temple waste
	Plant	Animal	Chemical (pure)	
Carbon source	Sugarcane molasses, Beet Molasses, Cereal grains and Potatoes	Milk, Meat	Sugars like Glucose, Sucrose, Starch, Lactose, etc.	Sugar (sucrose) lump sugar (sucrose), jaggery (sucrose), rice, sweets (sucrose), sugarcane juce (sucrose), Pedha (sucrose), banana (fructose), grape juice, milk in panchamrut (lactose)
Nitrogen source	Corn steep liquor, peanut granules, soyabean meal, Yeast extract	Slaugher house waste/meat extracts	Ammonium salts, nitrate, urea	Flowers amino acids present in milk and coconut water, milk proteins, fruits, coconut water
Growth factors	Vitamins, Amino acids	Meat extract, Yeast extract	Pure/microbial source vitamins	Through milk, curd, coconut water, lemon juice
Fatty acids as antifoam agents	Sunflower oil, olive oil, cotton seed oil	Animal fat	-	Butter, ghee, different edible oils
Water	-	-	Pure water	Spent water of worships and rituals



A: Temple waste medium, B:Nutrient Agar
1. B. subtilis, 2 B. megaterium, 3. Staphylococcus aureus
Fig. 2: Growth of bacteria.

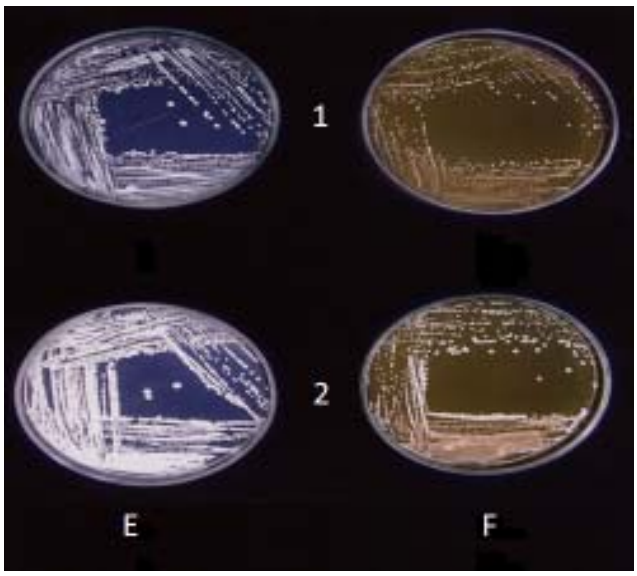
C: Temple waste medium D: Sabouraud's Agar
1. *Aspergillus niger* 2. *Penicillium chrysogenum*
Fig. 3: Growth of fungi (molds).

used to design the culture media to prepare potato dextrose agar, tomato juice agar, onion extract agar, etc. (Cruickshank et al. 1975, Harrigan 1980) and hence, similar plant material of temple waste can be used for culture media preparation.

Fruits are so valuable for human consumption that no one can allow their use for other purposes like media formulation. But there are reports of excellent microbial growth in fruit juices, e.g. wines (Prescott & Dunn 1974) and hence, temple waste containing fruit refuse can be used for media preparation.

Flowers have medicinal value and are used in the cosmetics. But fruits, leaves, flowers and plant and animal material (milk and milk products) sugar and oily material support growth of microorganisms, and many workers already have used these as natural constituents in the microbiological media formulations.

It is already mentioned that the temple waste consist of a variety of components of plant and animal origin, which can fulfil the requirements of natural media. Different nutrient elements required for microbial growth that are provided by common microbiological media components are compared with temple waste components (Table 2), and it is highly justifiable that the extracts of temple waste organic constituents can be used to prepare natural and complex type of media to support saprophytic microorganisms like bacteria, yeasts and molds.



E : Temple waste medium F : Sabouraud's agar
1. *Saccharomyces cerevisiae* 2. *Torulla* species
Fig. 4: Growth of fungi (yeasts).

CONCLUSION

The distinct advantages of using temple wastes in preparation of microbiological media include:

1. Temple waste based microbiological nutrient media with further modification and study can be used to cultivate other common microorganisms.
2. These media will be highly economical as compared to costly standard and commercial microbiological media.
3. This ecofriendly approach will serve recycling of the waste and pollution management in case of temple waste and other similar wastes.

REFERENCES

Booth, C. 1971. Fungal culture media. In: C. Booth (ed.) Methods in Microbiology, Vol. 4, Academic Press, London.

Bridso, E.Y. and Brecker, A. 1970. Designs and formulations of microbial culture media. In: J.R. Norris and D.W. Robbons (eds.) Methods in Microbiology, Vol. 3, Academic Press, London.

Cruickshank, R., Duguid, J.P., Marimon, B.P. and Swain R.H.A. (Eds.) 1975. Medical Microbiology. Vol. II, 12th Edn., Churchill Livingstone, London.

Deshmukh, A.M. 2001. Media, Stains and Staining Methods. PAMA Publications, Karad, Maharashtra.

Doctornutritionist.com, Nutritional News Article. (Internet reference for nutrition value of green coconut water).

Harrigan, C.W. 1980. Methods in Food and Dairy Microbiology. HBC, New York.

Kulkarni, S.W. 2002. Use of Coconut Water Agar for the Growth of Actinomycetes from Ponds and Lakes of Barshi (Maharashtra). Ph.D. Thesis, Shivaji University, Kolhapur.

Prescott, S.C. and Dunn, C.G. 1974. Industrial Microbiology. 3rd Edn., McC-Graw-Hill Book Company, New York, U.S.A.