FRUIT PEEL WASTE: A SUSTAINABLE NUTRIENT MEDIA FOR THE GROWTH OF MICROORGANISM.

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ABSTRACT:

There are several benefits to use fruit waste as a source of nutrients for culture medium. Because less garbage is transferred to landfills, it is first and foremost an ecologically responsible method of waste management. Second, fruit waste may be an inexpensive and convenient way to get nutrients. For the purpose of growth and reproduction, microorganisms need three things: basic nutrients, an energy supply, and environmental conditions. Microorganisms take up residence in environments that best fit their needs for growth; Louis Pasteur devised a "culture medium" in 1860 to meet these needs,
to get the growing substrate for microorganisms ready. The organisms depend on the availability of carbon, energy supplies, and other growth factors. Culture medium come in a variety of forms, depending on the nutritional requirement of the microorganisms for development. Several microelements are needed for the microorganism, most likely C, H, O, N, S, P, K, Ca, Mg, and Fe. For the production of nucleic acids, proteins, lipids, and carbohydrates. Using C. H. O. N. S. and P As K, Ca, Mg, and Fe serve as cell captions, Mn, Zn, Co, Mo, Ni, and Cu are components of enzymes and cofactors. Growth medium either as a liquid or a solid. Observe, cultivate, enrich, and quantify microorganisms using this method. The microbiologist's job is to separate, cultivate, and identify the bacteria in accordance with pure cultures. In this study, we are working with nutrient media made from leftover fruit peels, which may be used in the event that the lab does not have access to synthetic nutrient media. Fruit waste, which can come from a variety of fruits including apples and bananas, is used to make fruit agar, a form of commercial culture medium. Agar containing fruit waste may be used to cultivate a variety of microorganisms, including fungus and bacteria. Fruit and vegetable wastes such as peels, pulp, seeds, pomace, stems, and pods are examples of wet organic waste that comes from kitchen and home activities.
These waste materials are abundant in carbohydrates and other nutrients that are used by microbes as a substitute source. India's growing trash problem and how to dispose of it are major issues. Every day, 170000 tons of trashes are produced in India's cities, with 40% of the waste coming from domestic activities. This may be divided into two categories: moist waste and dry waste.

KEYWORDS: Fruit peel wastes, Fungi, *Aspergillus niger, Penicillium chrysogenum* ,yellow orange media , peels, edible films/coatings.

INTRODUCTION:

The waste fruit peel which is suitable for use if the synthetic nutrient media is not provided in the laboratory. Fruit agar is a type of culture media that is made from fruit waste, which can be sourced from various fruits such as banana, apple to commercial culture media. fruit waste agar can be used to culture various microorganism, such as bacteria and fungi. It is particularly useful for isolating microorganisms that are associated with fruit and can be used in the study of fruit microbiology. Fruit waste agar is a type of culture the media that is prepared using fruit waste as a source of nutrients for the growth of microorganism. This type of agar is made by combining fruit waste with other ingredients such as peptone, yeast extract, and agar.

Distinct forms like dry waste and wet waste. Wet waste generally contains organic waste. 2-3 thousand tone of organic kitchen waste are generated per year which can become an effective resource for recovery of recyclable materials. Wet organic waste emanating from kitchen and household practices includes fruits and vegetable wastes like peels, pulp, seed, pomace, stems, pods etc. Such waste is rich in carbohydrates and other nutrients which are used by microorganism, an alternative source for the growth of microorganisms.In India increasing waste and managing its disposal is a big problem. 170000 tones of waste are generated in urban areas of India everyday, 40%-60% of waste emanating in urban through household practices. This can be classified into two distinct forms like dry waste and wet waste.

Wet waste generally contains organic waste. 2-3 thousand tones of organic kitchen waste are generated per year which can become an effective resource for recovery of recyclable materials. Wet organic waste emanating from kitchen and household practices includes fruits and vegetable wastes like peels, pulp, seed, pomace, stems, pods etc. Such waste is rich in carbohydrates and other nutrients. For the cultivation of bacteria The fruit wastes such as mango peel and ground nut shell can be a good source of nutrients,as it contains simple and complex sugars that are metabolize by microorganisms. It also contains other nutrients such as protein.

The problem of waste management can be decrease by utilizing the waste at large scale for the production of culture media. This can also minimize the problem of costly commercial media by using natural media prepared by using the fruit waste and vegetable waste. Standard procedures in any microbiological laboratories require large number of media for techniques like isolation. Enrichment, spread plate technique and several other experiments. Thus, low-cost media rich in nutrients, giving reproducible result is need of the day for the cultivation It also contains other nutrients such as protein, fibre, carbohydrate and ions like sodium, potassium, magnesium, calcium, iron, zinc and phosphorus etc. The increasing cost of culture media has necessitated continuous search for replacing the commercial media with cheap alternative media. Considering the commercial media 100 gm of nutrient agar powder cost approximately 330/- in India (hi media laboratories, Mumbai) thus 1kg of this media costs around 3,300/-. The problem of waste management can be overcome by utilizing the waste at large scale for the production of culture media.

Nutrition

Orange: In a 100 grams reference amount raw orange peels supplies 97 calories, with dietary fiber and vitamin C in rich content having 42% and 227% of the Daily value (DV) respectively calcium content is 16% of the DV, with no other micronutrients in significant amounts serving of raw orange peel provides 63% DV for vitamin C and 12 % DV for dietary fiber.

Advantage of using fruit

Environmental benefits: Fruit waste can be a significant source of environmental pollution if not disposed of properly. By utilizing it, we can reduce the amount of waste that ends up in landfills, which can decrease greenhouse gas emissions and other environmental impacts.

Resource utilization: Fruit waste contains a significant amount of nutrients that can be used to create value-added products such as animal feed, fertilizer, and biofuels. Thus, fruit waste can be a valuable resource rather than a waste product.

Social benefits: Utilizing fruit waste can create job opportunities in the waste management and recycling industry, which can have positive social impacts on the community.Overall, using fruit waste can provide significant economic, social, and environmental benefits. Reduced waste: Fruit waste is often discarded as food waste, which can contribute to environmental problems such as pollution and greenhouse gas emissions. By using fruit waste, we can reduce the amount of waste that ends up in landfills, which can help mitigate these environmental issues.

Resource efficiency: By using fruit waste, we can make better use of the resource that go into producing fruit. For Example, the water, energy and large resources that are used to grow fruit can be more efficiently utilized by using the waste in other product.

Economic benefits: Using fruit waste can create new economic opportunities, such as the production of biofuels, animal feed, and fertilizer. This can help to diversity local economies and create new jobs. Fruit waste can be a valuable resource for creating new products and generating revenue. By using fruit waste, companies can reduce their input costs, create new revenue streams, and enhance their bottom.

Sustainability: Using fruit waste can contribute to more sustainable production practices, as it helps to reduce waste and can be used to produce other products. This can helps to reduce waste and can be used to

produce other products. This can help to promote sustainable agriculture and reduce the environmental impact of food production. Overall, using fruit waste can have a range of benefits, including reducing waste, improving resource efficiency, creating economic opportunities, and promoting sustainability.

Environmental Sustainability: Fruit waste can be a significant contributor to environmental pollution if not properly managed. By reusing fruit waste, we can reduce the amount of waste sent to landfills and minimize greenhouse gas emissions. This approach helps to support a more sustainable and environmentally friendly economy.

Nutritional value: Fruit waste is often rich in nutrients and can be used to produce high- quality, nutrient-dense products such as juices, smoothies, and food supplements. These products can provide consumers with a convenient and healthy way to incorporate more fruit into their diets.

Resource conservation: By using fruit waste, we can reduce the demand for natural resources such as water, land, and energy. This approach helps to the environment.

Composting: Fruit waste can be used as a natural fertilizer for plants. Compositing fruit waste helps to reduce greenhouse gas emissions by diverting organic waste from landfills, where it would otherwise decompose and release methane.

Animal feed: Fruit waste can be used as feed for livestock, especially pigs and cows. This can help reduce the amount of food that is wasted and also provide a source of nutrition for animals.

Energy production: Fruit waste can be used to produce biogas, which is a renewable energy source. Biogas can be used for cooking and heating, as well as for generating electricity.

Environmental benefits: By using fruit waste in various ways, we can reduce the environmental impacts of food waste. This can help conserve resource, reduce greenhouse gas emissions, and promote sustainable agriculture.

MATERIALS AND METHODOLOGY

All the glassware's were first soaked in cleaning solution.Culture media can be made from fruit waste, which is a type of nutrient rich agar made from leftover fruit pulp and peels. For preparing culture media fruit waste was first dried and then a fine powder was prepared.

COLLECTION OF RAW MATERIALS:

The waste materials such as orange, apple, lemon, watermelon, banana, and chiku procured from kitchen waste material and vegetable market. One kilogram of each waste material was collected. Samples were brought to the laboratory using sterile plastic bags for further processing.

PROCESSING OF WASTE MATERIAL:

The waste of fruits was washed two to three times with sterile distilled water to remove any dust or soil particles. They were then cut into small pieces using a sterile knife.

FORMATION OF POWDER:

The raw material was sun dried for 5-4 days dried raw materials were ground by using electronic blender to obtain its powdered form. Each powder was sieved through sieve to obtained finer particles of the powder and then stored in clean and dry plastic containers.

FRUITS USED FOR PEEL POWDER

- Orange peel powder
- Apple peel powder
- Banana peel powder
- Watermelon peel powder

MATERIALS AND CHEMICALS

1. **Sodium chloride (Nacl)**

Sodium chloride is the most well-known salt and consists of a single sodium ion that is bonded to a single chloride ion. The presence of sodium chloride ion. The presence of sodiumchlorine in nutrient agar maintains a salt concentration in the medium that is similar to the cytoplasm of microorganism. if the salt concentration is not similar osmosis takes place transporting excess water into or our from the cell. Both of these scenarious can be led to the death of the cell.

2. **Agar**

Agar , on agar-agar is a jelly-like substance consisting of polysaccharides obtained from the cell walls of some species of red algae primarily from ogonori and tengusa. A large proportion of culture of culture media are consisting of the chemical agar. Agar is a gelatinous mixture that is extracted from seaweed. Agar consists of mixture of polymers polysaccharides, when the basic sugar is lactose and it is used to solidify the medium.

3. **Water**

Water is an inorganic compound with the chemical formula H2O. It is a transparent tasteless, odorless, and nearly colorless chemical substance, and it is the main constituent of Earth hydrosphere and the fluids of all known living organisms. Water makes up a large proportion of media. Water is essential for the growth and reproduction of microorganism and also provides the medium through which various nutrients can be transported.

ORGANISMS USED

- *Lactobacillus bulgaricus.*
- *E.coli*
- *Sacchromyces cerevisiae*
- *Aspergillus*
- *Pseudomonas*
-

EXPERIMENTAL RESULTS AND DISCUSSION

All the raw materials were procured and processed to obtain powdered form. The fruit waste agar media was formulated by two formulated by two formulas. Out of this two formula the formula supported the growth of bacteria and fungi.

Sr. No.	A1 = Fruit waste agar	A2= Laboratories media
1	Bacterial and fungi growth was better and requires less time to solidify on formulation	Laboratories media takes time and solidify on formulation
2	The bacterial growth was observed on fruits waste agar and show growth in 24 hours at 370C	On the nutrient agar (NA) it took 24 hours to show the growth at 37^{o}C
3	*Lactobacillus bulgaricus , E.Coli, Sacchromyces cerevisiae, Aspergillus, S.aureus,Pseudomonas* showed luxuriant growth	Bacteria and fungi growth on Laboratories media show equal growth on synthetic media.

Table 1: Comparative result between peel media and synthetic media.

Sr. No.	**NAME OF ORGANISM AND FUNGI**	**OBSERVATION**	**GROWTH IN 24 HOURS**

1	*E.Coli*	Found in colonies	+
2	*Aspergillus*	Found in bunches	+
3	*S.cerevisiae*	Found in colonies	+
4	*Lactobacillus*	Found in colonies	+
5	*S.aureus*	No growth found	-
6	*Pseudomonas*	No growth found	-

Table 2: Observation table respective to organism growth

MORPHOLOGICAL CHARACTERISTICS OF ORGANISMS

E. *Coli* :- Bacteria

ACTIVITY	**OBSERVATION**
Gram staining	Gram -ve pink colour coccobacilli
Motility	Sluggishly motile
Colour on fruit agar	**Colour on laboratory media**
Grayish white	Grayish white
Characteristics observed on fruit agar	**Characteristics on laboratory media**
Large and thick	Shiny texture

***Lactobacilli* :- Bacteria**

ACTIVITY	**OBSERVATION**
Gram staining	Coccobacilli araanged in singly was observed
Motility	Non-motile organism was observed
Colour on fruit agar	**Colour on laboratory media**
Yellow	White and yellow
Characteristics observed on fruit agar	**Characteristics on laboratory media**
Long slender	Long slender, large

***Aspergillus* :- Fungus**

ACTIVITY	**OBSERVATION**
Gram staining	Gram negative
Motility	Non-motile fungus
Colour on fruit agar	**Colour on laboratory media**
Yellow and black	Yellow green to brown
Characteristics observed on fruit agar	**Characteristics on laboratory media**
Cottony structure appearance	Rough walled stipes, mature vesciles bearing

***Sacchromyces cerevisiae* :- Yeast**

ACTIVITY	**OBSERVATION**
Gram staining	Purple coloured rod shaped gram positive

Motility	Non-motile
Colour on fruit agar	**Colour on laboratory media**
Cream in colour	Yellow and cream in colour
Characteristics observed on fruit agar	**Characteristics on laboratory media**
Flat, moist	Large, flat, moist

***Pseudomoanas* :-Bacteria**

ACTIVITY	**OBSERVATION**
Gram staining	Gram negative
Motility	Swimming and twitching
Colour on fruit agar	**Colour on laboratory media**
No colour observed	Blue green
Characteristics observed on fruit agar	**Characteristics on laboratory media**
No Characters	Motile by one or more polar flagella and straight to curved rods

Table 3: Morphological characteristics of isolated organisms on peel agar

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