PREPARATION OF BIOPLASTIC USING BANANA PEELS (Musa acuminata) AND DETERMINATION OF ITS ANTIMICROBIAL ACTIVITY

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ABSTRACT

Plastic is a polymer material consisting of a wide range of synthetic or semi synthetic compounds. Plastics being though attractive, the decomposition and disposal had been a huge issue. The indisputable behavioral needs which led to overconsumption started destroying the Biomes. As of 2019, 368 million tonnes of plastic was produced in which 9% only recycled 12% incinerated. This plastic waste could be found in our ecosystem surprisingly 90% of seabirds bodies consists of plastic debris. To reduce the problem of plastic waste that has continuously suffocated the planet and leading to contamination of environment, there is another way of choice to give solution to this issue, from where bioplastic emerges. Hence there is a need to produce plastic from materials that can be readily eliminated from our biosphere in an “eco-friendly” fashion. Banana being a tropical fruit grown worldwide in about 122 countries having its production in metric ton. Every part of banana has medicinal properties, similarly banana peel also has its own properties which is not consumed by humans leading to waste. This waste could be altered into bioplastic being a double benefit that could solve two problems directly or indirectly namely reducing plastic food waste simultaneously, thereby promoting environmentally sustainability. Hence, materials which are synthesized using banana peels have properties of pliability, user friendliness and mostly dehydration tractable. The best bioplastic was obtained. The antimicrobial activity of banana peel was determined for the further processing of bioplastic based products.
INTRODUCTION:

Plastic is a polymer material consisting of a wide range of synthetic or semi synthetic compounds. "The word plastic comes from the Greek word 'plastikos' which means to be molded into different shapes" (Joel 1995). Plastic waste is derived from hydrocarbon-based material, which can be used for incineration or boiler. Despite burning of plastics at lower temperature it may liberate deadly and poisonous chemical gases into the air, including dioxins which is corrupting to the human being on the other hand, if plastic is made from 100% hydrocarbon-intermediates, it is very serviceable but it leads to slow degradation. Though plastics destroys the biomass it is something precious used in the field of construction if they are processed, used and recycled. There emerges a solution to this problem the degradation time for bioplastic depends upon their environmental condition such as Moisture, Location, temperature and less corbondioxide are emitted during this process. When microorganisms are involves in the degradation process they are converted to corbondioxide and water during aerobic process. Hence there are ecofriendly, more sustainable and does not affect any biotic factors. 

Thus bioplastic are widely used in medical devices, agriculture, horticulture and offers a versatile potential in packaging industry. Hence scientist made to explore foodwaste challenge as environmentally friendly as it can reduce food waste and plastic waste at the same time. Banana is a tropical fruit utilized over 122 countries therefore significant amount of waste that is banana peel will be produced it can be utilized in many industries for biofuel production, pharmaceutical industries it has nutritional benefits. The nutrients such as calcium, iron, starch, potassium, sodium present in banana peel makes it effective for the preparation of bioplastic the functional group OH present in banana peel is used to absorb pollutant.

The foodwaste that have starch, cellulose and biopolymer can be converted into bioplastic and banana peel is one among them.

The Banana peel-based bio plastic had been obtained. When these bio plastics are applied over commercial purpose such as bags, toys, packaging materials and bottles, these application-oriented concept cannot be directly implemented. They should have higher safety for consumption. Thus, without practical examination we can’t assure safety. Hence, the need of antimicrobial had arised. When a packaging material being prepared out of banana. Peel should have the capacity to resist the microbial entry and should not cause spoilage to the product present inside. Hence the nature of banana peel to let the resistance of microorganisms can be determined by antimicrobial activity.

Every banana peel are waste where this could be utilized in different ways which would gain attention due to nutritional & Pharmaceutical properties. This is not only handles waste management but molds to every aspect of manufacturing new products significantly as an antimicrobial agents.

MATERIALS:

Banana peel, Citric acid, Chitosan, Sorbital, Aquadest.

EQUIPMENTS:

Soxhlet apparatus, Hot air oven, WaterBath
COLLECTION OF PLANT MATERIALS:

Fresh banana was bought from the market. (*Musa acuminata*). The peel and edible part was carefully separated which is the basic need for this experiment. Certain amount of the fresh peel was taken for the pectin extraction of bioplastic production. The remaining amount was dried for 3 days under sunlight then they were finally blended by using mechanical blender. The grated powder was stored in an air tight container for further analysis.

PECTIN EXTRACTION:

For each treatment, 500 grams of banana peels were cleaned and blended. After filtration, the filtrate are obtained by boiling in 2% citric acid solution at 90°C for 3hrs. Then the liquid extracted is mixed with ethanol (1:1) filtration is carried out to obtain pectin by drying in hot air oven at 50°C for 8 hours. Obtained pectic was analysed for making Bioplastic.

MAKING OF BIOPLASTIC FILM:

The pectin was dissolves in distilled water along with addition of 5 gram of Banana peel extract. This extract was heated at 60°C. On the other side, Chitosan was dissolved with 3% citric acid, This mixture was stirred homogenously with pectin. To this pectic add 2% sorbitol and heated at 80°C for 10min. Finally Bioplastic was obtained by action of drying at 50°C - 60°C.

PREPARATION OF BANANA PEEL EXTRACTION:

In this method, ethanol is used as a solvent. Soxhlet apparatus was used for the ethanol extraction ground banana peel sample is placed in thimble chamber of the Soxhlet apparatus 50g of banana peel was powder was extracted with 500ml ethanol at 78.37°C. Now the extracts were evaporated to dryness.

ISOLATION OF PATHOGEN:

We isolated *E. coli* from sewage sample by culturing it in EMB Media and *Staphylococcus aureus* from the waste water of Thermal Power plant and was cultured in Mannitol Salt Agar and *Vibrio cholerae* was isolated from the sewage sample by using TCBS agar. The liquid Culture was prepared by inoculating a loop full of bacterial culture in the nutrient broth and incubated at 37°C for further procedure.

ANTIMICROBIAL ACTIVITY:

Well diffusion assay was carried out to check the antibacterial activity of banana peel extract against *Staphylococcus aureus*, *E. coli*, *Vibrio cholerae*. A loop or swab was used to transfer the colonies to the Muller Hinton Agar. The sterile cotton swab was then dipped into the inoculum and the surface of the agar plate was swabbed 5mm diameter hollow tube was used to prepare the wells on each plate, and then the ethanolic banana extract was added into the respective wells. The plates were then incubated for 18-24 hr at 37°C in an incubator. Three wells were made, one is for sample, ethanolic extract of banana peel, the second well is for positive control (antibiotic) and the last well is for negative control (DMSO).
RESULT:

Bioplastic was obtained by Pectin extraction from Banana peel.

<table>
<thead>
<tr>
<th>TOTAL BANANA PEEL (IN GRAMS)</th>
<th>PECTIN EXTRACT (IN GRAMS)</th>
<th>BIOPLASTIC OBTAINED (IN GRAMS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>500</td>
<td>50</td>
<td>27.9</td>
</tr>
</tbody>
</table>
ISOLATION OF PATHOGEN:

After incubation of plates, Sewage sample which was inoculated in selective media – EMB. This showed metallic sheen growth which confirms that it is *E. coli*. Thermal waste water which was inoculated in Mannitol Salt Agar which showed yellow colonies that indicated the presence of *Staphylococcus aureus*. From sewage sample, flat yellow colonies on TCBS plate confirmed as that the pathogens was *V.cholerae*.

ANTIMICROBIAL ACTIVITY – WELL DIFFUSION ASSAY:

After incubation of Muller Hinton agar plate zone of inhibition was shown by ethanolic plant extract against *Staphylococcus aureus* and *Vibrio cholerae*.

ZONE OF INHIBITION:

<table>
<thead>
<tr>
<th>Organism</th>
<th>Zone of Inhibition</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>E.coli</em></td>
<td>No Zone of Inhibition</td>
</tr>
<tr>
<td><em>Staphylococcus aureus</em></td>
<td>5mm</td>
</tr>
<tr>
<td><em>Vibrio cholerae</em></td>
<td>2mm</td>
</tr>
</tbody>
</table>

ANTIMICROBIAL ACTIVITY OF ETHANOLIC EXTRACT OF BANANA PEEL AGAINST BACTERIAL STRAINS.
CONCLUSION:

- The results showed that the banana peels based bioplastic is able to achieve the main grand challenge of increasing the industries efficiency and its supports.
- And the general economy in many other products such as bags, toys, drinking water bottles etc. that the plastics plays a major role and an important factor in the process of their manufacturing.
- Ethanolic extract of banana peel was carried out well diffusion assay to determined the antimicrobial activity and it was considered as good antimicrobial agent against *S.aureus* and *V.cholerae* and can replace synthetic medicine in the treatment of diseases caused by these bacteria.

FUTURE PLAN

- The obtained bioplastic can then be further processed for making toys that are safe for children as they are prepared from non-toxic based materials.
- It plays a key role in the production of bags.
- Bioplastic are used for the manufacture of drinking bottles which are safe to consume as it has antimicrobial properties.

BIBLIOGRAPHY


