EDIBLE FILM DEVELOPMENT USING JACKFRUIT SEED POWDER BY INCORPORATING BIOACTIVE COMPOUNDS FROM ESSENTIAL OILS

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ABSTRACT

The shelf life of food products can be extended while maintaining their nutritional, biological, and sensory quality by using edible packaging, which is seen as an alternative to synthetic polymers. It helps in minimizing lipid oxidation, reducing weight loss, retarded respiration, and enzymatic browning of food products. The present study explores the edible packaging, physiochemical properties and edible film forming ability of fruit wastes of jackfruit seed. The polysaccharide obtained from jackfruit seed is starch. Almost 70.22% of starch is present in jackfruit seed. As a result, edible film can be created at industrial scale using the byproducts of the fruit processing to extend the shelf life of food goods. Essential oils are incorporated in the developed edible film to enhance the shelf life as well as to provide nutritional value of the food products. Bioactive compounds extracted from essential oils are utilized to provide a value addition to the developed edible film. Due to their capacity to inhibit the development of food-borne diseases and preserve food products, bioactive compounds are suited for active packaging. Essential oils and bioactive substances present in it could extend the shelf life of food goods. Essential oils have a high concentration of bioactive chemicals, which enhance the packaging material's antibacterial characteristics and shield food from dangerous germs. Bioactive substances are appropriate for use in active packaging due to their capacity to stop the growth of food-borne diseases and preserve food. The developed edible film will be studied for various analysis like physio-chemical properties, textural properties, barrier properties and sensory analysis.

Keyword: *Edible film, Jackfruit seeds, starch, essential oils, bioactive compounds.*

1. INTRODUCTION

Many companies now prioritize environmentally friendly and cultural practices, especially when it comes to food packaging. Food packaging is an excellent alternative to plastic packaging when it comes to food storage and care. The new approach to food packaging requires the use of materials that are not only fit for consumption, but also help to extend the shelf life of food products by preserving their nutritional value. The use of single-use plastics and other non-biodegradable materials should be reduced to reduce their negative impact on the environment. By using food from different sources, such as fruit waste, the food industry can reduce waste and create a circular economy. This reduces the overall footprint by facilitating the reuse of products from fruit processing, including starch polysaccharides found in seeds. Second, food packaging has proven effective in blocking external factors that cause food spoilage. This new packaging helps maintain freshness and overall nutritional quality by reducing lipid oxidation, weight loss, respiration and enzymatic browning. The preservation of nutritional and organoleptic properties ensures that consumers receive products that are not only safe, but also pleasant to eat. Consuming the

supplement gives good results Known for their biological activities, essential oils have strong anti-inflammatory properties. These natural antibiotics provide an additional defense mechanism for bacteria, making edible films stronger and helping to prevent bacterial growth in foods. This dual purpose of storage and packaging makes it ideal for increasing safety and security needs. Therefore, it would be a good idea to combine polysaccharides from fruit waste such as seeds with essential oils to extend the shelf life of vegetables, rice, make food safe and reduce contamination. Environmental impact of non-biodegradable packaging.

1.1 Objectives

The primary objective is to create edible films using jackfruit seed powder as a base material. These films should be safe for human consumption, biodegradable, and capable of preserving food. The sustainable and environmentally friendly substitutes for conventional packaging materials, edible films are receiving more and more attention in the food business. A natural material for creating edible films has been identified as jackfruit seed powder (JSP), a byproduct of jackfruit manufacturing. The following are the objectives for the formation of edible film.

i. Optimization studies of the edible film solution.
ii. Development of the edible film from the starch source.
iii. Characterization studies of the developed edible film.
iv. Incorporation of essential oils to the edible film formation.
v. Shelf-life studies of the developed edible film.

1.2 Scope of the project

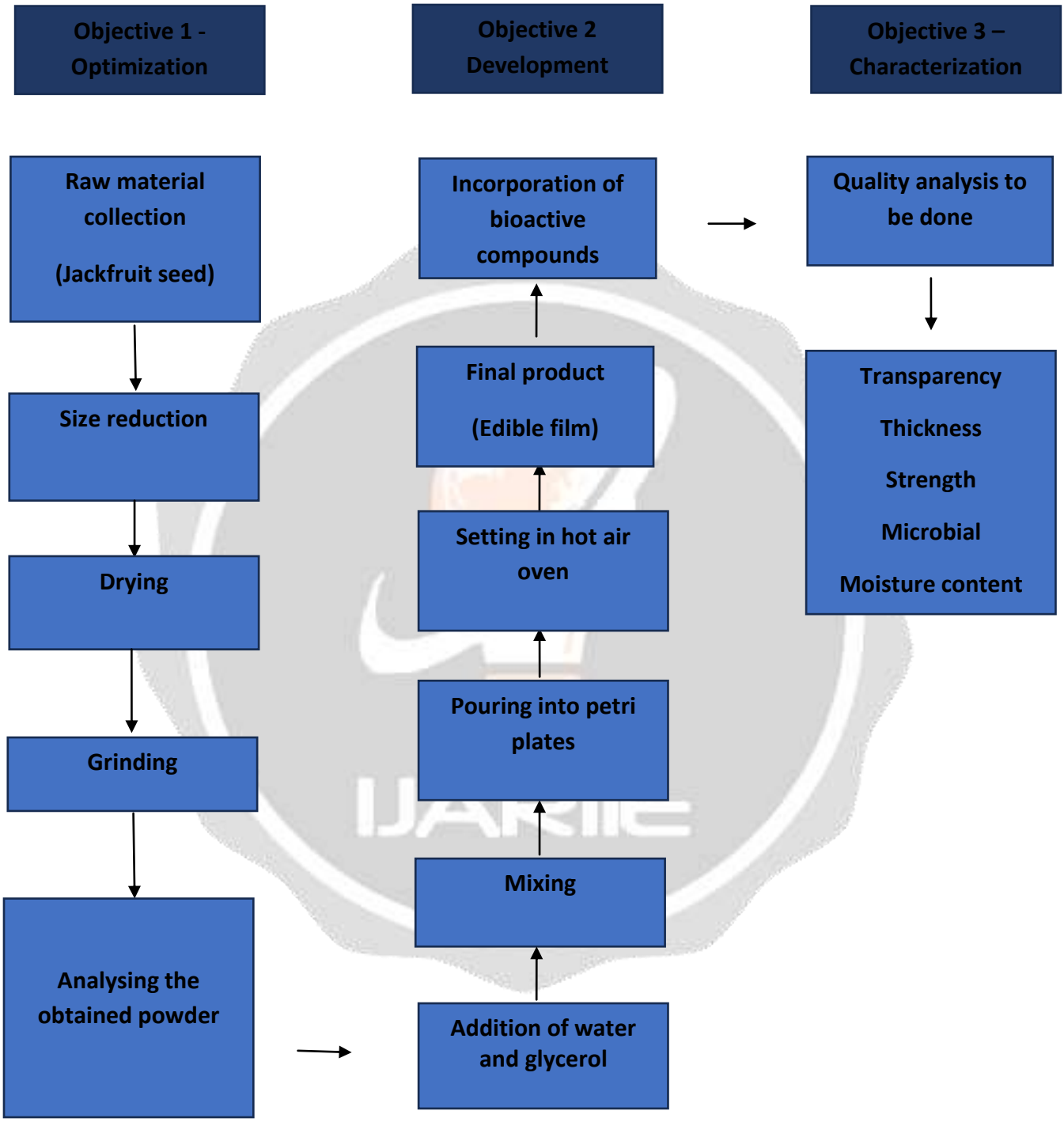
The scope of the study is to create edible films with bioactive components from essential oils utilizing jackfruit seed powder as a base material. The main objective of this research is to produce edible films that are safe and biodegradable that may be used to preserve and improve food. The antibacterial and antioxidant qualities of essential oils will improve the functional qualities of the films. Specific essential oils will be chosen for the project, and beneficial components will also be extracted. The films' potential for enhancing flavor, extending food product shelf life, and providing health advantages will all be put to the test. The physical characteristics, antibacterial activity, and chemical stability of the films will be thoroughly tested and analyzed in order to accomplish these goals. Consumer acceptance will be assessed using sensory evaluations, and compliance with food safety laws will be verified. Sustainability issues will be taken into account at every stage of the project, and it will be sought after to work with specialists in related sectors. The ultimate objective is to develop a unique, green, and marketable product with applications in the food and packaging sectors.

2. MATERIALS AND METHODOLOGY

An intriguing concept that integrates food technology and natural ingredients for possible health benefits uses jackfruit seeds to create edible films and includes bioactive components from essential oils. It's essential to keep up strong laboratory procedures throughout the development process, keep meticulous records of observations, and carry out experiments with meticulous control variables. Additionally, consider safety and regulatory aspects, especially if intending to commercialize the edible film product. To generate edible films with a variety of qualities suited for use in a variety of food applications, jackfruit seed powder can be blended with other edible film-forming materials like starches or gums. Jackfruit seeds are frequently regarded as a waste product from jackfruit eating, however using them to make edible films can cut waste and offer an affordable source of raw materials.

Developing edible films using jackfruit seeds and incorporating bioactive compounds from essential oils is a fascinating project that combines food technology and natural compounds for potential health benefits. Here's a general methodology to guide you through the development process:

FLOW DIAGRAM OF THE EDIBLE FILM DEVELOPMENT



2.1 Ingredients:

- Jackfruit seeds
- Essential oils with bioactive compounds (Peppermint)
- Glycerol

2.2 Preparation of jackfruit seed powder:

- Collect jackfruit seeds and clean them thoroughly to remove any dirt or debris.
- Remove the skin of the jackfruit seed powder and grind in the mixer.
- Dry the seeds in the tray drier at 60 ± 2 °c for 3 hours and grind them into a fine powder.
- Sieve the obtained powder until completely fine enough.

2.3 Edible Film Formation:

- Mix the ingredients thoroughly until a homogeneous mixture is obtained.
- Dissolve the prepared jackfruit seed powder in water thoroughly.
- Start heating the solution.
- Add glycerol to it while heating. Mix the solution properly for few minutes.

2.4 Incorporation of Bioactive Compounds:

- Add 3 to 4 drops of essential oils (peppermint)
- Mix continuously until the texture is obtained.

2.5 Film casting:

- Pour the solution in petri plate to make edible film.
- Spread the film solution evenly in the petri plate.
- Place the petri plate in hot air oven at 60 ± 2 °c for 24 hours to achieve desired texture of edible film.

3. RESULT AND DISCUSSION

A sustainable and environmentally friendly packaging solution was achieved by successfully producing edible films with jackfruit seed powder as a primary ingredient, along with plasticizers and water. Thickness, color, and transparency were among the physical traits of the films that were evaluated. According to the formulation, the films showed varied degrees of transparency and opacity. Several mechanical characteristics were tested, including Young's modulus, elongation at break, and tensile strength. Higher jackfruit seed powder concentration resulted in more brittleness, and these characteristics varied depending on composition and processing circumstances. The films' capacity to shield food products from moisture and oxygen and so increase shelf life was demonstrated by the evaluation of barrier qualities, specifically water vapor permeability (WVP) and oxygen permeability (OP). The use of jackfruit seed powder in the creation of edible films is in line with sustainability objectives since it efficiently recycles a waste byproduct of the jackfruit industry and helps to cut down on food waste. It is crucial to adjust the mechanical characteristics of the films, and it was found that adding the right plasticizers improved the films' flexibility and tensile strength, which are crucial for real-world packaging applications. Although more optimizations may be needed for some applications, the films' strong barrier qualities to moisture and oxygen make them a feasible alternative for maintaining food quality and increasing shelf life.

3.1 Quality analysis for jackfruit seed powder

ANALYSIS TECHNIQUES	FIGURES	CALCULATION
MOISTURE CONTENT		**Total moisture content of jackfruit seed =10.33%**
WATER ACTIVITY		**Water activity of jackfruit seed powder = 0.602 a_w**
pH ANALYSIS		The pH value of jackfruit seed powder is **6.74.** This means our product is **slightly acidic.**

COLOUR ANALYSIS		The values of Hunter colorimeter for jackfruit seed powder: **L* - 66.01** **a* - 7.34** **b* - 16.26**
ASH CONTENT		Initial crucible weight = 32.890 g Final crucible weight = 32.984 g **Total ash content = 0.094 g**
FAT CONTENT		FAT % = $\frac{W2-W1 \times 100}{W}$ = $\frac{83.963 - 83.921 \times 100}{1.534}$ =2.737 % **Total fat content = 2.737%**
FIBER CONTENT		Weight of empty crucible = 35.2g Crucible with sample = 34.5g Ash content in the crucible = 35.2g Weight of fiber sample = 0.7 g **Fibre = (Crucible with sample - Weight of empty crucible) - (Ash content in the crucible - Weight of empty crucible)**

		= (0.8 – 0.7) × 100 0.8 = 0.1 x 100 0.8 = 12.5% **Total ash content = 12.5%**
PROTEIN CONTENT		**The Jackfruit seed powder sample contains protein content of 18.66%.**

4. CONCLUSIONS

Edible films are flexible, thin materials that can either be consumed with food or used to package it. Typically, they are produced utilizing lipids, proteins, polysaccharides, or combinations of these. The type of food that will be coated with the film, its intended usage, its mechanical strength, and its moisture and gas barrier properties will all influence the choice of edible film material. The creation of edible films utilizing jackfruit seed powder has a lot of potential as an original and environmentally friendly approach to the food packaging problem. Natural byproduct jackfruit seed powder has several benefits, including biodegradability, affordability, and possible health advantages. These edible films have been proved via research and development to be an efficient way to reduce food waste, increase shelf life, and offset the environmental impact of conventional plastic packaging. Additionally, because jackfruit seed powder is so adaptable, it may be used to modify and improve the film's characteristics, including its mechanical strength, barrier qualities, and antibacterial activity. It is excellent for a variety of uses in the food business due to its versatility. Finally, the creation of edible films utilizing jackfruit seed powder offers a viable and promising replacement for traditional food packaging. According to the findings, these films have good mechanical and barrier qualities and are well-liked by customers in terms of their sensory qualities.

5. REFERENCES

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