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Development of Biodegradability Film from Modified Banana Peel Starch

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ABSTRACT: The plastics are the main threat to environment as they are non-degradable. Hence a study has been carried out to synthesize biodegradable film using modified banana peel starch and also to study its properties like opacity, tensile strength and biodegradation tests. Banana peel starch was modified by succinylation process by adding succinic anhydride (1,2,3g). Degree of substitution of modified banana peel starch was determined by alkaline titration. The result shows that increase the amount of succinic anhydride increase in degree of substitution (0.16, 0.28 and 0.35). Biodegradable film is formed by adding modified banana peel starch, glycerol and acetic acid (6:1:1). The result of synthesis of biodegradable film from modified banana peel starch showed that it was brown in colour and was odourless. The results of tensile strength for modified banana peel starch film which was high compared to other.

KEYWORDS: biodegradability film, modified starch, banana peel.

I. INTRODUCTION

Banana (*Musa paradisiaca*) is a native plant filling broadly in India. Most pieces of banana, including its stem, leaf, bloom, organic product have been utilized by the general public. In any case, banana peel is considered as a waste material and arranged as a natural waste or utilized as a animal feed for cow and goat. Indeed, weight of banana peel is around 33% of the absolute load of banana organic product. Banana peel is a rich wellspring of starch, unrefined protein, rough fat, absolute dietary fibre, gelatine, polyunsaturated unsaturated fats, fundamental amino corrosive, and micronutrients (Mg, Ca, K, P). Banana peel as a wellspring of starch may altogether improve its financial qualities, it tends to be utilized in different food and non-food businesses and drug ventures. Yet, the usage of banana peel from the banana chips handling businesses are still moderately low.

Starch is a significant inexhaustible happening polymer which has discovered wide application in different spaces of polymer science. Starch change includes the modification of the physical and chemical modification of the native starch to improve its utilitarian qualities which can be utilized for food applications. It is for the most part accomplished through derivatization, e.g., by esterification, etherification, uniting of starch and cross-connecting or actual treatment of starch utilizing radiator dampness. The compound and useful properties can be accomplished after adjusting starch by synthetic replacement, rely upon starch source, sort of substituent, response conditions like reactant fixation, response time, pH and the presence of impetus, the appropriation of the substituent in the starch particle and degree of replacement. Succinic anhydride starch has been utilized in food items, for example, puddings, sauces, and infant nourishments. as of now, succinic anhydride starch was accounted for to have uncommon healthy benefit. starch is chemically altered by substance response with hydroxyl group in the starch particle to present extra properties like hydrophobicity, porosity, usefulness, formability and mechanical uprightness. Altered starch subsidiaries are given physicochemical properties that contrast essentially from native starch, hence augmenting their applications in food processing.

The most regularly utilized plasticizers included glycerol, sorbitol, xylitol, poly (ethylene glycol) 200 and poly (ethylene glycol) 400. Glycerol, the frequently utilized little atom plasticizer, effectively obtains entrance between the polysaccharide chains through hydrogen bonds, decreasing intermolecular polysaccharide cooperation, expanding intermolecular separating, and hence expanding film stretchability.

plastics are made of petroleum-based materials that are not readily biodegradable and therefore lead to environmental pollution, the most obvious form of pollution associated with plastic packaging is waste plastic dump to the landfills. In order to overcome these problems, several studies are concentrated on the development of new



biodegradable packing film materials that can be manufactured with the utilization of environmentally friendly raw materials.

The main objective of this research was to produce biodegradability film which are obtained from modified banana peel starch and analyse its properties of film..

II. METHODOLOGY

Raw material

Unripen banana peel (Nendran variety) were taken from chips shop from Nagercoil. Chemicals used in this research were purchased from local chemical shop.

Extraction of starch

Unripened banana peels were washed to remove the dirt present on the surface of banana peel. After washing cut the banana peel into small pieces (4 mm). Cut pieces which was 500g weight soaked in distilled water contain sodium metabisulphite (0.3%) for 60 min. After soaking, grind the cut pieces of banana peel and squeeze it. Let the squeezed starch slurry for precipitation for 24 hr then decanted the starch slurry. Starch extract was washed for 3-4 times with distilled water. Starch extract was dried in hot air oven at 50°C for 2 hr.

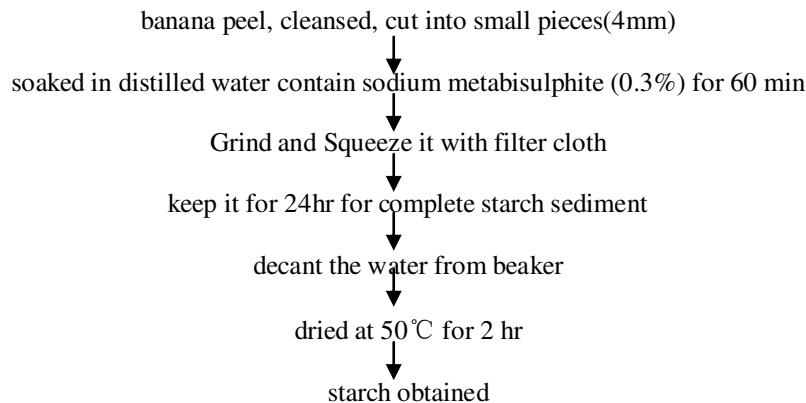


fig 1: Flowchart for extraction of starch

Modification of starch

Banana peel starch(30g) and dispersed in 100ml distilled water and stirred magnetically for 1 hr. Adjusted the pH of solution to 8-9 by adding 0.5 M of sodium hydroxide (NaOH). Treated the solution with succinic anhydride (1, 2, 3g) over a period of 2hr and maintain the pH 8-9 throughout the treatment. After 2hr of reaction adjust the pH to 6 by adding hydrochloric acid (HCl). Filtered and washed the modified starch with 75% ethanol. Dried the modified starch in hot air oven at 40°C for 24hr. finally we got modified banana peel starch (M1, M2, M3 which represent the starch modified by 1,2,3g of succinic anhydride).

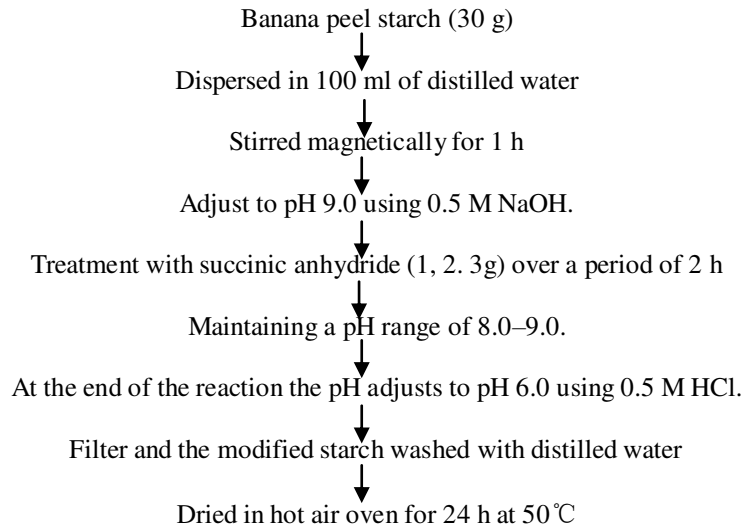


Fig 2: flowchart for modification of banana peel starch

Degree of substitution

To evaluate the degree of substitution, 0.5g of modified banana peel starch and dispersed in 25ml of 75% of ethanol and add 20ml of 0.5M of sodium hydroxide (NaOH), kept that solution for 3hr. After 3hr titrate the solution with 0.5M of hydrochloric acid and phenolphthalein as indicator. We repeat this procedure for banana peel starch for blank value. Percentage succinyl and degree of substitution were calculated by following equation(1),(2).

$$\%succinyl = \frac{(blank\ value - titre\ value) * 0.1 * molarity\ of\ acid * 100}{weight\ of\ sample(g)} \quad (1)$$

$$Degree\ of\ substitution\ (DS) = \frac{162 * \%succinyl}{10000 - (99 * \%succinyl)} \quad (2)$$

Film formation

The modified starch(M3) was allowed to heat in water bath at 70°C by adding glycerol, acetic acid and distilled water (6:1:1). We stirred the solution continuously without formation of the lumps till it come into a thick consistency. And then spread this solution on a glass plate in the thickness of 0.2mm±0.1mm. Let it dry for 24 hours at room temperature in an open place. After drying, the film is peeled from glass plate gently.

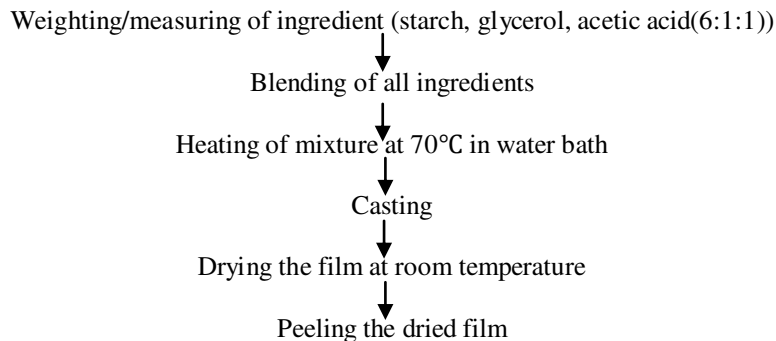


Fig 3: flowchart for film formation



Properties of film

Film thickness

The modified banana peel starch film thickness is determined by screw gauge with 0.01 LC. Calculation of film thickness are to be done at three points randomly for each film and the average of the three points should be checked. The average thickness calculated is used for evaluation of the real film thickness.

Film Opacity

The opacity of the films was calculated as ratio of absorbance (A) (in nm) to the film thickness (in mm) using a spectrophotometer. Rectangular film strips (1 cm × 4 cm) were placed directly in glass cuvettes. The absorbance was measured at 600 nm and the opacity of the film was calculated by the following, equation.

$$\text{Opacity} = \frac{\text{absorbance at } 600\text{nm}}{\text{thicness of film(mm)}}$$

Tensile strength

Tensile strength is measured in texture analyzer. The film in the size of 4×4cm is to be taken for tensile strength in texture analyzer.

III. RESULTS AND DISCUSSION

Degree of substitution

Degree of substitution value was determined by titration. The value shows that increase in amount of succinic acid increase in degree of substitution.

SAMPLES	DEGREE OF SUBSTITUTION
M ₁	0.16
M ₂	0.28
M ₃	0.35

Table 1 – degree of substitution of modified banana peel starch

Film thickness

All the samples were measured by screw gauge and the mean thickness were then calculated and showed that the mean thickness was in the range of 1.17 mm to 1.25 mm.

Film opacity

All the samples were measured by spectrophotometer. The opacity of film is opaqueness due to brown colour starch. The opacity was in the range of 0.516 to 1.46 AU_{nm}.

Tensile strength

The modified banana peel starch films were prepared and tested for its tensile strength using a texture profile analyser. Tensile strength of the modified banana peel starch is higher than the banana peel starch. This is because the change in structure of starch during modification.

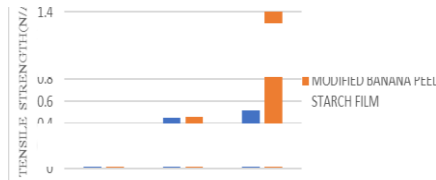


fig 4: tensile strength of film

V. CONCLUSION

We concluded that banana peel which was cut into 4mm size was easier to extract slurry. Banana peel which was been soaked in sodium metabisulphite for extraction gives the high yield compared to other extraction methods. From the varieties we have taken nendran banana was the one with maximum starch. In modification process ph plays an important role in its consistency. . In titration method we found that the degree of substitution will increase as we increase the amount of succinic anhydride. Film formed from modified banana peel starch has good tensile strength and thickness when compared to other normal starches. Film which was formed with acetic acid was better at consistency than the others. Acetic acid and glycerol enhanced the plasticity and flexibility of the films. As conclusion, the film formed from the modified banana peel starch had potential application in covering fruits which will enhance the food quality even though it is cut.

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