Chapter 17

Anti-Fungal Biodegradable Edible Film

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Abstract

Disposal of plastics in our daily lives have led to environmental pollutions as they are non-biodegradable. In our work, a green, light, edible and functionalized with ginger extract product was successfully prepared from seaweed. Study shows that the film is anti-fungal and has higher water solubility (80%) compared to other edible films. The anti-fungal, biodegradability and nutritious properties of the seaweed based film makes it a quality, environmental friendly and long lasting alternative to plastic in the food industry.

Introduction

Plastic is widely used in our daily lives, especially in the food industry to meet consumer's demands. However, the large disposal of plastics have led to environmental pollution as they are non-biodegradable. Therefore, the production of edible films which can be consumed together with food and is biodegradable provide an environmentally-friendly solution to this issue. Currently, edible films produced from various sources of protein, such as corn, milk, soy, wheat and whey have been used for years (Pavlath & Orts, 2009). However, to meet the growing demand of degradable and natural materials, much more research is needed to produce edible films from raw materials originating from agricultural or marine sources. Hence, our project is a research to produce edible seaweed based film. Seaweed is one of the imperishable natural resources with industrial potential that is not yet fully exploited. In Malaysia, the forming of seaweed has developed promptly especially Sabah (Siah et al., 2015). Since seaweed is the important product in food as fiber resources (Djaeni & Sari, 2014), and also it contains large amount of polysaccharides which are able to disperse in water, retain cholesterol and inhibit lipid absorption (Gomez-Ordonez et al., 2010), it has a high value of production for consumers. Consequently, the idea of using edible film from seaweed in our lives promotes a greener way of living for a better quality of life of the people as well as the environment, therefore conserving mother nature for the future generations to come.

Content

In this project, a green and light seaweed based edible film was successfully produced. The edible film was functionalized with ginger extract to produce an anti-fungal film. The edible film has many favourable characteristics: it is elastic, biodegradable, and has anti-fungal properties. Hence, this prolongs shelf life of food, thus preserving the quality of food.

The raw materials used to produce this film are seaweed, distilled water, glycerol, ginger extract and food flavouring.

Table 1. Comparison between Existing Features of Edible Film Vs Innovative Features of Seaweed-Based Edible Film

Aspect	Existing features	Innovative features
Main material	Protein sources like corn, whey and wheat	Seaweed
Water solubility	Low Water Solubility	Higher water solubility
Anti-fungal property	No ginger	Functionalized with ginger to give it anti-fungal properties
Cost	Costlier	Low cost
Shelf Life	Shorter shelf life	Longer shelf life

Table 2. The Total Cost of Raw Materials to Produce One Batch of Edible Films (About 8 Films)

Substance	Quantity	Price (RM)	Price (USD)
Seaweed	5g	RM 0.05	0.01 USD
Glycerol	2ml	RM 0.19	0.05 USD
Ginger extract	1 ml	RM 0.01	0.01 USD
Flavouring	2 ml	RM 0.10	0.02 USD
TOTAL		RM 0.35	0.09 USD

Results & Discussions

Water Solubility Test

A water solubility test was conducted to test the water solubility of the edible film. An edible film was cut into a piece of 2 cm x 3 cm. The mass of the edible film was measured using an electronic balance and recorded. Using a measuring cylinder, 80 ml of distilled water was measured and poured into a beaker. The edible film was then put into the beaker containing distilled water and swirled for 30 minutes. The mixture was then filtered with a filter paper. The precipitate collected was put into a petri dish and dried in an oven at 60°C and weighed at intervals of 30 minutes until a constant mass is obtained. The constant mass was recorded and the solubility of the edible film is calculated using the formula: S % = (Initial mass - constant mass) x 100.

Table 3. Results of the Water Solubility Test

Initial mass (g)	1.6	1.5	1.6
Final mass (g)	0.8	0.8	0.7
Initial mass - Final mass (g)	0.8	0.7	0.9
Solubility (%)	80	70	90

From the test, the average percentage of the anti-fungal biodegradable films tested is 80% which is higher than edible films we currently have in the market (rise starch-chitosan, 36.54%; cellulose, 55%). This shows that it has high water solubility.

Anti-Fungal Test

Two petri dishes containing agar was prepared. One edible film with ginger and one edible film without ginger was both cut into circles with radius 2 cm. Both the edible films was put into separate petri dishes containing agar as shown in Figure 1. Both the petri dishes was left for 3 days. The condition of the edible films in the petri dishes is observed after 3 days.

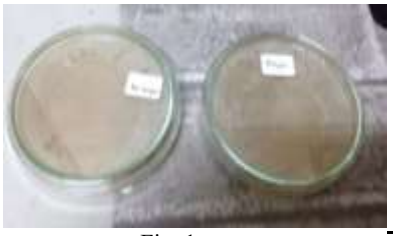

Fig. 1

Fig. 2

As can be seen in Figure 1 and Figure 2 the fungal has grown and spread throughout the agar and edible film without ginger in the petri dish on the left. Whereas in the petri dish on the right, the agar is covered with fungal but the edible film with ginger extract remains clear. This shows that the film produced has anti-fungal properties that can prevent fungal growth and infection. Thus, ensuring the safety, quality and longer shelf life of the edible film for consumers.

Conclusion

As a conclusion, the edible film produced by seaweed has anti-fungal & high water solubility properties. Most importantly, the developed film is non-toxic, bio-degradable and does not cause any environmental problems.

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