Preparation of Edible Film from Mung Bean Protein

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Abstract

Mung bean (Pedesein) was collected from Chaung–U Township, Sagaing Region. Mung bean protein edible film was prepared based on different concentration of protein isolate. 5% mung bean protein isolate based edible film had the maximum tensile strength, 1.31±0.5 MPa and elongation at break, 62±0.03%. Moreover, the minimum solubility was found 7% to 9% mung bean protein based edible film. SEM image of 5% mung bean protein isolate film showed homogeneous, uniform and continuous surface without cracks and porous structure. Thus, this film can be applied as a wrappers for fruits and vegetables.

Keyword: edible film, mechanical properties, surface morphology

Introduction

Edible films are thin layers made from edible materials which have been introduced as a barrier layer to improve consumers acceptability and shelf–life of food products. The protective function of edible films is to prevent oxidative processes, absorption and desorption of moisture, contamination, microbial growth and sensory changes [Arham *et al.,* 2015].

Packaging is necessary for preserving the organoleptic, nutritional and hygienic characteristics of food during storage and marketing. The wide variety of packaging films available can be divided into synthetic and edible or biodegradable [Bourtoom,2008].The purpose of this research work was to study the characteristics of edible film and to use as food packaging.

Materials and Methods

Raw Materials

Mung bean (Pedesein) was collected from Chaung–U Township, Sagaing Region.

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Methods

Preparation of Mung Bean Protein Edible Film

About 5 g of mung bean protein isolate was mixed with 100 ml of distilled water. After that, this protein solution was added with 3 ml of glycerol and this solution was adjusted to pH 8.5 by using 0.1 N NaOH solution. This film solution was casted on the glass plate to form a thin film and dried in an oven at 80 °C. The resultant protein film was peeled off.

Methods of Analysis

Biodegradability of Edible Film

Biodegradability of edible film was carried out in plastic container were filled with the soil Rectangular polymer samples were cut into 30 x 50 mm pieces and buried in the soil at a depth of about 5 cm. The compost was kept moist by sprinkling water at regular time intervals to maintain 45–50% humidity. The excess water was drained through the hole at the bottom of the container. The containers are stored at about 30–35° C. The degradation of the samples was studied at regular time intervals by removing the samples carefully from the soil and washing them gently with distilled water to remove the soil adhering on the surface. The samples were dried at 60° C under vacuum until a constant weight was obtained. Weight loss of the polymer with respect to time was recorded as a measure of degradation .The soil burial test was studied by evaluating the weight loss of the film over time [Roy,2015].

Results and Discussion

Mechanical Properties of Mung Bean Protein Film

Film thickness, tensile strength and elongation at break of edible film using mung bean protein isolate are shown in Table (1). The resulting films thickness in this study ranges between 0.18±0.2and 0.41±0.1 mm depending on the concentration of protein. Edible film based on 5 % mung bean protein has observed the maximum tensile strength at 1.32±0.6MPa and elongation at break, 63±0.04% than other films.

Table (1) Amount of Mung Bean Protein Isolate on the Mechanical Properties of Edible Film

Sr.No.	Mung Bean protein isolate (%w/w)	Thickness (mm)	Tensile Strength (MPa)	Elongation at Break (%)
1	1	0.18±0.2	0.17±0.3	12±0.02
2	3	0.24±0.3	1.04±0.2	46±0.02
*3	5	0.36±0.3	1.32±0.6	63±0.04
4	7	0.37±0.2	1.08±0.2	48±0.09
5	9	0.41±0.1	1.12±0.3	57±0.05

*most suitable mechanical properties

Solubility of Mung Bean Protein Isolate Film

Figure (1) describes effect of amount of mung bean protein isolate on the solubility of edible film. Solubility of the mung bean protein isolate film prepared with 1% mung bean protein isolate was 80.1% while solubility of the mung bean protein isolate film based on 5% mung bean protein isolate was 70.2 %.

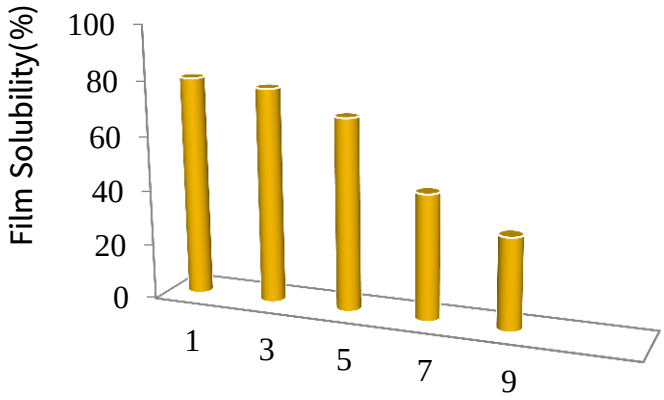


Figure (1) Solubility of Edible Film

Transparency of Mung Bean Protein Isolate Film

Figure (2) shows the effect of protein concentration on transparency of edible film. The transparency of 5 % mung bean protein film was 4.14 ± 0.3.

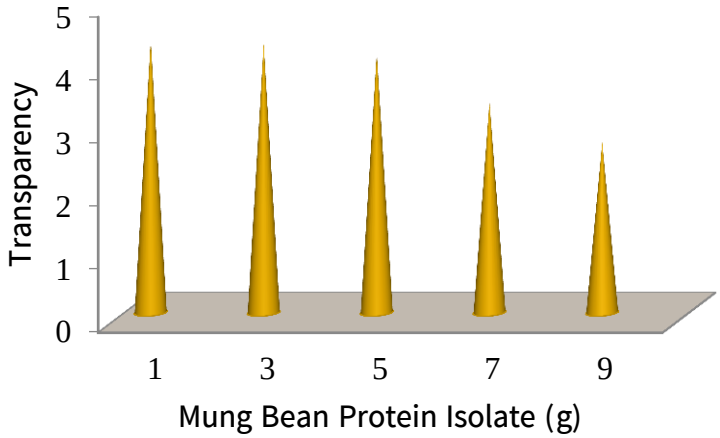


Figure (2) Transparency of Edible Film

Surface Morphology of Edible Film

Surface morphology of mung bean protein film is described in Figure (3). 5% mung bean protein film showed continuous surface without cracks and porous structure. The homogeneous matrix of film is a good indicator of its structure integrity, and consequently good mechanical properties [Siah *et al.*,2015].

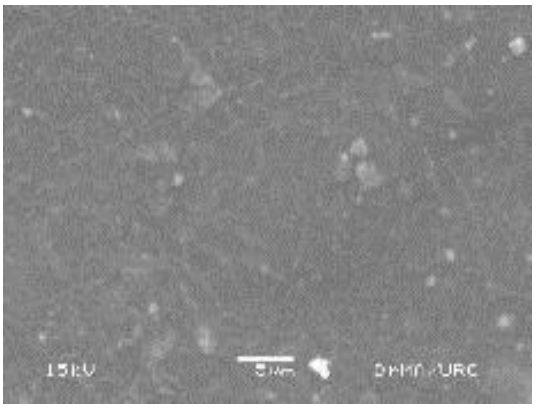


Figure (3) Morphology of Edible Film

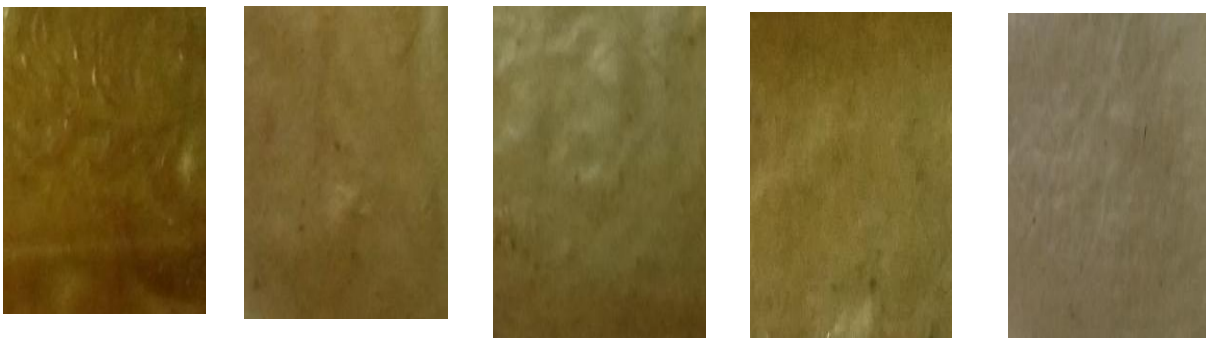
Biodegradability of Edible Film

Mung bean protein film was started degraded after one week and completely degradation was observed after two weeks. Biodegradability of mung bean protein isolate based film by soil burial test are shown in Table (2). The films buried in soil began to degrade in 7 days and became more degradation over time. More than 80 % of total film weight was lost in 14 days. In addition, edible films with different protein concentration of mung bean protein isolate is shown in Figure (4).

Table (2) Biodegradability of Mung Bean Protein Isolate Based Film (Soil Burial Test)

Sr.No	Mung Bean protein isolate (%w/w)	Initial Weight (g)	Weight Loss (% w/w)	
			Degradation after one week	Degradation after two weeks
1	1	0.2	80±0.03	98±0.04
2	3	0.28	73.33±0.01	96.67±0.02
*3	5	0.34	68.18±0.02	96.36±0.02
4	7	0.39	63.64±0.03	82.76±0.01
5	9	0.47	58.33±0.02	80.56±0.01

*most suitable condition



(a) (b) (c) (d) (e)

Figure (4) Edible Films with Different Compositions of Mung Bean Protein Isolate

(a)with 1 % mung bean protein isolate
(b) with 3 % mung bean protein isolate
(c) with 5 % mung bean protein isolate
(d) with 7 % mung bean protein isolate
(e) with 9 % mung bean protein isolate

Figure (5) Mustard Wrapped in Edible Film

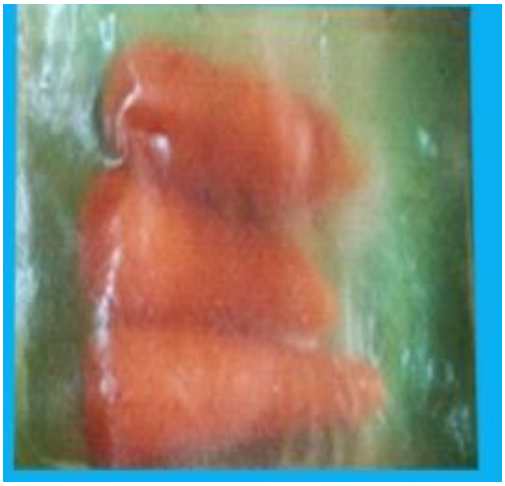


Figure (6) Carrots Wrapped in Edible Film

Figure (7) Water Convolvulus Wrapped in Edible Film

Figure (8) Tomatoes Wrapped in Edible Film

Conclusion

In the preparation of mung bean isolate film, 5 % mung bean protein film showed higher tensile strength and elongation at break but lower solubility than other films. Moreover, biodegradable film was completely damaged after 14 days.

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