QUALITY ATTRIBUTES OF RED CHILLIES (*Capsicum annum*) COATED WITH MUNG-BEAN PROTEIN ISOLATE

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ABSTRACT

The effect of mung bean protein isolates as edible coating (EC) in red chillies (*Capsicum annum*) were investigated. The red chillies samples were coated with (i) 5% protein EC and (ii) 5% protein EC + 2% potassium sorbate. The samples were stored at (i) 30 ± 3°C and (ii) 7 ± 3°C and at different duration of storage, samples from each storage temperature were analyzed for weight loss, pH, ascorbic acid, total soluble solid content and total plate count. Result showed that weight loss in coated red chillies is slower than uncoated red chillies (control) during storage at different temperatures. Similar result was obtained for reduction in ascorbic acid content in both samples at different storage temperature. However, pH of control sample increased rapidly than the treated samples at different temperature. No significant difference in total soluble solid contents among samples at different temperature. The TPC of the coated chillies with added 2% potassium sorbate was found to be lower when stored at 30°C. The TPC of chillies coated with EC and EC + 2% potassium sorbate when stored at 7°C showed a significant lower count as compared to the control.

OBJECTIVES

- **To develop a protein-based edible coating from mung bean protein isolates.**

- **To investigate the effects of the protein-based edible coating stored at different storage temperature (30°C dan 7°C) on the quality attiributes of red chilli in terms of weight loss, pH, ascorbic acid, total soluble solid and total plate count**

INTRODUCTION

- **Food products especially fruit and vegetable spoiled easily or undergo physical damaged when stored at low temperature for a long time. Spoilage resulted from degradative oxidation and respiration reactions could be controlled by application of edible coating (McHugh and Krochta, 1994).**
- **Edible coatings created a modified atmosphere within the fruit, control respiratory exchanges, and thus improved the fresh fruit and vegetables. The rate of moisture and gas (oxygen and carbon dioxide) transfer between a food product and its surrounding atmosphere can be reduced by coating the entire product with an edible coating (Tasdelen, 1998).**
- **Chilli (*Capsicum annum*) is a native of Central and South America. It can grow from sea level to 1800 m altitude or more in the tropics. There are about 150 different types of chillies, with colours including purple, red, yellow, orange and green. Chilli is high in vitamin A, C, iron and calcium. It contains magnesium, phosphorous sulphur and B-complex.**

METHODOLOGY

- **The samples were obtained from a local farm in Air Hitam, Penang**
- **Samples were dipped in water at 49C for 20 minutes (Akamine et al., 1953)**
- **Samples were then prepared for coating in the following manner**
  - **(i) uncoated**
  - **(ii) coated with edible coating**
  - **(iii) coated with edible coating + 2% potassium sorbate**

Films were prepared by dispersing mung bean protein isolates (5 %w/v), potassium sorbat (2%w/v), glycerol (3 % w/v) and glucose (5%w/v) in distilled water.,

↓

The protein isolate solution was homogenized using a homogenizer (Model Labor Technic Ultra-Turax T25) at 8000-9500rpm for 3 minutes.

↓

The pH was adjusted with 2N NaOH and the solution was homogenized for an additional 1 minutes.

↓

The solution was heated in the water bath at 75-80°C for 20 minutes and stirred by using overhead stirrer (Model Lab-Egg).

↓

The solution was then cooled at 37°C for 3-5 minutes.

FIGURE I: Preparation of Edible Coating.

Fresh chillies were dipped completely into the coating solutions for about 2 minute at room temperature

↓

The coated sample were dried using a fan.

↓

Coated and uncoated chillies were stored in perforated plastic bags and stored at 30°C and 7°C prior to analysis at different duration of storage

FIGURE II: Method of Coating Chillies.

RESULTS & DISCUSSION

- At 30±3°C and 7±3°C, the weight loss of all samples increased upon storage time (Figure 1(a) & 1(b)).
- The pH of all samples increased upon storage time at both temperatures. The coated red chillies was significantly ($P<0.05$) lower in pH as compared to the uncoated red chillies (Fig. 2(a) & 2(b)).
- At both storage temperatures, ascorbic acid content for coated red chillies was significantly ($P<0.05$) higher than the uncoated red chillies (Fig. 3(a) & 3(b)).
- No significant different observed in terms of total soluble solid content among the samples.
- Total bacteria count (TPC) of all samples increased upon storage time at both temperatures (Figure 4(a) & 4(b)). At 30±3°C, the coated red chillies with added potassium sorbate had significant lower TPC than the other two treated samples (Fig. 4(a)). However at 7°C the uncoated red chillies had significantly ($p<0.05$) higher TPC than the both coated red chillies.

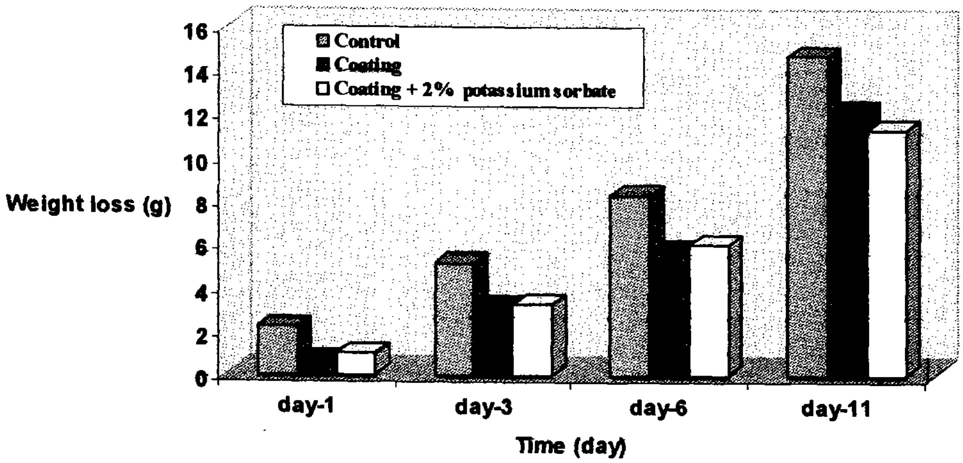

Figure 1 (a) Weight loss of red chilli stored at 30 ± 3 °C.

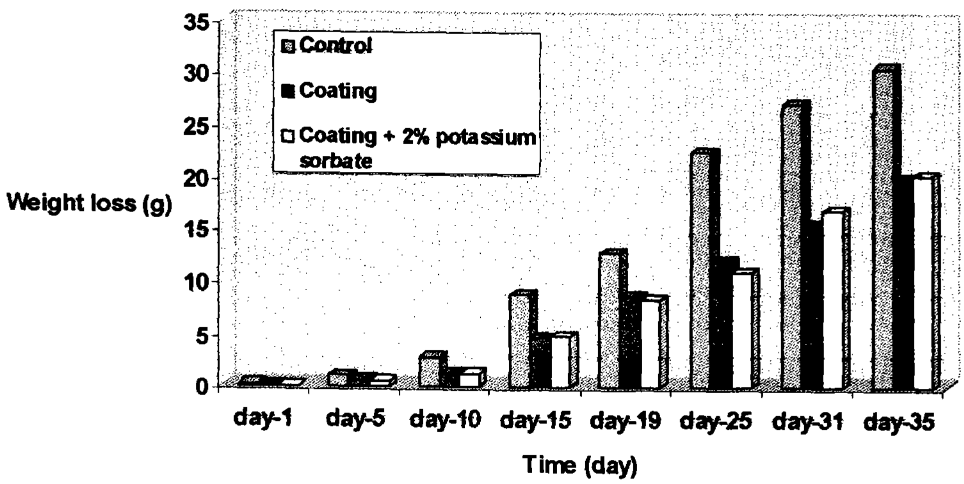

Figure 1 (b) Weight loss of red chilli stored at 7 ± 3 °C.

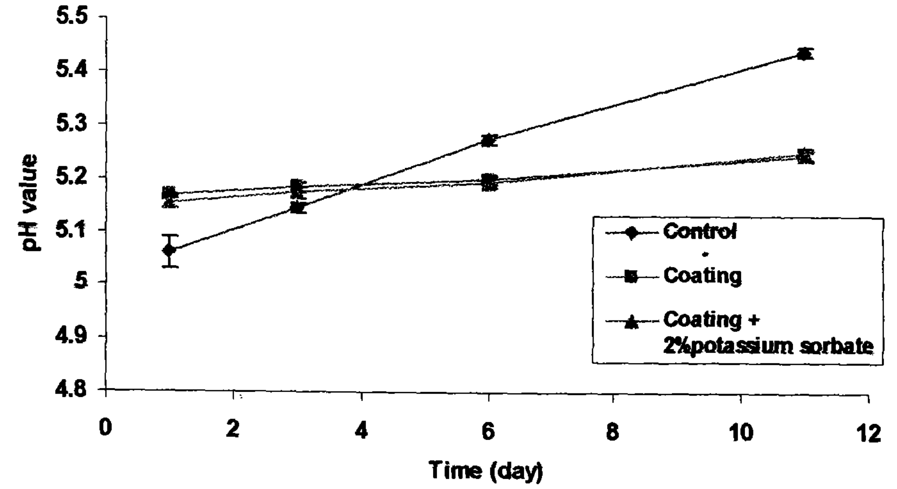

Figure 3 (a.) pH changes of red chilli stored at 30 ± 3 °C.

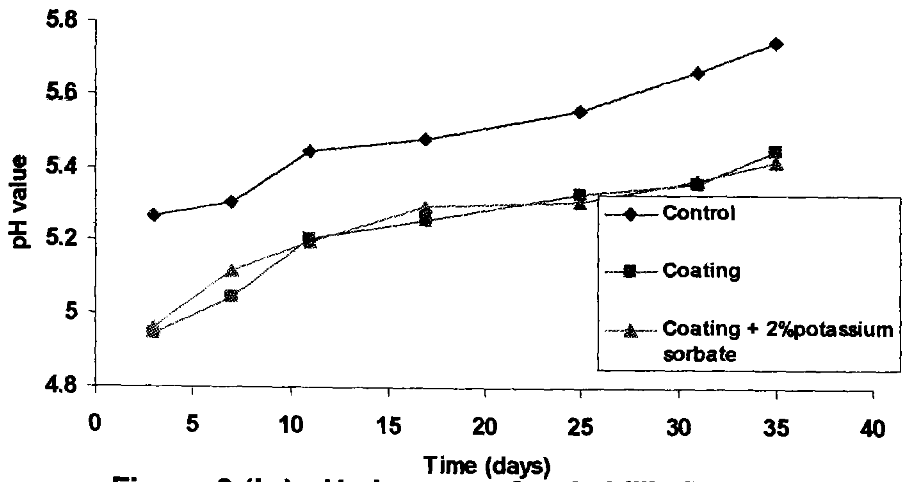

Figure 3 (b.) pH changes of red chilli cili stored at 7 ± 3 °C.

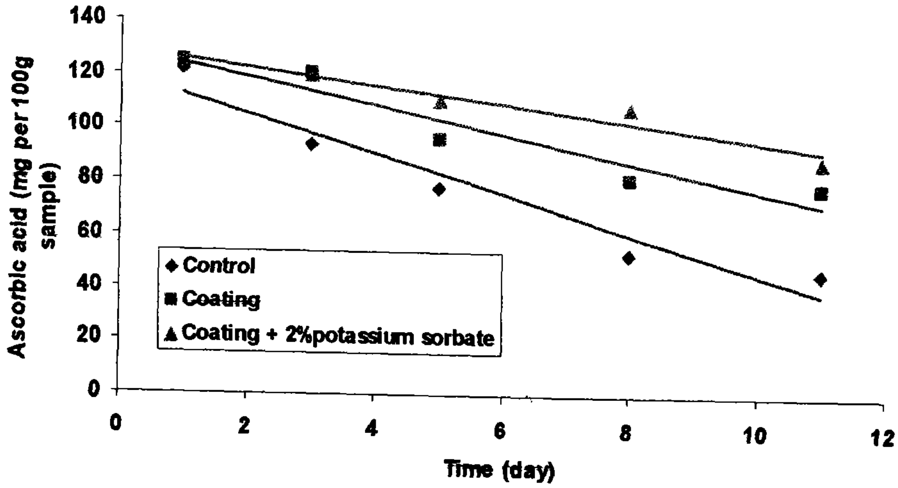

Figure 2 (a.) Ascorbic acid content of red chilli stored at 30 ± 3 °C.

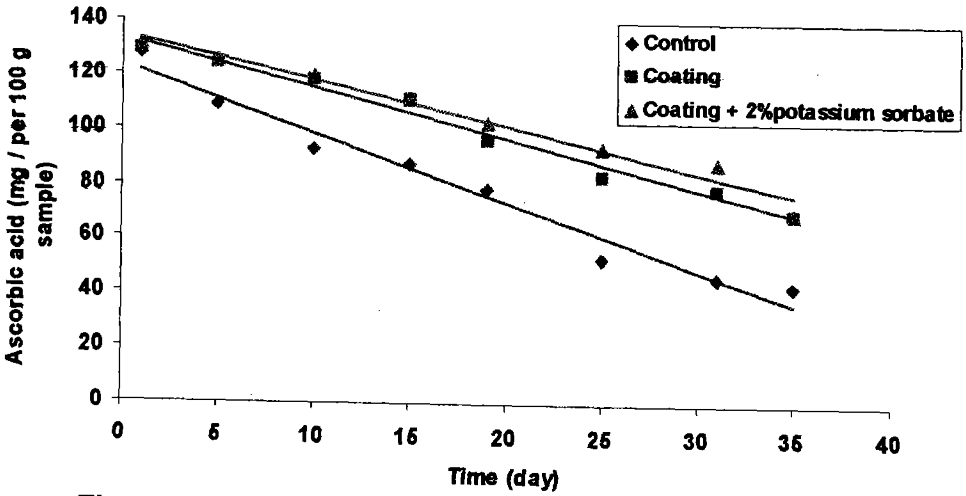

Figure 2 (b.) Ascorbic acid content of red chilli stored at 7 ± 3 °C.

Table 1. % Soluble solids of red chilli during storage

Time (day)	% Soluble solids		
	Uncoated chilli	Coated chilli	Coated + 2% potassium sorbate
Day 3	0.50 ± 0.00[a]	0.50 ± 0.00[a]	0.50 ± 0.00[a]
Day 6	0.50 ± 0.00[a]	0.50 ± 0.00[a]	0.50 ± 0.00[a]
Day 11	1.15 ± 0.12[a]	1.20 ± 0.16[a]	1.25 ± 0.16[a]

* Means within a row with the same letter are not significantly different at the 5% probability level.

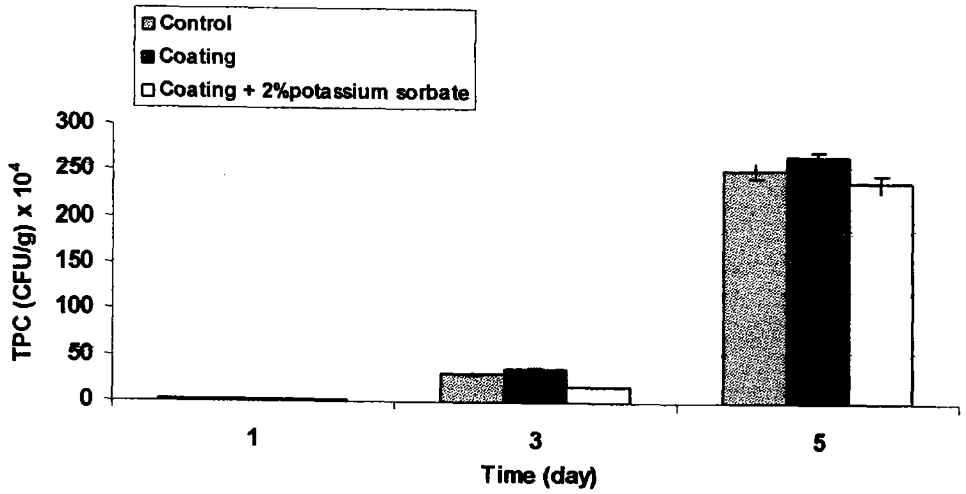

Figure 4 (a.) Bacteria content of red chilli stored at 30 ± 3 °C.

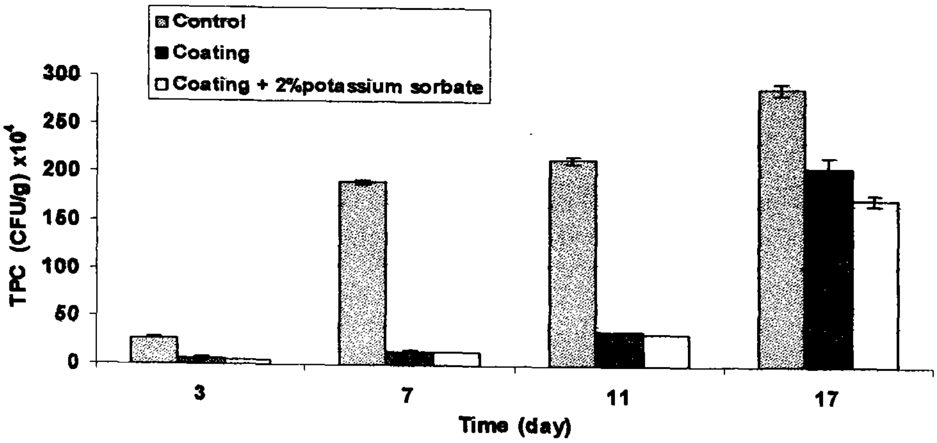

Figure 4 (b.) Bacteria content of red chilli stored at 7 ± 3 °C.

CONCLUSIONS

- **Mung Bean protein-based edible coating was found to reduce the weight and ascorbic acid content, pH and microbial count.**
- **Soluble solid content was not affected by protein-based edible coating.**
- **Storage temperature at 7°C was more effective in reducing weight and ascorbic acid losses.**
- **Storage at 7°C was suitable in extending the quality attributes of coated chillies during storage**
- **The TPC of red chillies was reduced in the both coated samples when stored at 7°C**

ACKNOWLEDGEMENT

This research was supported by IRPA grant sponsored by Ministry of Science, Technology and innovation of Malaysia (MOSTI).

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PHYSICAL, CHEMICAL AND ORGANOLEPTIC EFFECT OF EDIBLE COATING UTILIZATION ON VARIOUS DEEP FAT FRYING PRODUCTS

NOOR AZIAH .A.A. AND JULIANA AGNES MOSES

INTRODUCTION

- An edible coating formulation was developed by using mung bean *(Vigna radiata)* protein isolate with the inclusion of reducing sugar (glucose) to generate Maillard reaction.

- Antimicrobial agent; potassium sorbate & antioxidant agent; ascorbic acid were incorporated into the coating formulation. Glycerol was also added as a plasticizer agent.

- The edible coating formulation was then applied onto three fried products, namely samosa, donut and banana crisp.

OBJECTIVES

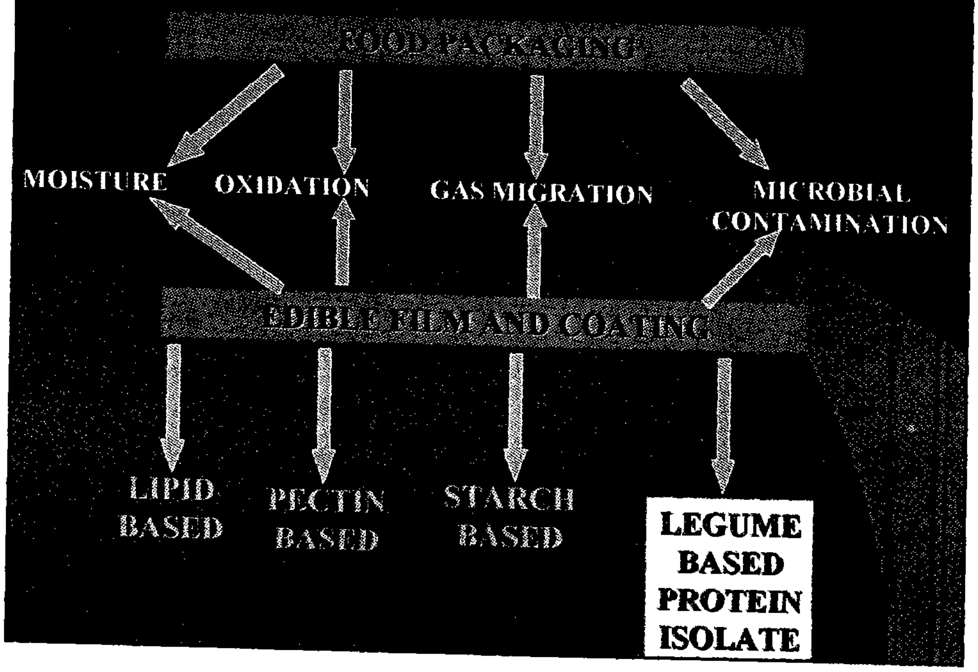
To develop an edible coating formulation from the protein isolate extraction from mung bean.

To investigate the ability of the coating to sufficiently extend the shelflife of 3 fried products; samosa, donut and banana crisp.

To conduct qualitative assessments on the coated samples, including mass loss, moisture content, PV determination, TPA, colour, SEM & sensory determination.

To evaluate the effectiveness of the edible coating in terms of oil uptake reduction and moisture retention during deep fat frying of coated samples.

1.0 RESEARCH BACKGROUND



2.0 LITERATURE REVIEW

SAMOSA

-traditional delicacy- India

-ingredients: skin: flour, water, salt, filling: yam, sugar

DONUT

-prominent snack in the West

- ingredients: flour, water, sugar, self raising flour

BANANA CRISP

-popular snack in Malaysia

-ingredients: thinly sliced banana (*Musa paradisiaca*)

SIMILARITIES

-short shelf life

-Prone to microbial contamination

-physical deformation :moisture loss

-chemical deterioration :lipid oxidation ; rancidity, off-flavour

2.0 LITERATURE REVIEW

EDIBLE COATING FORMULATION BASED ON MUNG BEAN PROTEIN ISOLATE (*Vigna radiata*)

- **Asian countries, USA, Canada**
- **Rich in protein, fiber, minerals (potassium). Low in fat & sodium. Add nutritional components to coated product.**
- **excellent antimicrobial & antioxidant carrier**
- **CO_2 & O_2 barrier properties. Efficient in moisture retention.**
- **modification of mung bean protein isolate edible coating thru Maillard reaction.**

Pic of mung bean

Fig 2.1 : Mung bean (*Vigna radiata*)

2.0 LITERATURE REVIEW

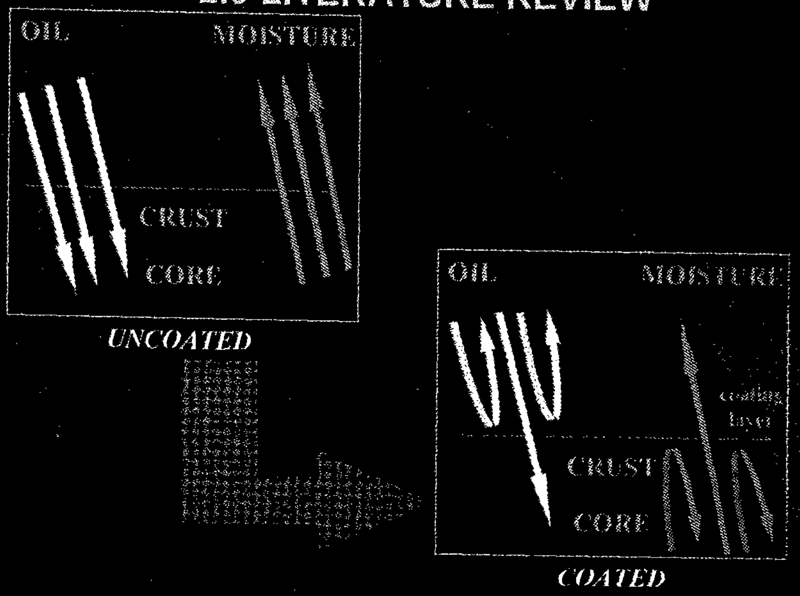


Fig 2.2 : Conceptual diagram illustrating the effect of edible coatings on moisture and fat transfer during deep fat frying of fried samples

2.0 LITERATURE REVIEW

PLASTICIZER- GLYCEROL

-increase film extensibility, strength & flexibility

-decrease fracturability, brittleness, WVTR, cracking & chipping during storage & handling

ANTIMICROBIAL AGENT- POTASSIUM SORBATE

-wide antimicrobial spectrum

-fungistatic, bacteriosratic & micostatic properties

-non-toxic (GRAS)

ANTIOXIDANT-ASCORBIC ACID

-prevents lipid oxidation

-natural antioxidant, non-toxic

3.0 MATERIALS & METHODS

PREPARATION OF MUNG BEAN FLOUR

Selected, washed with distilled water

Soaked (3 hrs, room temp)

Washed & dried-hot air dryer (12 hrs, 50-60 °C)

Grounded (grinder)

PREPARATION OF MUNG BEAN PROTEIN ISOLATE

Adjusted to pH 9 (1N NaOH) (ratio 15:1, water:flour, v/w)

Homogenized (25°C, 20 mins)

Centrifugation (1000xG, 20 mins)

Precipitation (1N HCl, till pH 4)

Repeated centrifigation & washed

Adjusted to pH 7 (1N NaOH)

Freezedrying (2 days, -50°C)

FORMULATION OF MUNG BEAN EDIBLE COATING

Fig 3.1: Summary of mung bean protein isolate edible coating preparation process

3.0 MATERIALS & METHODS

FORMULATION OF MUNG BEAN EDIBLE COATING

Mung bean protein isolate (5% w/v) + potassium sorbate (0.3% w/v) in distilled water

+ glucose (5% w/v) & glycerol (3% w/v)

Homogenized (9500 rpm, 3 mins)

Adjusted to pH 10 (2N NaOH).{ Maillard reaction}

Homogenized (9500 rpm, 1 min)

Cooled & ascorbic acid added (1g/100ml)

APPLICATION OF FORMULATED MUNG BEAN EDIBLE COATING ON SAMPLES

Fig 3.1: Summary of mung bean protein isolate edible coating preparation process

3.0 MATERIALS & METHODS

SAMOSAS, DONUTS & BANANA SLICES

coated in coating formulation (10 secs)

Hanged horizontally to dry on a pair of retort stands (for banana slices, dried vertically on net structure) (approx. 3 hrs)

Deep fat frying (150-180 °C, 3 mins)

Placed on tissue to absorb surface oil

Cooled

Kept in sterilled polyethylene

Stored in incubator (25 °C, 9 days)

Physical, chemical & organoleptic evaluation

Fig 3.2 : Summary of application of mung bean edible coating on 3 deep fat fried products ; samosa, donut & banana slices

PHYSICAL, CHEMICAL & ORGANOLEPTIC EVALUATION OF COATED DEEP FAT FRIED PRODUCTS; SAMOSA, DONUT& BANANA CRISPS

DAY 0 :

- MASS LOSS
- MOISTURE CONTENT
- FAT DETERMINATION
- SEM
- SENSORY EVALUATION

DAY 1, 3, 5, 7, 9 :

- PEROXIDE VALUE
- TPA
- COLOUR

4.0 RESULTS & DISCUSSIONS

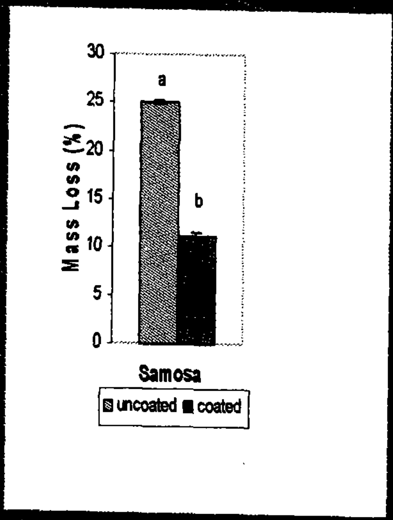


Fig. 4.1a: Mass loss of uncoated & coated samosa

Columns with the same letter are not significantly different at ($p<0.05$). Bars indicate standard deviation.

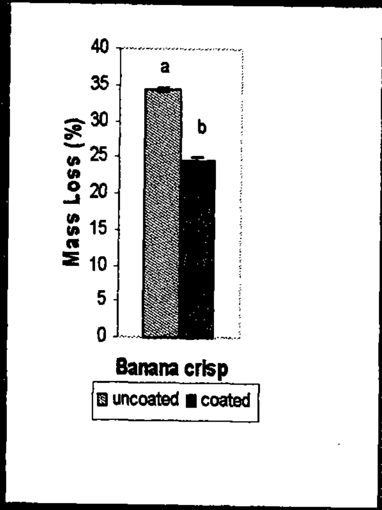


Fig. 4.1b: Mass loss of uncoated & coated banana crisp

Columns with the same letter are not significantly different at ($p<0.05$). Bars indicate standard deviation.

4.0 RESULTS & DISCUSSIONS

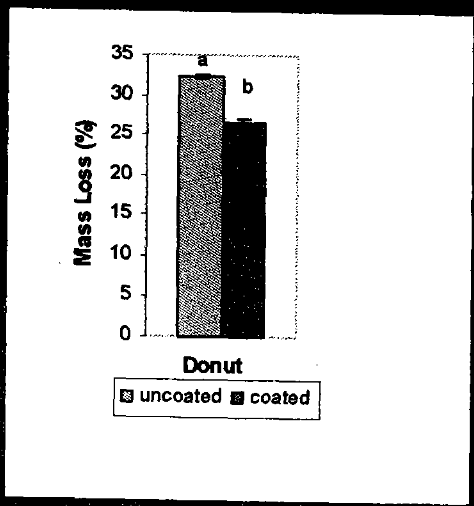


Fig. 4.1c: Mass loss of uncoated & coated donut

Columns with the same letter are not significantly different at ($p<0.05$). Bars indicate standard deviation.

4.0 RESULTS & DISCUSSIONS

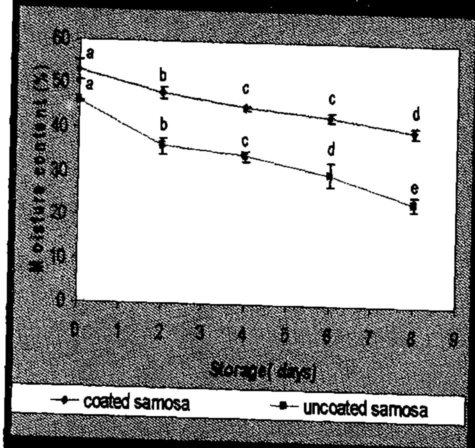


Fig. 4.2a: Moisture content of uncoated & coated samosa

Different letters within the same group are significantly different at ($p<0.05$). Bars indicate standard deviation.

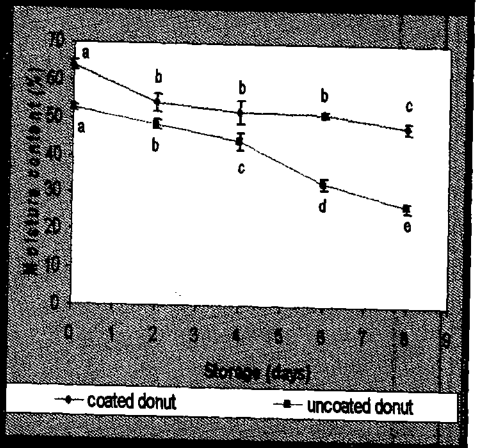


Fig. 4.2b: Moisture content of uncoated & coated donut

Different letters within the same group are significantly different at ($p<0.05$). Bars indicate standard deviation.

4.0 RESULTS & DISCUSSIONS

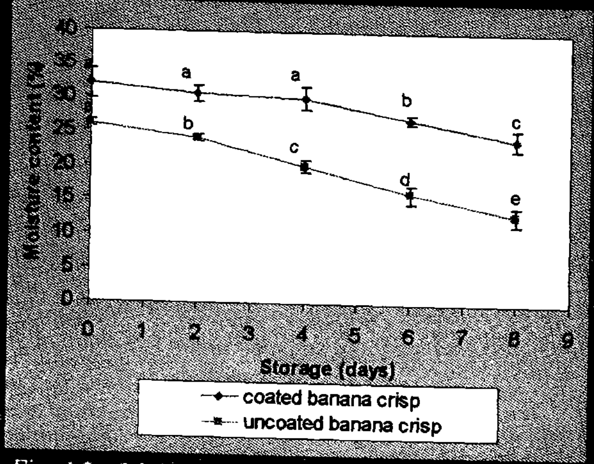


Fig. 4.2c: Moisture content of uncoated & coated banana crisp

Different letters within the same group are significantly different at ($p<0.05$). Bars indicate standard deviation.

4.0 RESULTS & DISCUSSIONS

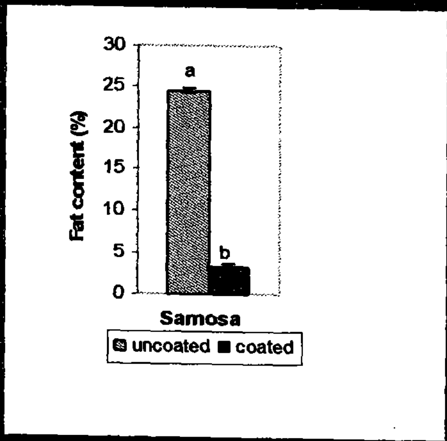


Fig. 4.3a: Fat content of uncoated & coated samosa

Columns with the same letter are not significantly different at ($p<0.05$). Bars indicate standard deviation.

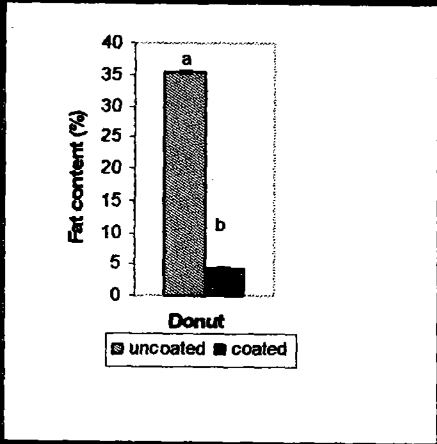


Fig. 4.3b: Fat content of uncoated & coated donut

Columns with the same letter are not significantly different at ($p<0.05$). Bars indicate standard deviation.

4.0 RESULTS & DISCUSSIONS

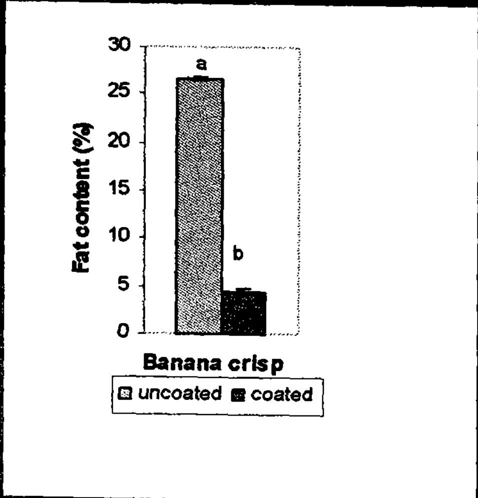


Fig. 4.3c: Fat content of uncoated & coated banana crisp

Columns with the same letter are not significantly different at ($p<0.05$). Bars indicate standard deviation.

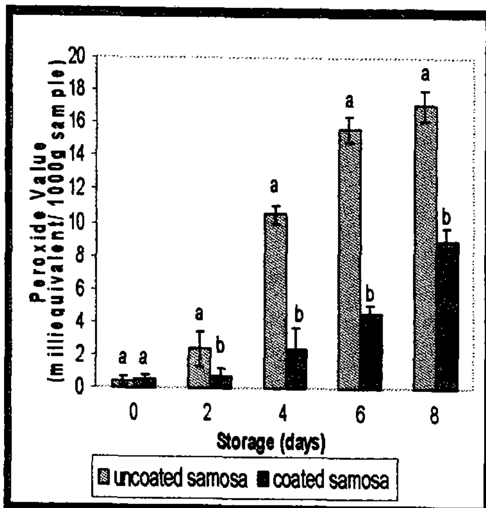


Fig. 4.4a: Peroxide value of uncoated & coated samosa during storage

Columns with the same letter in different groupsare not significantly different at (p<0.05). Bars indicate standard deviation.

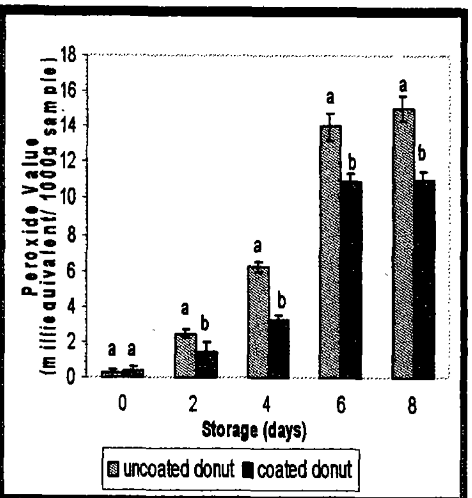


Fig. 4.4b: Peroxide value of uncoated & coated donut during storage

Columns with the same letter in different groups are not significantly different at (p<0.05). Bars indicate standard deviation.

4.0 RESULTS & DISCUSSIONS

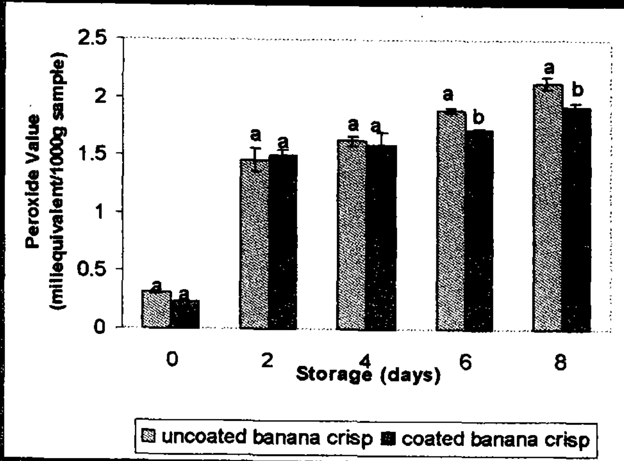


Fig. 4.4c: Peroxide value of uncoated & coated banana crisp during storage

Columns with the same letter in different groups are not significantly different at (p<0.05). Bars indicate standard deviation.

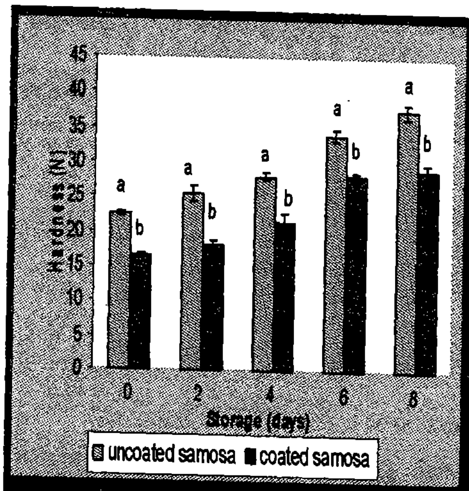


Fig. 4.5a: Hardness value (N) of uncoated & coated samosa during storage

Columns with the same letter in different groups are not significantly different at ($p<0.05$). Bars indicate standard deviation.

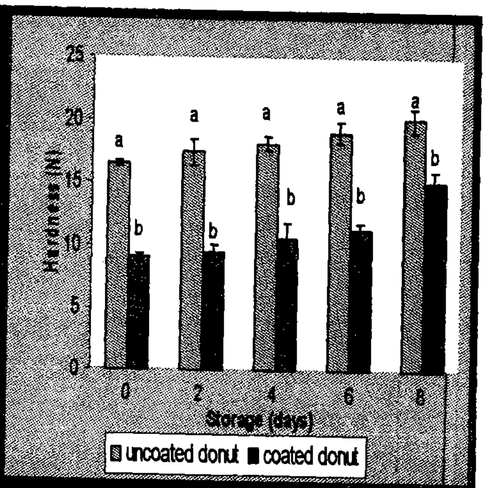


Fig. 4.5b: Hardness value (N) of uncoated & coated donut during storage

Columns with the same letter in different groups are not significantly different at ($p<0.05$). Bars indicate standard deviation.

4.0 RESULTS & DISCUSSIONS

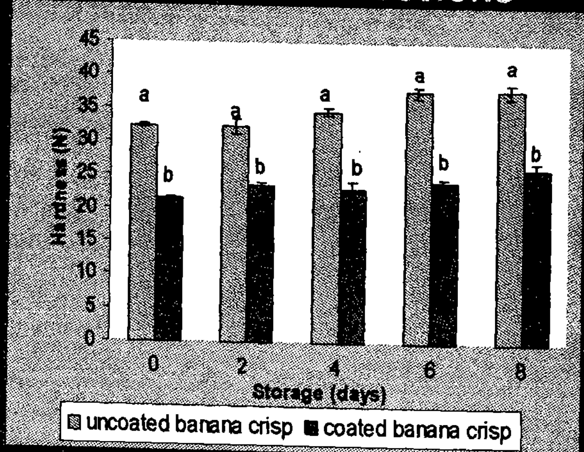


Fig. 4.5c: Hardness value (N) of uncoated & coated banana crisp during storage

Columns with the same letter in different groups are not significantly different at ($p<0.05$). Bars indicate standard deviation.

4.0 RESULTS & DISCUSSIONS

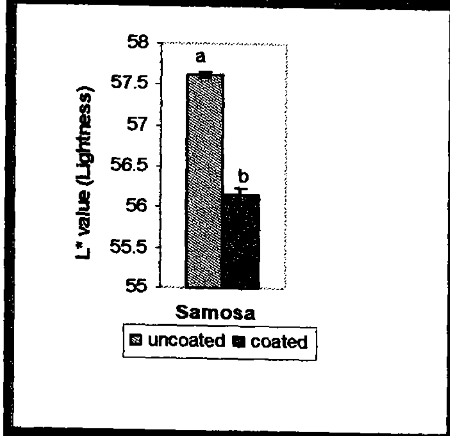


Fig. 4.6a: L* value of uncoated & coated samosa

Columns with the same letter are not significantly different at ($p<0.05$). Bars indicate standard deviation.

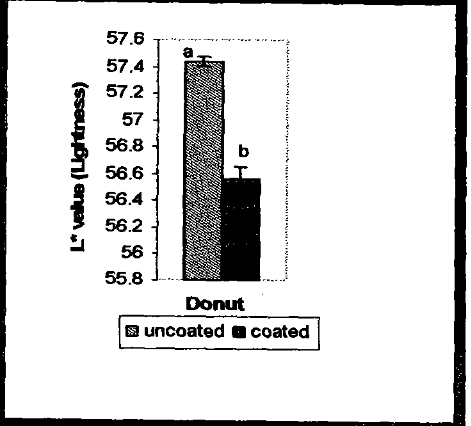


Fig. 4.6b: L* value of uncoated & coated donut

Columns with the same letter are not significantly different at ($p<0.05$). Bars indicate standard deviation.

4.0 RESULTS & DISCUSSIONS

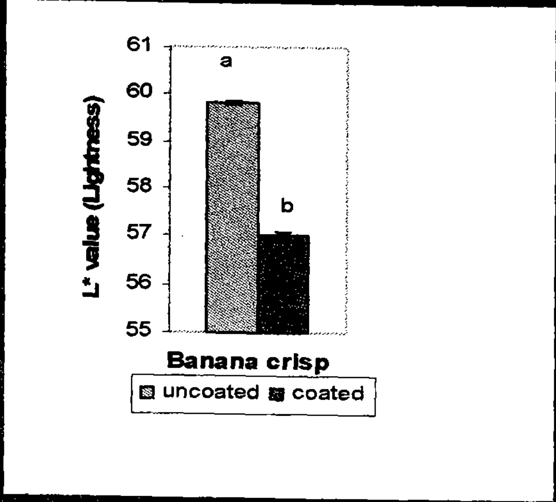


Fig. 4.6c: L* value of uncoated & coated banana crisp

Columns with the same letter are not significantly different at ($p<0.05$). Bars indicate standard deviation.

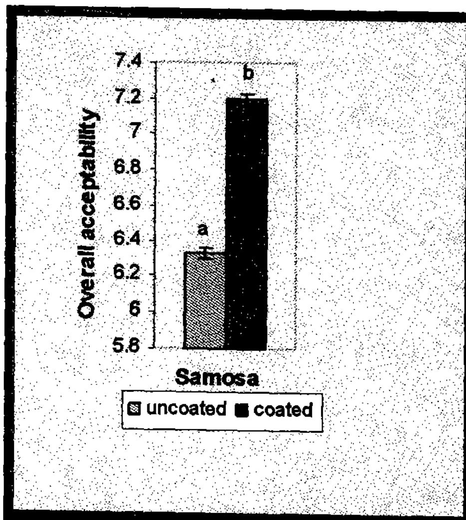


Fig. 4.7a: Overall acceptability of uncoated & coated samosa

Columns with the same letter are not significantly different at ($p<0.05$). Bars indicate standard deviation.

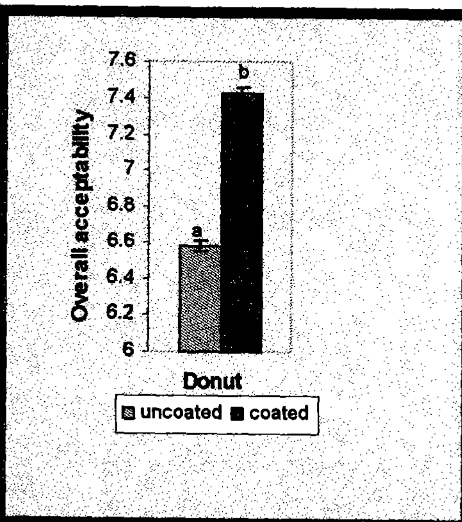


Fig. 4.7b: Overall acceptability of uncoated & coated donut

Columns with the same letter are not significantly different at ($p<0.05$). Bars indicate standard deviation.

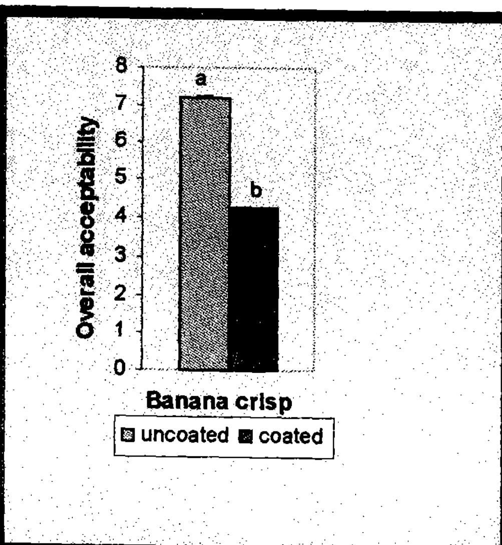


Fig. 4.7c: Overall acceptability of uncoated & coated banana crisp

Columns with the same letter are not significantly different at ($p<0.05$). Bars indicate standard deviation.

4.0 RESULTS & DISCUSSIONS

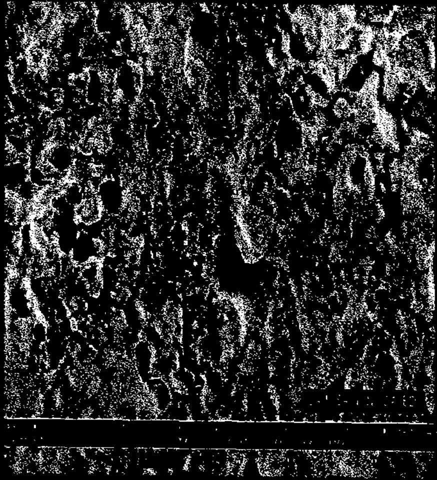


Fig. 4.8a: Electron micrograph of uncoated samosa at 43X magnification

Fig. 4.8b: Electron micrograph of coated samosa at 43X magnification

4.0 RESULTS & DISCUSSIONS

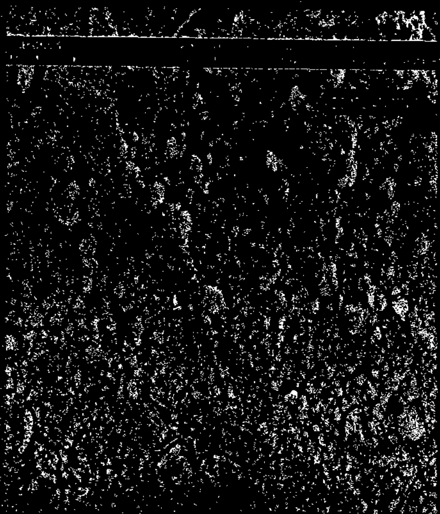


Fig. 4.9a: Electron micrograph of uncoated donut at 43X magnification

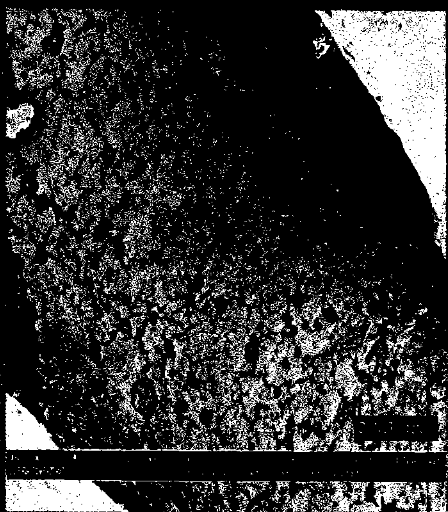


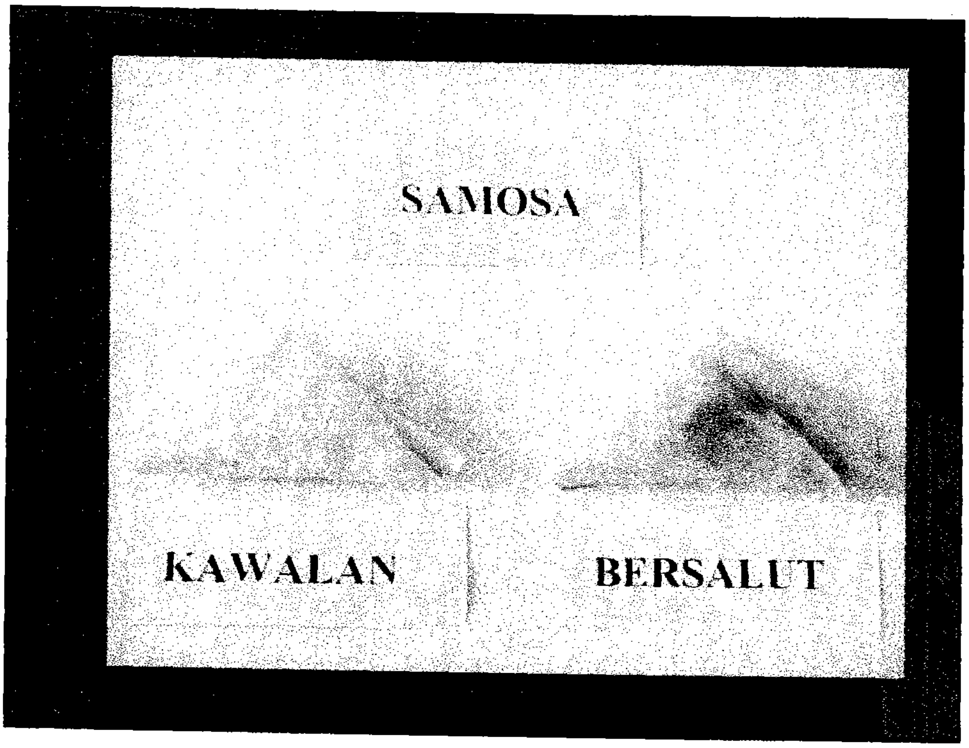
Fig. 4.9b: Electron micrograph of coated donut at 43X magnification

APPENDIX A

- An edible coating was succesfully developed from mung bean protein isolate.
- Electron micrographs (SEM) revealed a strong network structure between protein isolate and glucose, which improves the mechanical properties of coating.
- Results showed that mung bean edible coating significantly reduces moisture loss in sample during storage.
- Coated samples portrayed significant reduction in mass loss & higher reduction of oil uptake during deep fat frying.
- PV test indicated that the rancidity rate in coated samples are lower throughout storage time.
- Colorimetric analysis showed a decrease L* value & higher intensity in coated samples.
- Sensory score was higher in overall acceptability for coated samples. However, coated banana crisps were not favoured by panellists.
- Overall research showed that mung bean edible coating has proven to be economical, suitable & effective coating apllication on deep fat fried products.

6.0 RECOMMENDATIONS FOR FURTHER STUDIES

- To conduct the edible coating formulation & application process in a sterilized condition in order to avoid or minimize exposure to microbial contamination.
- To conduct microbial evaluation to determine the ability of coating to efficiently inhibit microbial growth during storage
- To assess synergystic effects of various plasticizers in improving the elasticity & barrier properties of coating.
- To investigate hurdle effects from various antimicrobial agents.
- Further studies on types & nutritional compositions of different oils used in deep fat frying & the effects to coated samples during storage.


SAMOSA
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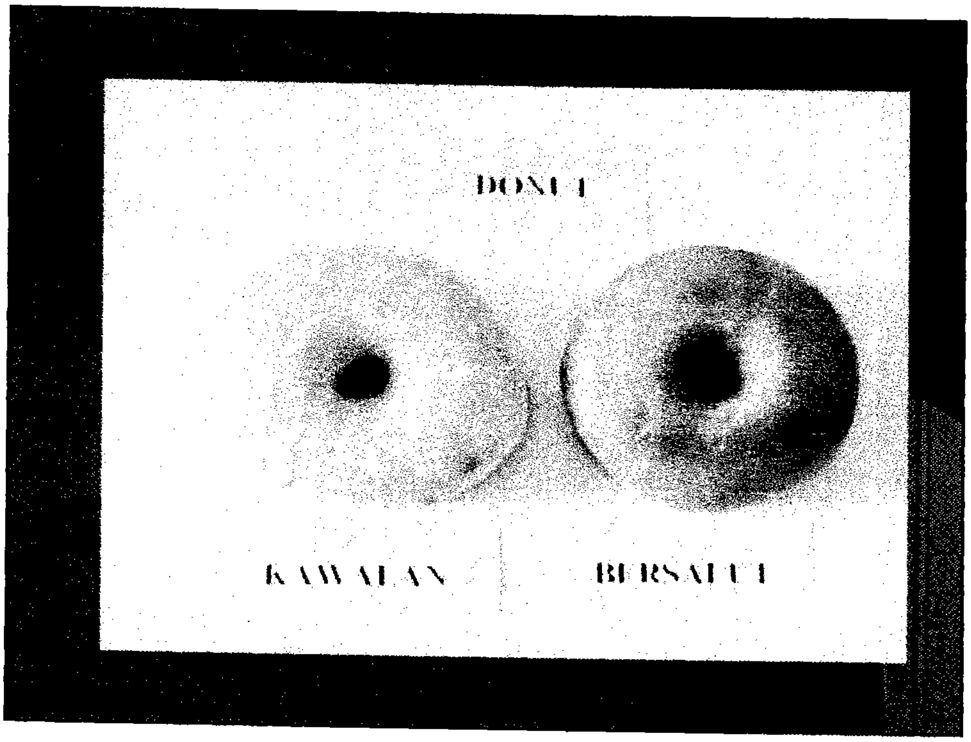

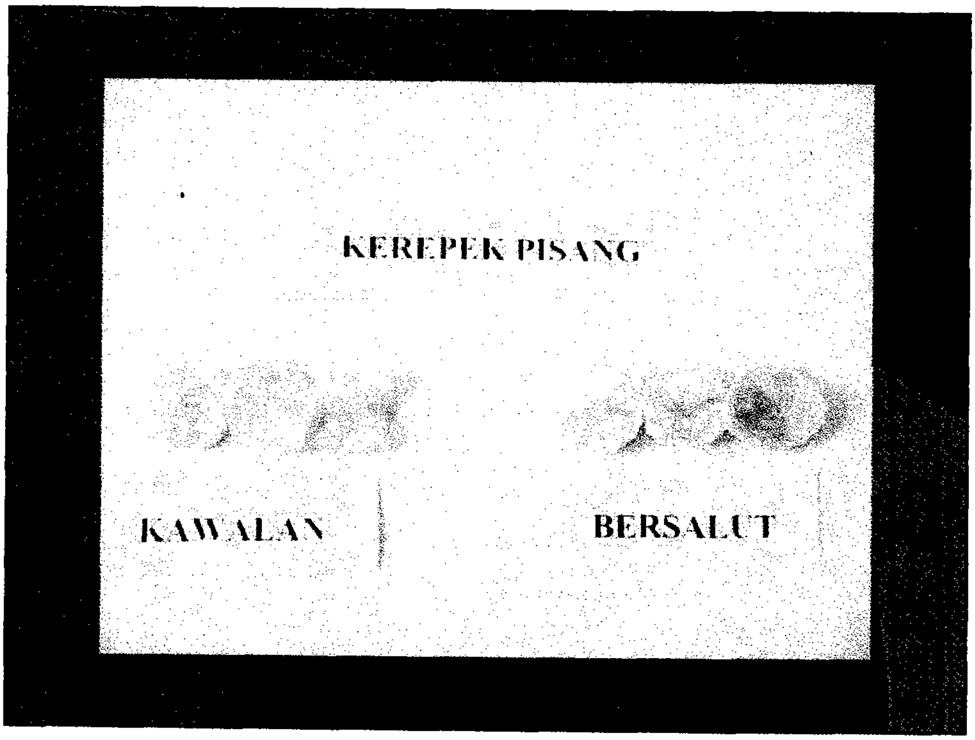
KEREPEK PISANG
KAWALAN
BERSALUT

KAJIAN PENGHASILAN FILEM BOLEH DIMAKAN DARIPADA ISOLAT PROTEIN KACANG HIJAU (*VIGNA RADIATA*) DAN KESANNYA TERHADAP JANGKA HAYAT CILI MERAH (*CAPSICUM ANNUM*).

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2005