



UNIVERSITI PUTRA MALAYSIA

APPLICATION OF SAGO STARCH IN INSTANT NOODLES

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By

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**Thesis Submitted in Fulfilment of the Requirement for the
Degree of Master of Science in the Faculty of Food Science and Biotechnology
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March 2001



**This work is dedicated to
all my family members
who had given me constant
encouragement and support.**

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Master of Science

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Chairman: Encik Dzulki-fly B. Mat Hashim

Faculty: Food Science and Biotechnology

A study was conducted to investigate the effects of utilizing sago starch in the preparation of instant noodles. The first aspect of the study was to observe the effects of partial substitution of native sago starch on the amylograph profiles of the composite flours and the textural quality of the instant noodles. From the study, it was concluded that the instant noodles produced using native sago starch were of inferior quality in terms of colour, cooking losses, texture and sensory acceptability in comparison to the control which was prepared from 100% wheat flour. However, of all the wheat flour/sago starch blends, the most acceptable in terms of colour and texture from both instrumental and sensory assessment was the sample that was substituted with 20% and below.

The second aspect of this study was to determine whether the different types of firming agents could improve the textural quality of the instant noodles produced. The firming agents that were used in the study were alkali mixtures of potassium and



sodium carbonate, guar gum and potassium alum. The composite flour used was at the ratio of 80% wheat flour to 20% sago starch. Based on the results, the use of the alkali mixture or guar gum between the range of 0.5% to 1.0% concentrations produced noodles that have improved noodle colour and strength, in terms of firmness and elasticity, consequently giving a more acceptable product compared to the addition of potassium alum. Potassium alum can be a potential firming additive but has to be used at concentrations of more than 1%. However, the use of potassium alum at more than 1% levels was not studied.

Finally, the last part of the study involved an investigation on the effect of partially replacing the wheat flour in the instant noodle preparation with modified sago starch on the textural quality of the instant noodle. The phosphorylated sago starch PSS1 was prepared in the laboratory using a mixture of 5% sodium tripolyphosphate and 2% sodium trimetaphosphate at pH 9.5 at a temperature of 135°C for 2 hours whereas a physically modified sago starch NMS22 was provided by a sago starch company. The replacement of wheat flour with PSS1 (phosphorylated sago starch) and NMS22 up to 35% improved the textural quality of the sago starch substituted wheat noodles. The resulting noodles became more firm and elastic when cooked. Noodles with PSS1 were preferred since there is a reduced cooking loss even at a higher substitution level and less sticky during cooking. Otherwise, the type and the quantity of modified starches did not affect the overall acceptability of the noodles up to 35% replacement since only the colour was significantly affected at substitution levels greater than 35%.

Abstrak Tesis yang dikemukakan kepada Senat Universiti Putra Malaysia
sebagai memenuhi keperluan untuk ijazah Master Sains

PENGGUNAAN KANJI SAGU RUMBIA DI DALAM MI SEGERA

Oleh

NORAMINA BT. HJ. HAMPDEN

Mac 2001

Pengerusi: Encik Dzulkifly B. Mat Hashim

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Satu kajian terhadap kesan penggunaan kanji sagu rumbia ke atas penyediaan mi segera telah dijalankan. Aspek pertama di dalam kajian ini ialah melihat kesan penggunaan dan penggantian tepung gandum dengan kanji sagu natif (tidak terubahsuai) terhadap profil amilograf tepung komposit tersebut dan kualiti tekstur mi segera yang telah dihasilkan. Dalam kajian ini, keputusan menunjukkan bahawa mi segera yang dihasilkan menggunakan kanji sagu rumbia adalah kurang bermutu dari segi warna, kehilangan bahan pepejal semasa pemasakan, tekstur dan penerimaan sensori bila dibandingkan dengan sampel mi segera yang dihasilkan menggunakan 100% tepung gandum. Bagaimanapun, penilaian instrumental dan sensori menunjukkan bahawa penerimaan mi yang dihasilkan dari tepung komposit yang mengandungi 20% atau kurang kanji sagu amat menggalakkan dari segi warna dan tekstur.

Aspek kedua kajian ialah untuk memperbaiki kualiti tekstur mi segera yang dihasilkan dalam kajian sebelumnya dengan menggunakan additif. Additif yang digunakan ialah campuran potassium dan sodium karbonat, gam guar dan potassium alum. Tepung komposit yang digunakan mengandungi 20% kanji sagu dan 80% tepung gandum. Keputusan kajian menunjukkan penggunaan campuran alkali atau gam guar di antara julat 0.5% dan 1.0% memberi kesan yang amat signifikan ke atas kekerasan dan keanjalan mi dan memberi warna yang lebih menarik. Oleh itu, produk ini lebih diterima dibandingkan dengan penggunaan potassium alum. Potassium alum berpotensi digunakan sebagai additif dalam konsentrasi lebih tinggi dari 1.0%. Bagaimanapun, penggunaan potassium alum pada kadar tersebut tidak dikaji.

Kajian terakhir dalam projek ini ialah menyiasat kesan penggantian tepung gandum dengan kanji sagu terubahsuai terhadap mutu tekstur mi segera. Kanji sagu terfosforilasi PSS1 dihasilkan di makmal menggunakan campuran 5% Sodium Tripolifosfat dan 2% Sodium Trimetafosfat pada pH 9.5, suhu 135°C untuk 2 jam, manakala kanji sagu terubahsuai NMS22 diperolehi dari syarikat sagu tempatan. Penggantian tepung gandum dengan PSS1 dan NMS22 sehingga 35% boleh menghasilkan mi segera yang bermutu dari segi tekstur. Mi segera yang dihasilkan menjadi lebih kenyal dan elastik bila dimasak. Mi yang ditambah dengan PSS1 lebih diterima sebab kehilangan peratusan pepejal semasa pemasakan adalah kurang dan tidak melekit. Keseluruhannya, jenis dan kuantiti kanji sagu terubahsuai tidak memberi kesan yang ketara pada tahap gantian sehingga 35%, hanya kesan terhadap warna mi yang amat signifikan ketika dinilai.

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I hereby declared that the thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declared that it has not been previously or concurrently submitted for any other degree at UPM or other institutions.

NORAMINA BT HJ HAMPDEN

Date:

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CHAPTER 1

GENERAL INTRODUCTION

Noodles are important end products from cereal grains, particularly wheat, and are a staple food in many Asian countries. Noodles are usually made from wheat flour by a process of sheeting and cutting. Flour-based noodles are mainly consumed in Asian countries. Other types of cereal grains that can be used to prepare noodles include rice, buckwheat, mung bean and sweet potato.

Noodles have extended shelf life in the dried form and retain their sizes and shapes during packing and shipping. They are relatively inexpensive and easily prepared. They are also important nutritionally, being high in complex carbohydrates and low in fat. Therefore, they appear frequently in both the diets of the poor and the rich.

There are various types of noodles produced throughout the world. Instant noodles are one of the most popular oriental noodles in East Asia and are growing in popularity throughout the world. In Malaysia, it has become one of the fastest growing industries. Instant noodle is widely consumed by all the ethnic groups in the country as a convenience food (Abu Kassim, 1986). Instant noodles generally refer to the steamed and deep-fat fried products, which are called *ramyon* in Korea and



ramen in Japan (Kim, 1996). At present, instant noodles are sold in polythene bags, cup or bowl whereby a soup base is included separately for seasoning.

Instant noodles are prepared from a wheat flour dough which contains an alkaline salt composition containing greater than one Potassium or Sodium carbonates as an additive and ortho, meta or polyphosphates (UK Patent 1980). However, certain high quality noodles is produced without the addition of alkali. Instant noodles are boiled and reconstituted in an amount of water in excess of the predetermined amount required for the reconstitution of the noodles. The boiled juice, in excess of a predetermined amount remaining after restoration is then separated and consumed as soup.

There is a tremendous increase in the production and consumption of instant noodles in Malaysia. These types of noodle product need a medium to standard hard wheat with crude protein between 9-13% and 0.35-0.55% ash content. The raw ingredient for the production of instant noodles is basically wheat, which is wholly imported in Malaysia. Hence, the need to reduce the dependence of utilizing wheat as the main raw material and finding an alternative source in the production of instant noodles needs to be studied.

Sago starch is a valuable source of carbohydrates and is abundantly available in Malaysia, particularly in Sarawak. It can be a potential source of raw material to partially replace or substitute wheat flour. Currently, sago starch is much cheaper than wheat starch (RM600.00 per tonne). Its utilization will reduce the production

costs and as a result, investors may develop an interest to set up an instant noodle factory based on sago starch. In addition, it would be able to reduce the country's dependence on imported wheat.

Some of the requirements of instant noodles include colour, dough strength and protein content. Noodle colour is usually bright, light yellow. The noodle dough must be moderately strong to pass through the noodle machine intact. The protein content of the flour used in the production of instant noodles is also important because it will influence the degree of the oil uptake during frying and the texture of the cooked noodle. Another requirement is the starch quality of the raw material used. The texture of the noodles is highly dependent on the gelatinized starch. Therefore, the inherent pasting viscosity is very important. A high starch paste viscosity is associated with noodle having the best eating quality.

Moss (1987) mentioned that the choice of flour might be related to the desired cooking volume of the resulting noodles. Softer flour with a lower protein content is usually preferred to produce noodles that are bright but soft in eating quality. This may be due to the rapid gelatinization of the starch and this quality is extremely important in the manufacture of instant cup noodles. The colour, texture and taste of the instant noodles may vary with the different raw materials substituted depending on the physical and chemical properties of the flours and starches used. Currently, instant noodle produced in Malaysia is made up wholly of wheat flour. In this study, sago starch is substituted for wheat flour in the preparation of instant noodles.

The substitution of sago starch in the production of instant noodles may bring about changes to the physical characteristics of the product. The characteristics of sago starch are much different from wheat that they may affect the instant noodle's quality. The addition of carbonates, gums and modified starch as firming agents to the instant noodles that substituted with sago starch will be studied. Modified potato starch has been used in the production of instant noodles as it helps the noodle to rehydrate evenly from surface to center so the texture remains uniform (Labell, 1990). In this study, two types of modified sago starches were used during the preparation of noodles. These modified starches were prepared for food applications.

The objectives of the study were:

- (1) To determine the optimum level of substitution of wheat flour with sago starch in the production of instant noodles
- (2) To compare the effect of different types of firming agents on the textural characteristics of wheat-sago noodles
- (3) To study the feasibility of using modified sago starches in the production of instant noodles