

Development of Seafood Bar from Left over
Dried Squid

By
Ms. Sarawan Kanin

A special project submitted to Assumption
University in part fulfillment of the requirement to
Bachelor degree in Science Biotechnology
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Title : Development of Seafood Bar from Left over Dried Squid

By : Ms. Sarawan Kanin

Advisor : Ms. Aussama Suntrunnarunrungsi

Level of study : Bachelor of Science

Department : Food Technology

Faculty : Biotechnology

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Aussama S

Advisor

(Ms. Aussama S.)

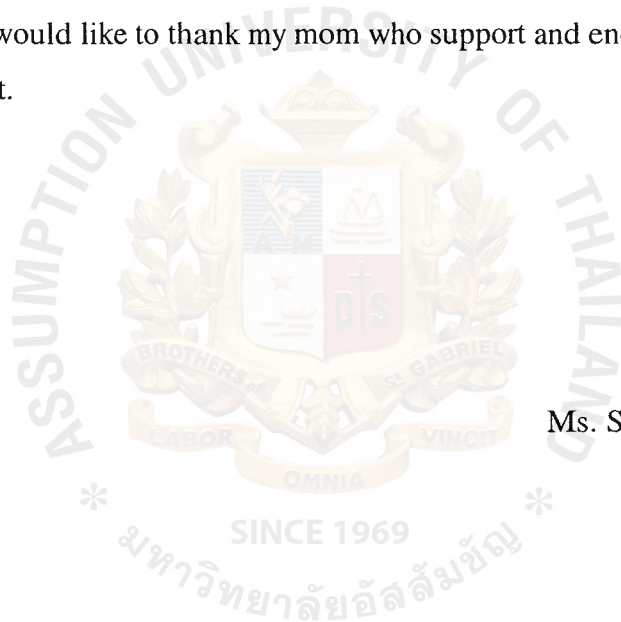
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Ms. Sarawan Kanin

July, 2006

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Abstract

The development of Seafood Bar from Left over Dried Squid aimed to adding value for left over dried squid from the process by developing a new product and provide new style of cereal bar for the consumer. The consumer survey was done for idea generation, it was found that the ingredients in seafood bar should included dried fish, dried shrimp, dried squid, peanut and dried herb. The taste and flavor of the product should be the original flavor. The important attributes were taste, crispiness and freshness. Formulation and study on appropriate process were conducted. There was a preliminary test of suitable process and observation the appearance of the product. The processes began by weighing all ingredients then heating the liquid part for 3-5 minutes until temperature reached 95 °C after that mixed solid part with syrup for 3 minutes. The 25 g. of mixture was taken to the mold and pressed for 10 minutes. The seafood bar was dried at 70 °C for 30 minutes and cooled down for 5-10 minutes. Type of squid, type of sauce, percentage peanut, dried chili and size of dried squid were studied to formulate the seafood bar. The prototype of seafood bar consisted of 33.5% puffed rice, 21.5% dried squid (prepared by chopped for 5 seconds), 15% peanut, 8.85% Glucose Syrup, 14.25% Sugar, 0.25% Chili, 0.45% of Vinegar, 6.2% Water The most preferable shape was bar shape of 25g. According to the result of consumer acceptance test from 200 consumers, it was found that 95% of consumer accepted the product with hedonic score of 7.3 ± 1.0 (moderately like). The seafood bar packed in plastic bag kept at room temperature had shelf life about four days.

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Introduction

Thailand was known as one of the most important resources in the world. There are two major resources in Thailand, one is agriculture production and another one is marine resource. The products derived from marine resources are in many forms such as fresh food for household use, frozen seafood, Thai traditional ingredient and dried seafood.

The dried seafood was passed through many processes causing small leftover that can not sell in the desired price. Value adding will be one of the solutions that make this leftover product more valuable. New product development by using leftover product with one of the existing product was the method that this research used to create the value for leftover dried squid.

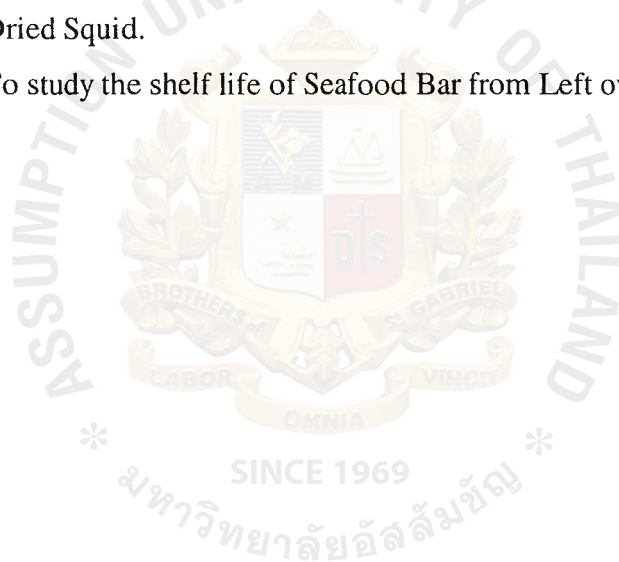
Cereal bar was chosen to develop a new product by adding dried squid and change from sweet dominant taste to have spicy taste for Thai preferences. This new product was developed followed product development process starting with the consumer survey, formulation and process development, consumer acceptance test and shelf-life study. Moreover the pilot plant scale production was done in order to determine the require adjustment for the existing plan.

Aim

To adding value for leftover dried squid by develop a new product and provide new style of cereal bar for the consumer.

Objective

1. To study on buying and consuming behavior of the consumer and opinion on seafood product that derived from seafood.
2. To formulate and development the appropriate process of Seafood Bar from Left over Dried Squid.
3. To conduct consumer acceptable test for Seafood Bar from Left over Dried Squid.
4. To study the shelf life of Seafood Bar from Left over Dried Squid.



Literature Review

1. Cereal Bar

Cereal bar is product in breakfast cereal. Breakfast cereal can be divided into two types. The first is cereal that requires cooking. The second is the first of the convenience foods, the ready-to-eat cereal. The story of ready-to-eat is Dr. Kellogg was in charge of the meal for vegetarians. (R. Carl Hoseney, 1994) He was interesting coincidence “Granola”. He made biscuits from dough composed of wheat meal, oatmeal, and corn meal and baked them until they had thoroughly dried and were starting to turn brown. These hard biscuits were then ground and packaged. Then they were developing to flakes to multiplied array of form, color and flavors. Additions of vitamins, minerals and protein as well as fiber supplementation have been developing to give finished products a nutritional. (Samuel, 1994)

Today producers are developing cereal bar into many type and taste by developing ingredients, mixed with dried fruits, nut, honey or chocolate. Therefore it contains more nutrition in product. In cereal bar has caloric value around 500 KJ. It is sufficient to give energy requirement of people between main meals. It can easily complete the morning and afternoon snacks. Anyway for develop cereal bar the stabilities under processing condition such as baking, sugar coating, various vitamins and mineral may be incorporate.

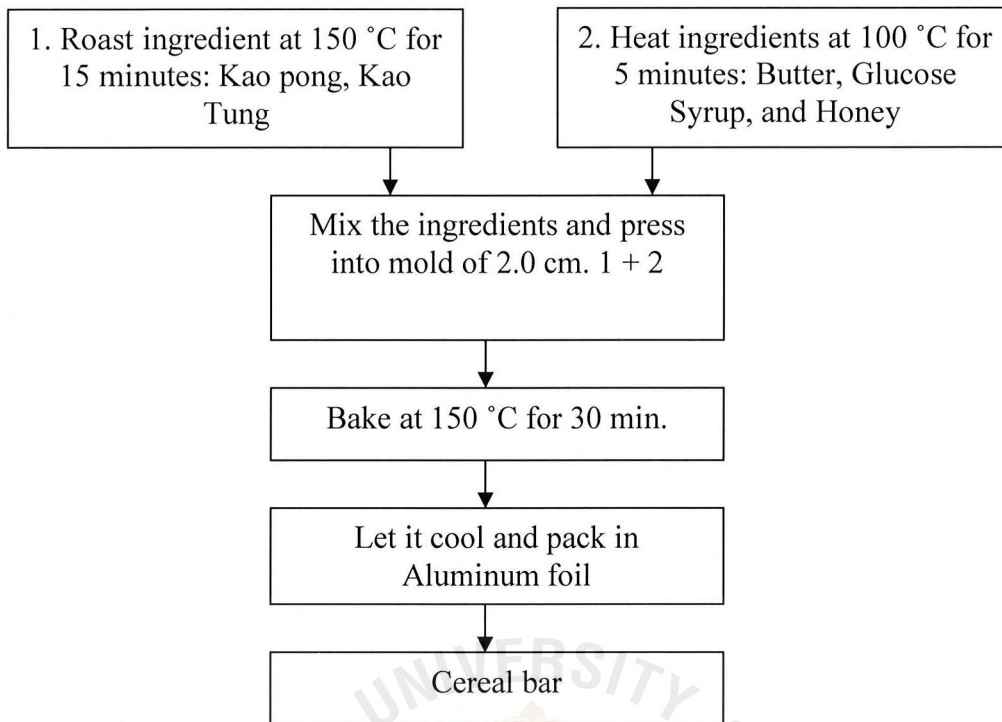


Figure 1: The process of Making Cereal-Bar



Figure 2: Example of Cereal-Bar

Marketing of Cereal-Bar

The cereal bar market has growth since 2000, outperforming the food market as a whole; and seeing rises and market volumes and values. The ongoing development of the eating on the go and snacking market has been an important context, but the profile of cereal bars as a healthier option has been the major factor in growth. Suppliers have also been proactive with a substantial level of new product development and promotional activity. The demand of consumer to portable snacks their interest in high-fiber, whole-grain foods. Mintel International (Chicago) estimate the U.S. consumer market for cereal bars at \$2.2 billion in 2004, excluding sales through Wal-Mart (Bentonville, Ark.) and natural food stores. The market grew at a compound annual growth rate of 13.4% between 1999 and 2004. Based on Mintel research, overall growth in the market should slow but remain strong--with sales

expected to rise 7.6% at an inflation-adjusted annual rate between 2004 and 2009. Growth is expected to result from the following four factors:

1. Increasing the percentage of households that consume cereal bars from its current 55% level
2. Increasing the frequency of use of cereal bars for as many eating occasions as possible (e.g. snack, energy boost, weight-loss, meal replacement)
3. Aggressive product development to improve and broaden the flavor choices
4. Increasing media expenditures to support brand development and encourage brand loyalty

Cereal bars are also commonly referred to as snack bars. In general, both types are cereal-based (traditionally oat-based) and contain ingredients such as nuts, seeds, fruit, raisins, and chocolate. However, some snack bars may not have a traditional cereal base (e.g. soy). Cereal bars can be used for multiple purposes such as breakfast, snacks, energy, meal replacement, and weight control.

2. Puffed Rice (Kao Pong)

Narong (1990) said that Puffed rice is product made from rice or flour. The characteristic is inflated, porous and crispy. The rice or flour use to make puffed rice snack there are amylose volume between 5-20 %. The method to make product is dried first and take it to fry or bake for inflate. There are 2 type of inflation. First, inflate rice or flour by fast evaporates water. Second, fry product in vacuum pressure the water will be evaporated. The process to produce the puffed rice is cooked rice adjust humidity and make it inflate. The Puffed rice is adjusting humidity in both before and after cooked. The adjustment humidity before cooking it is make the rice easy to cook and adjustment humidity after cook it make rice inflate when take it to fry or bake. The process of extrusion adjustment of humidity is only one time that makes it cooked and inflates in same time.

There are 7 group of Puffed rice separate from inflation.

1. Puffed rice that is produced by high pressure pressing using extrusion machine. This extrusion machine uses high pressure and high temperature together with time and temperature control. Steam pressures inflate the rice starch. When steam evaporate rapidly and dramatically decrease temperature, the structure of rice starch will be held in shape. The product from this type will have small pores and soft. The final moisture content is about 2-4%. The product should not be too dry because it will increase crumbliness and rancidity.
2. Puffed rice that is produced by pressing the flour between two hot metal plates. The mixed flour is placed on a hot metal plate and then press by another plate. The pressing creates the pressure on the flour and as pressure increase water in the flour will evaporate into steam. When the upper metal is removed the water pressure will decrease rapidly. As all water vapor evaporate and temperature decrease, it causes the flour to form shape.
3. Puffed rice that is produced by hot air. Hot air can inflate 1.5-3.0 times when the dough content moisture between 22-27%. The dough is put into steam pressure pot at pressure 20 lb/inch² for 6-20 min. then the dough is kneaded and slice into thin layer. The hot air is use to blow until moisture drop to 16-21%. After that the dough is ironed into thin sheet and bake at 177-400 c for 8-35 sec. The final product will have moisture content 3-7%
4. Puffed rice that is produced by vacuums. The rice must be made sticky before put in vacuums oven for inflate. First, prepare the high concentration syrup and mix with flour and knead the dough. Next iron and cool down. Cut into small piece before putting in vacuums oven. The rice is plate on the metal plate at 52 c. Turn on vacuums pump and maintained at 29 inch.
5. Puffed rice that is produced by microwave. When rice is in microwave water in the mixture will immediately evaporate and inflate the starch.
6. Puffed rice that is produced by oven. This type is most suitable for flour made from tubers and similar plant. In Japan this method used to produce Samba and Arare. The mixture should content moisture not more than 25%. Cut into shape and bake at 150-260 °C for 3-15 min.

7. Puffed rice that is produced by frying. The product that make from this method is crisp rice biscuit. The ingredient is mixed well and makes the shape. Oven it in stem pot to reduce moisture to 8% before fry to inflate it or keep it and fry it when want to eat it.

The method to produce the puffed Rice is cook the rice with rice cooker for 18-22 min. ratio is 1:1.3 by 1 cup of rice is 175 g. and 1cup of water is 200 g. (งามชื่น, 2531). The cooked rice is oven in tray dry at 70 °C for 180 min. and frying in palm oil at 190 °C for 30 sec. The rice is inflated and there are yellow gold of surface of the rice because of caramelisation. The figure show as following:

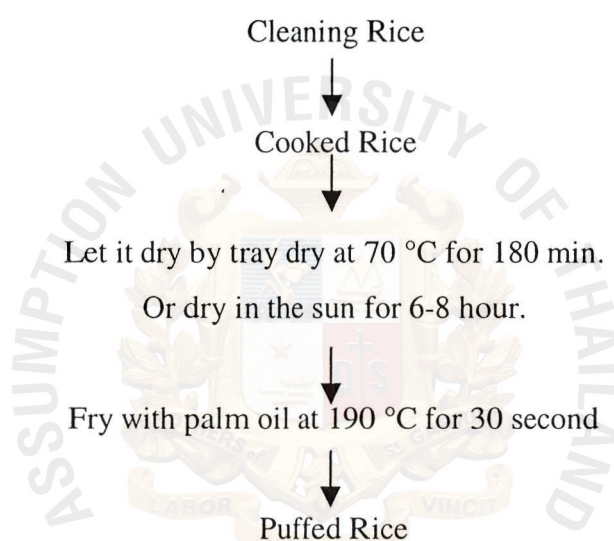


Figure 3: The process of Puffed Rice

Kao Pong is making from both rice and sticky rice known as “khao neeo” in Thai and Lao. The process to do Kao pong from rice and sticky rice is quit similar it different in the beginning of process for made the rice cooked. Kao pong that made from rice can do by steam the rice. Kao pong that made from sticky rice can do by soak with water for 20 minute. Then steam at 100 °C of boiling water. After it cooked let it dry by dehydration. Let the dry of rice or sticky rice to fry in palm oil at 170-180 °C for 5-10 second and it will inflate. Kao Pong can eat with palm sugar will good taste.

3. Squid

Squid is an invertebrate in type of shell (Naef, 1921). The family name is *Loliginidae* subfamily is *Photololigo duvauceli* (Nateewathana, 1992). There are in the Gulf of Thailand and Andaman Sea. These subfamilies there are important for fishery of Thailand. The Seafood factory would be transfigure squid to frozen food and exported to another country. Because of squid cannot raise and there are high demand therefore the price of raw material is not constant. Most of people is eat squid by cooked the fresh then can eat but there are short shelf life. For this reason producer transform squid to dry product to serve consumer. There are many type of product of dried squid that is dried squid and ready to eat squid. Both of it done by cleave and take out waste of it then let it dry by dehydration. After it dry they take it to process by mix with seasoning. Then bank it or rupture it so will get new product from squid. From the process would be get high shelf life and there is more flavor. Anyway from the process there are big size and small size of squid. The big size can pack to plastic bag and sell. The small size can not pack therefore it became by product from factory.

4. Sweetener

There are many type of sweetener the function of sweetener is give sweet when test. There are useful in food industry. The sweetener can separate by the sweet.

4.1 Sucrose

Sucrose is white. It can dissolve until concentration is 67% at 20 °C. When leave in room temperature it will crystallize. If mixed the glucose syrup with sucrose it helps for dissolve, not crystallize and prevent to spoilage from microorganism but sucrose should have concentration higher than 75%. The temperature is important for dissolve. Therefore the concentration can measurement from temperature or observe from boiled of sucrose or appearance of syrup when drop into cool water (table 2).

Table 1: Sweet level of sweetener

Type of sweetener	Sweet level
Levulose	140-175
Invert sugar	100-130
Sucrose	100
Dextrose anhydrous	70-75
Dextrose monohydrate	60-65
Maltose	30
Lactose	15
Galactose	58

Source: Eisenberg (1955)

Table 2: The relative of temperature and concentration of syrup when boiled, in cool water and example of food

Concentration (° Brix)	Temperature (° C)	Appearance when boiled	Characteristic in cool water	Food example
20-60	105-106	Big bubble	Stay in bottom of pan	Syrup with ice Fruit juice
75-80	110-112	Middle of bubble and clear	Long shape	Thai dessert
	112-115	Middle of bubble and clear yellow	~2 inch Soft lump	Thai dessert, Thai sweetmeats
~84	118-120	Small of bubble		

Table 2: The relative of temperature and concentration of syrup when boiled, in cool water and example of food (Continue)

Concentration (° Brix)	Temperature (° C)	Appearance when boiled	Characteristic in cool water	Food example
~86	121-130	Small of bubble and dark color	Hard lump Hard lump	Banana chip Sticky paste
	132-143	Concentrate of bubble and dark color	Hard line, can Broke	Toffee
	149-154	Concentrate of bubble and more dark color	Hard line and brittle	Cotton candy
	170	Small of bubble and smell of burn	Very hard lump and brown	Burn syrup

Source: นร (2530)

Yudkin and group (1973) qualification of sucrose

1. Increase sweet, osmotic pressure, stickiness and boiling point
2. Control moisturizer
3. Added smell and test
4. Increase glossy
5. Give energy
6. can make shape
7. emulsifier
8. Adjust color of product
9. use for fermentation
10. crystallization and control size of crystallize
11. can penetrate to product
12. can reduce freezing point used in ice-cream product

Saturated sucrose or there is syrup can dissolve in water at setting temperature (ศิริลักษณ์, 2522) the characteristic is solid translucent and not crystallize. If keep it for long time some of sucrose will be crystallize. The problem can solve by added glucose syrup replace sucrose Mathlouthi and Reiser (1995) said that sucrose do not hide the real smell of fruit. The high of sucrose increase smell of fruit. Sucrose help to adjust touch skill of food especially sweetness food and size of crystallize there are effect to quality of product. The temperature also has effect to test of product.

4.2 Glucose syrup

Glucose is formed in plants from carbon dioxide absorbed from the air using sun light as energy source. Part of the glucose is polymerized into long chains of glucose and stored as starch in granules as a reserve. In spring starch is broken down again to support new growth.

This break down of starch can be imitated by applying acid or enzymes to cooked starch. The way to does it cause the starch to hydrolyze into a variety of mixtures of glucose and intermediates and the way for characterize these various mixtures is by its DE number. DE means Dextrose Equivalent. The analytical procedure measures reducing end groups and attach a DE of 100 to pure glucose (glucose = dextrose) and a DE of 0 to pure starch.

Only glucose solution of high DE can crystallize easily and yield a product in powder or granular form. A most popular crystallized product is dextrose monohydrate with applications in confectionery, jam preserves and used in chewing tablets by people doing sport. The function of glucose syrup is to prevent crystallization of the sucrose present, reduce browning in high boiled candy. Glucose syrup is useful for coating cereal products, in co extrusion or rolling. It benefit for include shelf life.

5. Peanut

The peanut (*Arachis Hypogea*) is a species in the pea family. The peanut plant is unusual because it flowers above ground and pods containing one to five seeds are produced underground. Its seeds are rich source of edible oils and contain 40 -50% fat, 20 - 50 % protein, and 10 to 20 % carbohydrate (Nwokolo 1996). The seeds of peanut are contain more vitamin E, folacin, calcium, phosphorus, magnesium, iron etc. Therefore, the peanut is used to apply in food industry. It is food (roasted or boiled), animal feed and industrial raw material. All part of the peanut is usefulness especially the seed. The seed can be use directly for food and crushing to product oil and high protein meal (bunting et al 1985). The most common method of preparation for human consumption of whole seed is dry roasting the seed and snack food (Coffelt 1989).

Aflatoxins in Peanut, the toxin compounds of peanut are the aflatoxins as produce from moulds *Aspergillus flavus* and *Aspergillus parasiticus*. There are four types of aflatoxin, B1, B2, G1, and G2. The aflatoxin B1 is the most toxin and it is a vary potent hepatocarcinogen (Nwokolo1996). The limited of aflatoxin in food of WHO and UNICEF is 5 ppb and not above 30 ppb per 1 kg. In Thai Standard Regulation, the aflatoxin in peanut should not above 20 ppb.

Material and Method

A. Material

Ingredients

1. Cereal: Kao Pong (Dried Fried Rice)
2. Seafood: Squid (Sakonpan Factory)
3. Peanut
4. Glucose Syrup (Fancycapr Brand)
5. Sugar (Mitr Phol)
6. Chili Powder
7. 5% Distilled Vinegar
8. Water

Equipment

1. Scale
2. Tray Dryer (Food Institute)
3. Foil
4. Plastic bag
5. Block or Mould
6. Thermometer
7. Kitchenware
8. Blender

Tool of Sensory Evaluation

- Questionnaires

B. Method

1. To study on buying and consuming behavior of the consumer and opinion on the product that derived from seafood.

The investigation on consumer behavior was done by using questionnaire to collect the demographic, buying behavior and consumer opinion on. There were 100 respondents which were average in gender and age.

The demographic information was gender, age, education and occupation. The consumers were also asked about buying and consuming behavior and opinion on seafood product.

2. Formulation and study appropriate process of seafood bar.

2.1 Preliminary of suitable process for seafood bar from leftover dried squid.

The reference process of cereal bar was shown in figure 4. Temperature in drying step was studied to find the optimum level by varied temperature to 60 °C and 70 °C and then observe the appearance of the product to select the temperature that provides more combine.

Table 3: Percentage of ingredients for preliminary seafood bar

Ingredients	Percentage
Puffed rice	34
Dried Squid	22
Peanut	14
Glucose Syrup	8.8
Sugar	14.2
Water	6.15
Chili	0.45
5% Vinegar	0.4

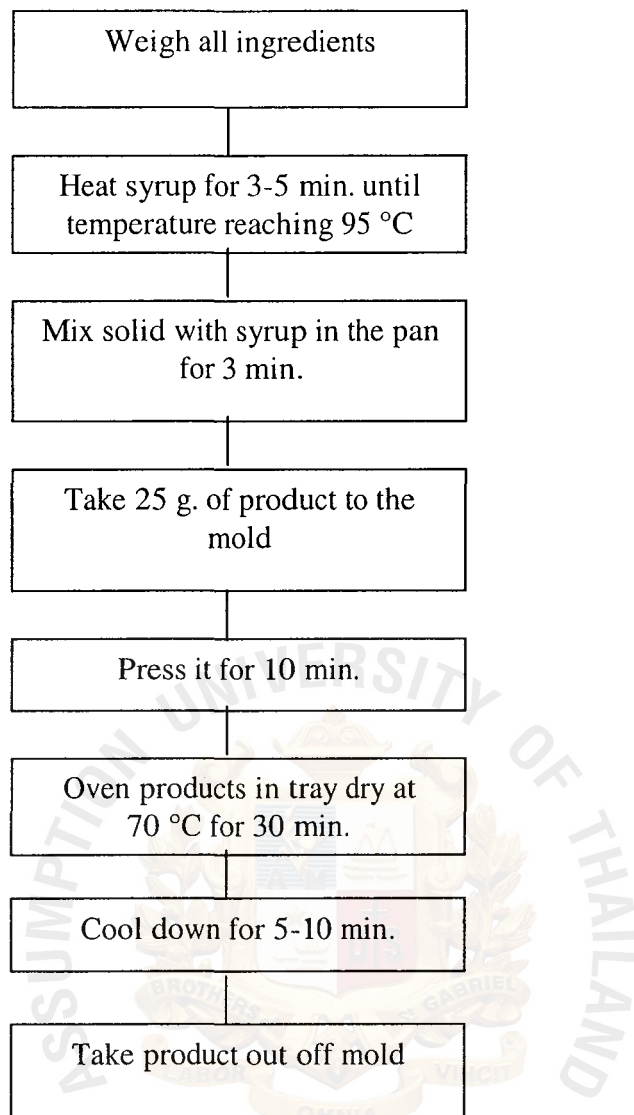


Figure 4: The method to make seafood bar

2.2 Formulate seafood bar from leftover squid

2.2.1 Study on the appropriate type of dried squid and sauce for seafood bar.

The formulation of seafood bar was developed based on cereal bar (Thianrapa, 2004). Two types of dried squid and sauce were studied to determine the appropriate type of dried squid and sauce for seafood bar by using 2^2 factorial design in RCBD. The products were evaluated by using 9-point hedonic scale to find the most preference. The best formula was prepared to study on the attributes that needed to be improved for the further development by using just about right and 9-point hedonic scale.

Table 4: Percentage of ingredients for formulation seafood bar

Ingredients	Percentage			
	Formula 1	Formula 2	Formula 3	Formula 4
Puffed rice	36	36	34	34
Dried Squid	22	-	22	-
Crispy Squid	-	22	-	22
Peanut	14	14	14	14
Glucose Syrup	11	11	8.8	8.8
Sugar	11	11	14.2	14.2
Water	6	6	6.15	6.15
Chili	-	-	0.45	0.45
5% Distilled Vinegar	-	-	0.4	0.4

2.2.2 Improve the formula and process by varying the attribute.

The formulation obtained from the method 2.2.1 was developed to improve sensory property. There are 3 factors were individually studied: peanut, dried chili and size of dried squid.

2.2.3 Study on optimum percentage of peanut in the seafood bar. There were three levels of peanut: 15%, 20%, and 25% were studied by using RCRD. The 9-point hedonic scale was used to evaluate the likeliness of 30 panelists.

2.2.4 Study on optimum percentage of dried chili in the seafood bar formula. There were three level of dried chili: 0.45, 0.25% and no added dried chili into product to study the spiciness of the product by using RCBD. The 9-point hedonic scale was used to rate the likeliness by 30 panelists.

2.2.5 Study on optimum size of squid in the seafood bar formula by using RCBD. There were three level sizes of squid: 1-2 cm., 2-3 cm. and 3-4 cm.; prepared by blending the squid in blender for 10 second, 5 second and not blended respectively. The 9-point hedonic scale was used to rate the likeliness by 30 panelists.

2.3 Study on the most preference shape of seafood bar

100 panelists were asked to rate the score from 1-5 (1-most preferred and 5 least preferred).

3. Consumer Acceptance Test.

The sensory evaluation was performed to determine the acceptance of product by serving 12.5 g of seafood cereal bar with packing in plastic bags attached with questionnaire to consumer. There are two groups of consumer: 100 Bangkok consumers and 100 tourists were random at Rayong province. The consumers answered the question about their demographic and rated the product by using 9-point hedonic scale.

4. Determine the shelf life of the product.

Twelve panelists of age between 16 to 25 years were requested to perform sensory evaluation for acceptability of seafood bar with one week packing in poly ethylene (PE) plastic bag at room temperature. The evaluations were made every 48 hours by using overall quality rating (Harry and Hilbecarde).



Result and Discussion

1. To study on buying and consuming behavior of the consumer and opinion on the product that derived from seafood.

According to the consumer survey, the majority of the consumer was in the age between 15-55 years old. The locations were school, university and village. For consumer demographic percentage, the highest percentage of age was between 16-25 years old. The education level of the subjects was 30 percent in bachelor degree. Most of the consumer was student. The income of the subjects was 41 percent in less than 5000 baht and 29 percent were between 5000-10000 baht (table 5).

Table 5: Demographic Data of 100 subjects

Demographic Data		Percentage (%)
Gender	Male	46
	Female	54
Age	Less than 15 years	15
	16-25 years	30
	26-35 years	20
	36-45 years	12
	46-55 years	12
	More than 55 years	11
Education	Less than high school	25
	High School	28
	Diploma	10
	Bachelor's degree	30
	Higher than Bachelor's degree	7

Table 5: Demographic Data of 100 subjects (Continue)

Demographic Data	Percentage (%)
Occupation	
Student	40
Government official	8
Employee	34
Business Owner	18
Income/month	
Less than 5000 Baht	41
5001-10000 Baht	29
10001-15000 Baht	9
more than 15000 Baht	21

According to the data about consumer behavior, 97% of consumers have eaten the crispy seafood and the products that they were normally had were dried crispy squid (25.9%), crispy fish (21.7%) and deep fried clam (17.8%) respectively. Most consumers bought the product with inconsistency rate (65.9%) and the place that they normally bought were s souvenirs shop (32.5%) and supermarket (31.9%). The consumer had crispy seafood as a snack (54.4%), porridge (21.8%) and rice (14.3%).

Table 6: Percentage for consumer behavior on marketing survey

Issue	Percentage
Have you ever test crispy seafood?	
Yes	97
No	3
Type of crispy seafood that consumer normally eat	
Crispy Fish	21.7
Deep Fried Clam	17.8
Dried Crispy Squid	25.9
Crispy Shrimp	15.0
Crispy Fish mixed with bread	11.2
Crispy Crab	8.4

Table 6: Percentage for consumer behavior on marketing survey (Continues)

Issue	Percentage
Place	
Convenience Store	26.5
Super Market	31.9
Grocery Shop	9.0
Souvenirs Shop	32.5
Frequency of buying	
Everyday	1.0
2-3 time/weeks	7.2
1 time/week	9.3
Once per mouth	8.3
2-3 time/year	8.3
Not sure	65.9
Food combination with crispy seafood	
Porridge	21.8
Noodle	9.5
Rice	14.3
As a snack	54.4

The consumers were asked to rate important attributes and weakness of crispy seafood product. It was found that the important attributes were taste (17.7%), crispiness (16.2%) and freshness (15.0%). The weakness attributes of crispy seafood were product hygiene (13.0%), fishy (12.7%) and product quantity in term of money value (12.6%).

Table 7: Percentage of important attribute and weakness attribute from marketing survey.

Issue	Percentage (%)
Important attribute of seafood bar	
Crispiness	16.2
Taste	17.7
Nutrition	13.9
Packaging	13.4
Glossy	12.7
Freshness	15.0
Innovation	11.2
Weakness attribute of each following factor.	
Fishy	12.7
Cleanliness	13.7
Expensive Price	11.6
Short shelf life	11.2
Difficult to eat	9.4
Packing	9.8
Quantity	12.6
Difficult to buy	7.8
Crispiness	11.2

Due to the project aimed to adding value to the seafood product, therefore, the consumer were ask to give their opinion to guide for the further development. Most of the consumer (88%) interested in seafood bar. The seafood that should be used as an ingredient in seafood bar was fish, shrimp, squid, peanut and dried herb. The taste and flavor of the product should be the original flavor of the product. And it should be sold at convenience store and supermarket with the price between 10 -20 baht.

Table 8: Percentage for consumer behavior on marketing survey

Title	Percentage (%)
Do you interest the seafood bar as new product	
Interest	88
Not interest	12
The appropriate ingredient of seafood bar	
Fish	14.8
Shrimp	13.2
Squid	12.8
Clam	9.8
Peanut	10.3
Dried Herb	11.8
Dried Chili	14
Puff Rice	5.5
Shredded Rice Grain	8
Flavor of seafood bar	
Original flavor of dried seafood	28.1
Pizza flavor	20.8
Barbecue flavor	19.6
Tom Yam flavor	7.9
Laap flavor	5.6
Sour cream	12.9
Japanese Seaweed	5.1
Suitable price for seafood bar (size 2*2*10 cm.)	
1-10 Baht	44.3
11-20 Baht	37.1
21-30 Baht	13.4
31-40 Baht	3.1
41-50 Baht	2.1

Table 8: Percentage for consumer behavior on marketing survey (Continues)

Title	Percentage (%)
Appropriate distributor for seafood bar	
Convenience store	37.6
Super market	34.8
Grocery shop	7.2
Souvenir shop	20.4

2. Formulation and study appropriate process of seafood cereal based bar.

2.1 Preliminary of suitable process for seafood bar from leftover dried squid.

Formulas of seafood bar were prepare with difference condition of the drying temperature at 60 °C for 30 min and 70 °C for 30 min. to observe the appearance of the product.

Table 9: Product appearance based on time and temperature

Formula	Appearance	
	60 °C for 30 min.	70 °C for 30 min.
Sweet sauce + Dried Squid	Sticky	Sticky, more combine

From above result the appearance of sweet sauce + dried squid oven at 70 °C for 30 min. there was sticky also at 60 °C for 30 min. was sticky too but the texture was hard than 70 °C for 30 min. Therefore in the process to oven at tray dry was chosen the temperature at 70 °C for 30 min. The process was applied with each formula to study all appearance of each formula. The result was show in table

2.2 Formulate seafood bar from leftover squid

2.2.1 Formulate seafood bar from leftover squid

Type of dried squid (type of squid) and sauce (type of sauce) were studied by using 2^2 factorial in RCBD. Four treatments of seafood bar were prepared and evaluated by using 9-point hedonic scale.

It was found that there was no significantly difference ($p > 0.05$) in the mean of overall odor comparing between treatments. However, there were significantly difference ($p \leq 0.05$) in the mean of overall flavor, overall color, crispiness and overall liking. From the following table, it was showed that formula 3 (Sweet sauce 2 + Dried Squid) got highest mean in overall flavor (7.0), crispiness (7.1) and overall liking (7.3).

Table 10: Show the mean hedonic score of each attribute.

Formula Indicate the condition	Overall odor	Overall flavor	Overall color	Crispiness	Overall liking
1. Sweet sauce 1+ Dried squid	6.4	6.8 ^a	7.0^a	6.4 ^b	7.0 ^a
2. Sweet sauce 1 + Crispy squid	5.8	5.8 ^b	5.7 ^b	6.4 ^b	6.3 ^b
3. Sweet sauce 2 + Dried Squid	6.3	7.0^a	6.8 ^a	7.1^a	7.3^a
4. Sweet sauce 2 + crispy squid	6.1	5.9 ^b	5.6 ^b	7.0 ^{ab}	6.2 ^b

Note: The same letter mean no significant difference at 95% confidence level

2.2.2 Study on the product attributes that needed to be improved from 2.2.1 by using 9-point hedonic scale and just about right test

The seafood bar that consisted of formula 3 (Sweet sauce 2+ Dried Squid) was prepared and rated by using 9-point hedonic scale and just about right test.

It was found that all attributes got the hedonic score at the range between 7-8 (like moderately to like very much). Moreover, the result from just about test was showed that all of the attributes were in the just like scale. However, there were some comments in spiciness, size of squid, peanut odor and flavor. Therefore, these four attributes were chosen for the further development.

Table 11: The liking score (9-Point Hedonic Scale) on seafood bar formulation

Attribute	Formula 3 Sweet sauce 2+ Dried Squid
Overall liking	8.0 ± 0.6
Color	7.4 ± 0.8
Glossy	7.4 ± 0.8
Peanut Odor	7.0 ± 0.9
Squid Odor	7.5 ± 1.0
Puff rice odor	7.4 ± 0.9
Puff rice flavor	7.4 ± 1.1
Squid flavor	7.7 ± 1.0
Crispiness	7.8 ± 1.0
Crumb	7.7 ± 0.7
Sweetness	7.5 ± 0.9
Spiciness	7.5 ± 0.9
Saltiness	7.6 ± 1.0

Table 12: Just About Like on seafood bar formulation

Attribute	Formula 3 sauce 2 + dried Squid						
	1	2	3	4	5	6	7
Color	-	-	10%	86.7%	-	3.3%	-
Glossy	-	-	13.3%	76.7%	6.7%	3.3%	-
Peanut Odor	6.7%	10%	10%	<u>66.7%</u>	6.7%	-	-
Squid Odor	-	3.3%	-	76.7%	13.3%	6.7%	-
Puff rice odor	3.3%	-	16.7%	73.3%	-	6.7%	-
Puff rice flavor	-	6.7%	16.7%	73.3%	3.3%	-	-
Squid flavor	-	-	10%	86.7%	-	3.3%	-
Crispiness	-	-	13.3%	76.7%	3.3%	6.7%	-
Crumb	-	-	-	90%	10%	-	-
Sweetness	-	-	16.7%	73.3%	10%	-	-
Spiciness	-	-	3.3%	<u>63.3%</u>	26.7%	6.7%	-
Saltiness	-	-	13.3%	83.3%	3.3%	-	-

Note: 1 = Much too little 2 = moderately too light
3 = somewhat too light 4 = Just like
5 = Some what too much 6 = moderately too much
7 = Much too much

2.2.3 Study on optimum percentage of peanut.

Study on optimum percentage peanut in the seafood bar. There were three levels of peanut: 15%, 20%, and 25% were studied by using RCBD. The 9-point hedonic scale was used to evaluate the likeliness of 30 panelists.

From the result, It was showed that there was no significant different between level of peanut in seafood bar. All of three treatments (15%, 20% and 25% peanut) got the hedonic score between 6-7 (like slightly to like moderately) Therefore, 15% peanut was chosen for the optimum level due to its minimum use.

Table 13: The mean hedonic score of peanut odor, peanut flavor and overall liking

Attribute	Peanut odor	Peanut flavor	Overall liking
15% peanut	6.4	7.1	7.2
20% peanut	6.4	6.7	7.0
25% peanut	6.8	6.8	6.8

Note: The same letter mean no significant difference at 95% confidence level

2.2.4 Study on optimum percentage dried of dried chili

The spiciness of the product was studied by varied percentage of dried chili in to 3 levels (0 %, 0.25% and 0.45 %). Three formulas were evaluated by 50 panelists with 9-point hedonic scale.

It was found that the likeliness on spiciness of seafood bar with 0.45% dried chili was not significantly different with seafood bar with 0.25% dried chili and seafood bar with 0% dried chili. However, the formula that consisted of 0.25% dried chili was significantly difference with seafood bar with 0% dried chili. The overall liking score was showed that panelists preferred low intensity of spiciness due to the hedonic score of 0% and 0.25% of dried chili added got the significantly higher score than added 0.45% of chili in seafood bar

Therefore, 0.25% chili was final formula of seafood bar product for further study.

Table 14: The mean hedonic score of spiciness, and overall liking

Treatment	Spiciness	Overall liking
0% chili	6.5 ^b	7.1 ^a
0.25 % chili	7.1^a	7.4^a
0.45 % chili	6.8 ^{ab}	6.7 ^b

Note: The same letter mean no significant difference at 95% confidence level

2.2.5 Study on optimum size of squid

In the sensory evaluation of each time panelists were comment about the piece of squid. It was big piece and still left over in the month while the puff rice and peanut was swallowed. Therefore, varying size of squid was conducted by varied chopping time. There were 3 sizes; 1-2 cm., 2-3 cm. and 3-4 cm.; prepared by chopping the squid by blender at speed 2 (Kashiwa, KW888) for 10 second, 5 second and not blended respectively. The result in table 16 was showed that there were not significant different in chopping time in every attribute except color. The color of the product that

The highest mean liking score was 7.3. Base on this result the not chopping the mean liking score was lower than 7 so not chopping were not chosen for process. Moreover, there were two processes left therefore, both of them were chosen to done again. The process size of squid was done again by using 10 sec. to chopping and 5 sec. to chopping by using paired sample t-test as result show in table 15. The 5 second chopping there were highest mean liking score in squid odor, crispiness, crumb, ease of chewing, saltiness, squid flavor and overall liking. Therefore, 5 second chopping squid was chosen to final formula of seafood bar product for consumer acceptance test.



Figure 5: not chopping squid.



Figure 6: 5 sec. chopping squid.



Figure 7: 10 sec. chopping squid.

Table 15: The mean hedonic score size of squid.

Attribute	Size 1-2 cm.	Size 2-3 cm.	Size 3-4 cm.
	10 sec. to chopping	5 sec. to chopping	Not chopping
Color	7.0 ^{ab}	<u>7.3</u> ^a	6.8 ^b
Glossy	7.0	<u>7.1</u>	6.97
Squid odor	6.7	6.6	6.7
Crispiness	<u>7.0</u>	6.9	6.9
Crumbliness	6.9	<u>7.1</u>	6.9
Sweet	<u>6.8</u>	6.7	6.5
Spiciness	6.7	<u>6.8</u>	6.6
Salty	6.2	<u>6.4</u>	6.2
Squid flavor	6.7	<u>6.9</u>	6.9
Overall liking	6.9	<u>7.1</u>	6.7

Note: The same letter mean no significant difference at 95% confidence level

2.3 Study on the most preference shape of seafood bar

Next, study the shape of seafood bar product was conducted by varied 5 shapes as the following picture. 100 panelists were asked to rate the score from 1-5 (1-most preferred and 5 least preferred).



The shape is cylinder shape

Diameter = 5 cm.

Thickness = 1 cm.

Weight = 15 g.

Figure 8: The circle shape of seafood bar



The shape is bar

Weight = 25 g

Size = 3.5 × 12 × 2

Figure 9: The bar shape of seafood bar



The shape is sphere shape

Diameter = 3.8 cm.

Weight = 10 g.

Figure 10: The Sphere shape of seafood bar

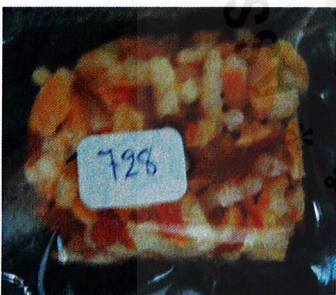


The shape is square shape

Weigh = 25g.

Size $5 \times 5 \times 1$

Figure 11: The square shape of seafood bar



The shape is cutting bar

Size = $3.5 \times 3.5 \times 1.8$

Figure 12: Cutting bar shape of seafood bar

The result was showed that consumer preferred cylinder shape and 15 g. bar followed by square shape and the least preferred were 25 g. bar and sphere shape. Therefore 25 g. bar was chosen due to its uncomplicated preparation process.

Table 16: Raking score of seafood bar shape

Shape	Raking Score
Cylinder	2.5 ^a
Bar	2.6 ^{ab}
Square	2.7 ^b
Cutting Bar	3.6 ^c
Sphere shape	3.7 ^c

Therefore, the seafood bar consists of 33.5% puffed rice, 21.5% dried squid (prepared by chopped for 5 seconds), 15% peanut, 8.85% Glucose Syrup, 14.25% Sugar, 0.25% Chili, 0.45% of Vinegar, 6.2% Water with 25 g. bar shape to do consumer test.

3. Consumer Acceptance Test.

Consumer test was conducted on 200 consumers. The consumer demographic percentage shows the ratio gender between male and female was 5:5 approximately. For consumer demographic percentage, the highest percentage of age was between 16-35 years old. The education level of the subjects was 44 percent in bachelor degree. The highest percent of occupation was students and business owner was following. In relation the level of age, education and percent of occupation the highest income was more than 15000 baht (table 17).

Table 17: Demographic Data of 200 subjects

Demographic Data	Percentage (%)
Gender	
Male	48
Female	52

Table 17: Demographic Data of 200 subjects (Continue)

Demographic Data	Percentage (%)
Age	
Less than 15 years	4
16-25 years	38.5
26-35 years	34
36-45 years	10.5
46-55 years	10.5
More than 55 years	2.5
Education	
Less than high school	15
High School	22.5
Diploma	8
Bachelor's degree	44
Higher than Bachelor's degree	10.5
Occupation	
Student	34
Government official	2
Employee	28
Business Owner	30
Other	6
Income/month	
Less than 5000 Baht	28.5
5001-10000 Baht	24
10001-15000 Baht	17
more than 15000 Baht	30.5

According to the data about consumer behavior the question were asked about buying frequency of consumer on crispy seafood. Most of the consumer liked crispy seafood product (86.5%). The buying frequency of most consumers was unstable. 95% of the consumer accepted the product with the hedonic score of 7.3 ± 1.0 (like moderately to like very much) and 74% of them willing to buy it, however 54% of the consumer thought that the price of the product should not higher than 15 baht and they will have it as a snack.

Table 18: Percentage of consumer behavior

Title	Percentage (%)
Have you ever test crispy seafood?	
Yes	86.5
No	13.5
Do you like to have dried crispy seafood?	
Like	86.5
Don't like	13.5
How often do you buy crispy seafood product?	
Everyday	2.5
2-3 time/weeks	9
1 time/week	9.5
Once per mouth	8
2-3 time/year	7
Not sure	64
Is the product acceptable?	
Yes	95
No	5
Would you buy this product if is commercially available?	
Yes	74
Maybe	20
No	6

Table 18: Percentage of consumer behavior (Continue)

Title	Percentage (%)
In your opinion, is the price 15-20 baht suitable for 25 gram of seafood bar?	
Yes	46
No	54
In your Opinion, what time is suitable to have Seafood Bar?	
Instead Breakfast	3.3
Between meal	12.2
Snack	30.8
Refreshments	19.5
Lunch and break time	3.9
Night time	4
Prefer to eat	14.8
Party time	9.3
Instead meal	2.2

4. Determine shelf life of the product

Twelve panelists were requested to perform sensory evaluation for acceptability of seafood bar that were kept in room temperature for one week by using overall quality rating test. The result showed that seafood bar was unacceptable after keeping for 4 days. The unacceptability of sample was due to the absorption of moisture the product was not crispy. Therefore, if the sample is stored in proper package, the shelf life of the product can be extended.

Table 19: The average and standard deviation of shelf life sensory evaluation of seafood bar by 12 panelists.

Day	Average	Standard Deviation
0	8	0.9
2	6.5	1.5
4	4.5	1.3
6	2.6	1.8

Conclusion

The purpose of the project is to added value left over dried squid and crated a new choice of seafood product for consumer. The development of seafood bar was consisted of study on the consumer behavior and opinion on seafood product, formulate the seafood bar, consumer acceptance test and shelf life study.

According to the consumer survey, the majority of the consumer was in the age between 15-55 years old, 97% of consumers have eaten the crispy seafood and the products that they were normally had were dried crispy squid (25.9%), crispy fish (21.7%) and deep fried clam (17.8%) respectively. Most consumers bought the product with inconsistency rate (65.9%) and the place that they normally bought were s souvenirs shop (32.5%) and supermarket (31.9%). The consumer had crispy seafood as a snack (54.4%), porridge (21.8%) and rice (14.3%). The important attributes were taste (17.7%), crispiness (16.2%) and freshness (15.0%). The weakness attributes of crispy seafood were product hygiene (13.0%), fishy (12.7%) and product quantity in term of money value (12.6%).

The prototype seafood bar consists of 33.5% puffed rice, 21.5% dried squid (prepared by chopped for 5 seconds), 15% peanut, 8.85% Glucose Syrup, 14.25% Sugar, 0.25% Chili, 0.45% of Vinegar, 6.2% Water with 25 g. bar shape to do consumer test.

The process of seafood bar begins with weigh all raw materials then heats the liquid portion until temperature reach 95 °C then mix the solid portion with the liquid in the pan. 25 g. of the mixture was put in to the mold then press for 10 minutes. After that the product was dry in tray dryer at 70 °C for 30 minutes.

The consumer acceptance test was conducted; it was fond that 95% of consumer accepted the product with 7.3 ± 1 (like moderately to like very much). The acceptable price of 25 g. bar was lower than 15 baht.

Seafood bar in polyethylene (PE) plastic bag can be kept for four day in room temperature due to its crispiness was decreased.

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Appendix A: Questionnaire

Questionnaire

Consumer Behavior toward Seafood Bar

Part 1: Demographic Data

Instruction: Please answer all questions by checking in the space provided.

1. Gender

- ☐ Male ☐ Female

2. Age

- ☐ Less than 15 years ☐ 16-25 years
☐ 26-35 years ☐ 36-45 years
☐ 46-55 years ☐ more than 55 years

3. Education

- ☐ Less than high school ☐ High School
☐ Diploma ☐ bachelor's degree
☐ Higher than Bachelor's degree

4. Occupation

- ☐ Student ☐ Government official
☐ Employee ☐ Business Owner
☐ Other/please specify.....

5. Income/month

- ☐ Less than 5000 Baht ☐ 5001-10000 Baht
☐ 10001-15000 Baht ☐ more than 15000 Baht

Part 2: Information about consumer's buying and consumption behavior of dried crispy seafood

6. Have you ever test crispy seafood?

- ☐ Yes ☐ No

7. What kind of crispy seafood?

- ☐ Crispy Fish ☐ Deep Fried Clam
☐ Dried Crispy Squid ☐ Crispy Shrimp
☐ Crispy Fish mixed with bread ☐ Crispy Crab
☐ Other please specify.....

8. Where did you buy the product?

- ☐ Convenience Store ☐ Super Market
☐ Grocery Shop ☐ Souvenirs Shop
☐ Other please specify.....

9. How often do you by crispy seafood product?

- ☐ Everyday ☐ 2-3 time/weeks ☐ 1 time/week
☐ Once per mouth ☐ 2-3 time/year ☐ Not sure

10. Do you have crispy seafood with?

- ☐ Porridge ☐ Noodle ☐ Cooked rice
☐ Snack ☐ Other please specify.....

11. According to your opinion please rate the important attribute of each following factor. The score is 1-100. The higher important is 100 and not important is 0

- Crispiness..... Glossy.....
Taste..... Freshness.....
Nutrition..... Innovation.....
Packaging.....

12. According to your opinion please rate the weakness attribute of each following factor the score is 1-100. The most weakness is 100 and least weakness is 0

- Fishy..... Packing.....
Cleanliness..... Quantity.....
Expensive Price..... Difficult to buy.....
Short shelf life..... Crispiness.....
Difficult to eat.....

13. Do you interest the seafood bar as new product?

- ☐ Interest ☐ Not interest

14. In your opinion, what ingredient should be use in seafood bar?

- ☐ Fish ☐ Shrimp
☐ Squid ☐ Clam
☐ Peanut ☐ Dried Herb
☐ Dried Chili ☐ Puff Rice
Shredded Rice Grain

15. In your opinion, what flavor should be for the seafood bar?

- ☐ Original flavor ☐ Pizza flavor
☐ Barbecue flavor ☐ Laab flavor
☐ Tom Yam flavor ☐ Sour cream
☐ Japanese Seaweed ☐ Other please specify.....

16. What is suitable price for seafood bar (size 2*2*10 cm.)

Price..... Baht

17. In your opinion, where should you buy seafood bar?

- | | |
|---|--|
| <input type="checkbox"/> Convenience store | <input type="checkbox"/> Super market |
| <input type="checkbox"/> Grocery shop | <input type="checkbox"/> Souvenir shop |
| <input type="checkbox"/> Other please specify | |



9- Point Hedonic Scaling Test

Seafood Bar

Name. _____

Date. _____

Instruction: 1. Please rinse your mouth with water before starting.

2. Please taste the four samples in the order presented from left to right.

Then evaluate hedonic scale in each attributes of sample by using the following score.

1 = dislike extremely

2 = dislike very much

3 = dislike moderately

4 = dislike slightly

5 = neither like nor dislike

6 = like slightly

7 = like moderately

8 = like very much

9 = like extremely

Sample _____

Color _____

Overall odor _____

Overall flavor _____

Crispiness _____

Overall liking _____

Comments:

Thank you for your participation.

Just about right and 9- Point Hedonic Scaling Test

Seafood Bar

Name. _____

Date. _____

Instruction: 1. Please rinse your mouth with water before starting.

2. Please taste the four samples in the order presented from left to right.

Then evaluate hedonic scale in each attributes of sample by using the following score and mark x in the channel which is related to your feeling.

1 = dislike extremely

2 = dislike very much

3 = dislike moderately

4 = dislike slightly

5 = neither like nor dislike

6 = like slightly

7 = like moderately

8 = like very much

9 = like extremely

Overall _____

Color (yellow orange, สีเหลืองส้ม) _____

Much too light	Moderately too light	Some what too light	Just right	Somewhat too dark	Moderately too dark	Much too dark
----------------	----------------------	---------------------	------------	-------------------	---------------------	---------------

Glossy _____

Much too little	Moderately too little	Some what too little	Just right	Somewhat too much	Moderately too much	Much too much
-----------------	-----------------------	----------------------	------------	-------------------	---------------------	---------------

Peanut Odor _____

Much too little	Moderately too little	Some what too little	Just right	Somewhat too much	Moderately too much	Much too much
-----------------	-----------------------	----------------------	------------	-------------------	---------------------	---------------

Squid Odor _____

Much too little	Moderately too little	Some what too little	Just right	Somewhat too much	Moderately too much	Much too much
-----------------	-----------------------	----------------------	------------	-------------------	---------------------	---------------

Puff rice Odor (กลิ่นข้าวทอด) _____

Much too little	Moderately too little	Some what too little	Just right	Somewhat too much	Moderately too much	Much too much
-----------------	-----------------------	----------------------	------------	-------------------	---------------------	---------------

Crispiness _____

Much too soft	Moderately too soft	Some what too soft	Just right	Somewhat too crispy	Moderately too crispy	Much too crispy
---------------	---------------------	--------------------	------------	---------------------	-----------------------	-----------------

Crumb (ความร่วน) _____

Much too stick	Moderately too stick	Some what too stick	Just right	Somewhat too crumbly	Moderately too crumbly	Much too crumbly
----------------	----------------------	---------------------	------------	----------------------	------------------------	------------------

Sweetness _____

Much too tasteless	Moderately too tasteless	Some what too tasteless	Just right	Somewhat too sweet	Moderately too sweet	Much too sweet
--------------------	--------------------------	-------------------------	------------	--------------------	----------------------	----------------

Spiciness _____

Much too tasteless	Moderately too tasteless	Some what too tasteless	Just right	Somewhat too spicy	Moderately too spicy	Much too spicy
--------------------	--------------------------	-------------------------	------------	--------------------	----------------------	----------------

Saltiness _____

Much too tasteless	Moderately too tasteless	Some what too tasteless	Just right	Somewhat too salty	Moderately too salty	Much too salty
-----------------------	--------------------------------	-------------------------------	---------------	-----------------------	-------------------------	-------------------

Squid flavor _____

Much too little	Moderately too little	Some what too little	Just right	Somewhat too much	Moderately too much	Much too much
--------------------	--------------------------	----------------------------	------------	----------------------	------------------------	------------------

Puff rice flavor _____

Much too little	Moderately too little	Some what too little	Just right	Somewhat too much	Moderately too much	Much too much
--------------------	--------------------------	----------------------------	------------	----------------------	------------------------	------------------



9- Point Hedonic Scaling Test

Seafood Bar

Name. _____

Date. _____

Instruction: 1. Please rinse your mouth with water before starting.

2. Please taste the four samples in the order presented from left to right.

Then evaluate hedonic scale in each attributes of sample by using the following score.

1 = dislike extremely

2 = dislike very much

3 = dislike moderately

4 = dislike slightly

5 = neither like nor dislike

6 = like slightly

7 = like moderately

8 = like very much

9 = like extremely

Sample	_____	_____	_____
Color	_____	_____	_____
(yellow orange, สีเหลืองส้ม)			
Glossy	_____	_____	_____
Peanut Odor	_____	_____	_____
Squid Odor	_____	_____	_____
Fried-rice Odor	_____	_____	_____
Crispiness	_____	_____	_____
Crumb (ความร่วน)	_____	_____	_____
Sweetness	_____	_____	_____
Spiciness	_____	_____	_____
Saltiness	_____	_____	_____
Peanut flavor	_____	_____	_____
Squid flavor	_____	_____	_____
Fried-rice flavor	_____	_____	_____
Overall liking	_____	_____	_____

Comments:

Thank you for your participation.

9- Point Hedonic Scaling Test

Seafood Bar

Name. _____

Date. _____

Instruction: 1. Please rinse your mouth with water before starting.

2. Please taste the four samples in the order presented from left to right.

Then evaluate hedonic scale in each attributes of sample by using the following score.

1 = dislike extremely

2 = dislike very much

3 = dislike moderately

4 = dislike slightly

5 = neither like nor dislike

6 = like slightly

7 = like moderately

8 = like very much

9 = like extremely

Sample	_____	_____	_____
Color	_____	_____	_____
(Yellow orange, สีเหลืองส้ม)	_____	_____	_____
Glossy	_____	_____	_____
Crispiness	_____	_____	_____
Crumb (ความร่วน)	_____	_____	_____
Sweetness	_____	_____	_____
Spiciness	_____	_____	_____
Saltiness	_____	_____	_____
Overall liking	_____	_____	_____
Comments:	_____		

Thank you for your participation.

9- Point Hedonic Scaling Test

Seafood Bar

Name. _____

Date. _____

Instruction: 1. Please rinse your mouth with water before starting.

2. Please taste the four samples in the order presented from left to right.

Then evaluate hedonic scale in each attributes of sample by using the following score.

1 = dislike extremely

2 = dislike very much

3 = dislike moderately

4 = dislike slightly

5 = neither like nor dislike

6 = like slightly

7 = like moderately

8 = like very much

9 = like extremely

Sample	_____	_____	_____
Color	_____	_____	_____
(yellow orange, สีเหลืองส้ม)			
Glossy	_____	_____	_____
Squid Odor	_____	_____	_____
Crispiness (1 st chew)	_____	_____	_____
Crumb (ความร่วน) (1 st chew)	_____	_____	_____
Case of chewing	_____	_____	_____
(30 th -35 th chew)			
Sweetness	_____	_____	_____
Spiciness	_____	_____	_____
Saltiness	_____	_____	_____
Squid flavor	_____	_____	_____
Overall liking	_____	_____	_____

Comments:

Thank you for your participation.

Questionnaire

Ranking Preference test appearance of Seafood Bar

1. Age

- | | |
|---|---|
| <input type="checkbox"/> Less than 15 years | <input type="checkbox"/> 16-25 years |
| <input type="checkbox"/> 26-35 years | <input type="checkbox"/> 36-45 years |
| <input type="checkbox"/> 46-55 years | <input type="checkbox"/> more than 55 years |

2. Please Rank the sample from most preferred using the following numbers

- | | |
|-----------------------------|-------------------|
| 1 = Preferred very much | 2= Preferred much |
| 3= preferred | 4= Less Preferred |
| 5= Less Preferred very much | |

Sample	471	830	952	161	728
	_____	_____	_____	_____	_____

Questionnaire for Overall Quality Rating

Name _____
Date _____

Instruction: Please taste the sample comparing with the control and rate on the scale of the overall quality depending on your feeling.

Overall quality rating

1	2	3	4	5	6	7	8	9	10
Reject		Unacceptable		Acceptable			Match		

Comment:

Consumer Acceptance

The Formulation of Seafood Bar

To: Panelists

Subject: Operation in answering the questionnaire about Seafood Bar Product

This questionnaire is a part of Ms. Sarawan Kanin's special project who is a student of Biotechnology Faculty at Assumption University. The project is about formulation of Seafood Bar that your cooperation is necessarily useful for the project.

Finally, great appreciation would be made for your cooperation.



Part 1: Demographic Data

Instruction: Please answer all questions by checking in the space provided.

1. Gender

- ☐ Male ☐ Female

2. Age

- ☐ Less than 15 years ☐ 16-25 years
☐ 26-35 years ☐ 36-45 years
☐ 46-55 years ☐ more than 55 years

3. Education

- ☐ Less than high school ☐ High School
☐ Diploma ☐ bachelor's degree
☐ Higher than Bachelor's degree

4. Occupation

- ☐ Student ☐ Government official
☐ Employee ☐ Business Owner
☐ Other/please specify.....

5. Income/month

- ☐ Less than 5000 Baht ☐ 5001-10000 Baht
☐ 10001-15000 Baht ☐ more than 15000 Baht

Part 2: Information about consumer's buying and consumption behavior of dried crispy seafood

6. Have you ever test crispy seafood?

- ☐ Yes ☐ No

7. Do you like to have dried crispy seafood?

- ☐ Like ☐ Don't like

8. How often do you by crispy seafood product?

- ☐ Everyday ☐ 2-3 time/weeks ☐ 1 time/week
☐ Once per mouth ☐ 2-3 time/year ☐ Not sure

9. 1. Please rinse your mouth with water before starting.

2. Please taste the four samples in the order presented from left to right. Then evaluate hedonic scale in each attribute of sample by using the following score.

- | | |
|------------------------------|------------------------|
| 9 = like extremely | 4 = dislike slightly |
| 8 = like very much | 3 = dislike moderately |
| 7 = like moderately | 2 = dislike very much |
| 6 = like slightly | 1 = dislike extremely |
| 5 = neither like nor dislike | |

Overall Liking.....

10. Is the product acceptable?

- ☐ Yes ☐ No

11. Would you buy this product if it is commercially available?

- ☐ Yes, because _____
- ☐ Maybe, because _____
- ☐ No, because _____

12. In your opinion, is the price 15-20 baht suitable for 25 gram of seafood bar?

- ☐ Yes
- ☐ No, because _____

Suitable price is _____ baht

13. In your opinion, what time is suitable to have Seafood Bar? (you can answer more than 1 question)

- | | |
|---|--|
| <input type="checkbox"/> Instead Breakfast | <input type="checkbox"/> Night time |
| <input type="checkbox"/> Between meal | <input type="checkbox"/> Prefer to eat |
| <input type="checkbox"/> Snack | <input type="checkbox"/> Party time |
| <input type="checkbox"/> Refreshments | <input type="checkbox"/> Instead meal |
| <input type="checkbox"/> Lunch and break time | |



2.2.1 Formulate seafood bar from leftover squid

Table20: Output of analysis of **overall liking** acceptance on formula and type of squid treatment in the formulation

Overall liking

	sauce	N	Subset	
			1	2
Dunca	sauce4	30	6.1667	
n(a,b)	sauce2	30	6.2667	
	sauce1	30		7.0000
	sauce3	30		7.3333
	Sig.		.731	.253

Table21: Output of analysis of **overall flavor** acceptance on formula and type of squid treatment in the formulation

Overall flavor

	sauce	N	Subset	
			1	2
Dunca	sauce2	30	5.8000	
n(a,b)	sauce4	30	5.9333	
	sauce1	30		6.8000
	sauce3	30		6.9667
	Sig.		.659	.581

Table22: Output of analysis of **overall odor** acceptance on formula and type of squid treatment in the formulation

Overall odor

	sauce	N	Subset
			1
Dunca	sauce2	30	5.8000
n(a,b)	sauce4	30	6.1333
	sauce3	30	6.3000
	sauce1	30	6.4333
	Sig.		.058

Table23: Output of analysis of **overall color** acceptance on formula and type of squid treatment in the formulation

Overall color

	sauce	N	Subset	
			1	2
Dunca	sauce4	30	5.5667	
n(a,b)	sauce2	30	5.7000	
	sauce3	30		6.8000
	sauce1	30		7.0000
	Sig.		.631	.472

Table24: Output of analysis of **crispiness** acceptance on formula and type of squid treatment in the formulation

Crispiness

	sauce	N	Subset	
			1	2
Dunca	sauce1	30	6.4000	
n(a,b)	sauce2	30	6.4333	
	sauce4	30	7.0333	7.0333
	sauce3	30		7.1333
	Sig.		.069	.760

2.2.2 Study on product attribute.

Table25:: Output of analysis of **Overall** acceptance on seafood bar formulation

One-Sample Statistics				
	N	Mean	Std. Deviation	Std. Error Mean
OVERALL	30	8.0000	.64327	.11744

Table26: Output of analysis of **Color** acceptance on seafood bar formulation

One-Sample Statistics				
	N	Mean	Std. Deviation	Std. Error Mean
COLOR	30	7.4333	.77385	.14129

Table27: Output of analysis of **Glossy** acceptance on seafood bar formulation

One-Sample Statistics				
	N	Mean	Std. Deviation	Std. Error Mean
GLOSSY	30	7.4333	.77385	.14129

Table28: Output of analysis of **Peanut Odor** acceptance on seafood bar formulation

One-Sample Statistics				
	N	Mean	Std. Deviation	Std. Error Mean
PEANUTO	30	7.0000	.90972	.16609

Table29: Output of analysis of **Squid Odor** acceptance on seafood bar formulation

One-Sample Statistics				
	N	Mean	Std. Deviation	Std. Error Mean
SQUIDO	30	7.5333	1.04166	.19018

Table30: Output of analysis of **Fry rice Odor** acceptance on seafood bar formulation

One-Sample Statistics				
	N	Mean	Std. Deviation	Std. Error Mean
FRYRICEO	30	7.4000	.93218	.17019

Table31: Output of analysis of **Crispiness** acceptance on seafood bar formulation

One-Sample Statistics				
	N	Mean	Std. Deviation	Std. Error Mean
CRISPY	30	7.8333	1.01992	.18621

Table32: Output of analysis of Crumb acceptance on seafood bar formulation
One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
CRUMB	30	7.7000	.74971	.13688

Table33: Output of analysis of Sweetness acceptance on seafood bar formulation
One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
SWEET	30	7.5333	.93710	.17109

Table34: Output of analysis of Spiciness acceptance on seafood bar formulation
One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
SPICY	30	7.5333	.89955	.16424

Table35: Output of analysis of Saltiness acceptance on seafood bar formulation
One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
SALTY	30	7.6000	1.00344	.18320

Table36: Output of analysis of Squid Flavor acceptance on seafood bar formulation
One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
SQUIDFLA	30	7.7333	.98027	.17897

Table37: Output of analysis of Fry rice Flavor acceptance on seafood bar formulation
One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
FRYFLA	30	7.4333	1.10433	.20162

2.2.3 Study on optimum percentage peanut

Table38: Perception of peanut odor

	Peanut	N	Subset 1
Duncan(a,b)	2.00	30	6.4000
	1.00	30	6.4333
	3.00	30	6.7667
	Sig.		.070

Table39: Perception of peanut flavor

	Peanut	N	Subset 1
Duncan(a,b)	2.00	30	6.7000
	3.00	30	6.8333
	1.00	30	7.1000
	Sig.		.118

Table40: overall liking peanut

	Peanut	N	Subset 1
Duncan(a,b)	3.00	30	6.8333
	2.00	30	7.0000
	1.00	30	7.2000
	Sig.		.178

2.2.4 Study on optimum percentage dried chili

Table41: Output of analysis of **Spiciness** acceptance

	TRT	N	Subset	
			1	2
Duncan(a, b)	chilli 0g	50	6.4800	
	chilli 2.47g	50	6.7800	6.7800
	chilli 1.39g	50		7.0600
	Sig.		.227	.259

Table42: Output of analysis of **Overall liking** acceptance

	TRT	N	Subset	
			1	2
Duncan(a, b)	chilli 2.47g	50	6.7000	
	chilli 0g	50		7.1200
	chilli 1.39g	50		7.4000
	Sig.		1.000	.182

2.2.5 Study on size of squid

Table43: Output of analysis means hedonic score of **color** acceptance depend on size of squid

	size of squid	N	Subset	
			1	2
Duncan(a,b)	0 sec.	30	6.8000	
	10 sec.	30	7.0000	7.0000
	5 sec.	30		7.2667
	Sig.		.292	.161

Table44: Output of analysis means hedonic score of **glossy** acceptance depend on size of squid

	size of squid	N	Subset
			1
Duncan(a,b)	0 sec.	30	6.9667
	10 sec.	30	7.0333
	5 sec.	30	7.0667
	Sig.		.563

Table45: Output of analysis means hedonic score of **squid odor** acceptance depend on size of squid

	size of squid	N	Subset
			1
Duncan(a,b)	10 sec.	30	6.6667
	5 sec.	30	6.6667
	0 sec.	30	6.6667
	Sig.		1.000

Table46: Output of analysis means hedonic score of **crispiness** acceptance depend on size of squid

	size of squid	N	Subset
			1
Duncan(a,b)	5 sec.	30	6.9000
	0 sec.	30	6.9667
	10 sec.	30	7.0333
	Sig.		.583

Table47: Output of analysis means hedonic score of **sweetness** acceptance depend on size of squid

	size of squid	N	Subset
			1
Duncan(a,b)	0 sec.	30	6.5000
	5 sec.	30	6.7333
	10 sec.	30	6.8000
	Sig.		.258

Table48: Output of analysis means hedonic score of **spiciness** acceptance depend on size of squid

	size of squid	N	Subset 1
Duncan(a,b)	0 sec.	30	6.6333
	10 sec.	30	6.7333
	5 sec.	30	6.8000
	Sig.		.405

Table49: Output of analysis means hedonic score of **saltiness** acceptance depend on size of squid

	size of squid	N	Subset 1
Duncan(a,b)	10 sec.	30	6.2333
	0 sec.	30	6.2333
	5 sec.	30	6.4000
	Sig.		.455

Table50: Output of analysis means hedonic score of **squid flavor** acceptance depend on size of squid

	size of squid	N	Subset 1
Duncan(a,b)	10 sec.	30	6.7000
	0 sec.	30	6.8667
	5 sec.	30	6.9333
	Sig.		.314

Table51: Output of analysis means hedonic score of **overall liking** acceptance depend on size of squid

	size of squid	N	Subset 1
Duncan(a,b)	0 sec.	30	6.7333
	10 sec.	30	6.8667
	5 sec.	30	7.1000
	Sig.		.181

2.3 Study on the most preference shape of seafood bar

Table52: Out put of analysis of ranking score of seafood bar

		N	Subset 1	2	3
Duncan	shape				
	cylender	100	2.4700		
	bar	100	2.5900	2.5900	
	square	100		2.6900	
	short	100			3.6000
	football	100			3.6500
	Sig.		.075	.137	.457

