

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่

Copyright© by Chiang Mai University

All rights reserved

Appendix A



Figure A1 Focus group interview



Figure A2 Questionnaire survey



Figure A3 Spray dryer



Figure A4 Salt preparation by foam-mat drying



Figure A5 Oil roasted peanut preparation

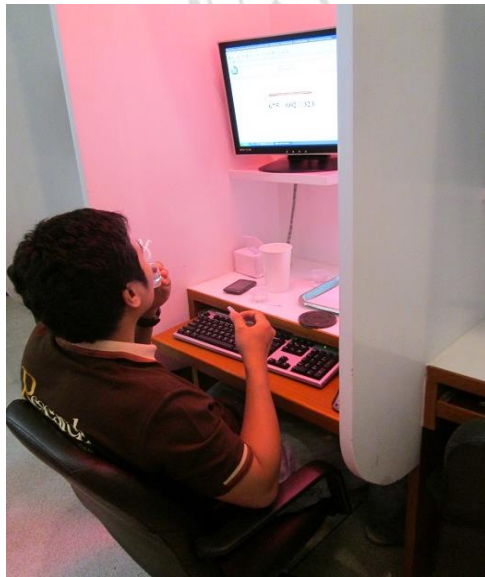
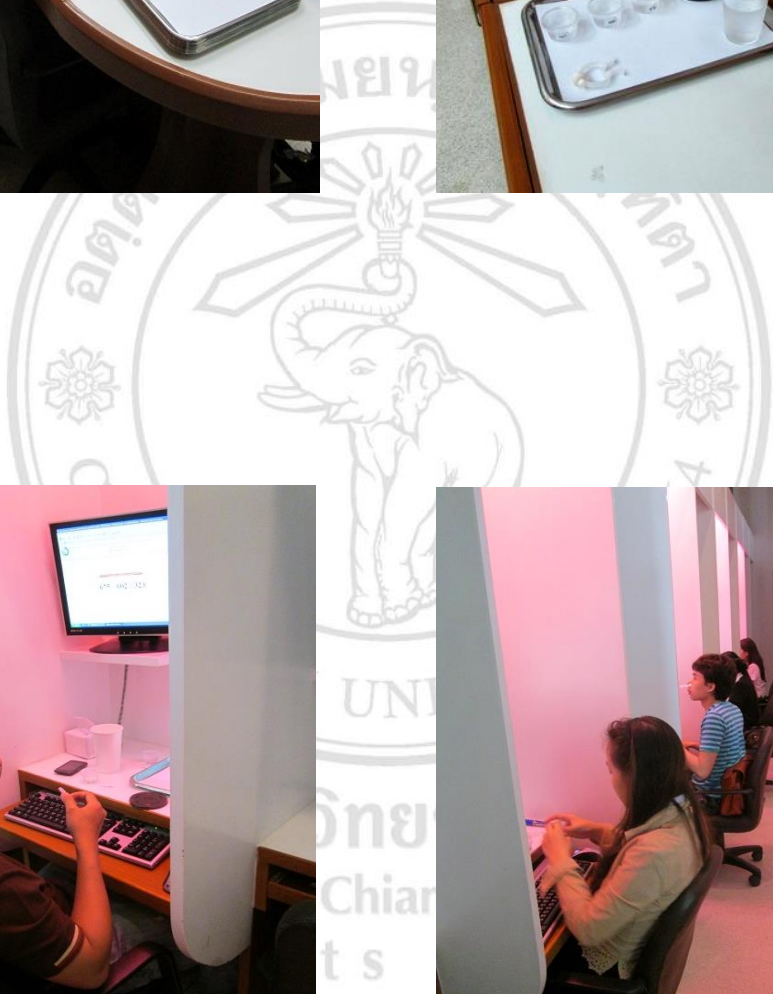


Figure A6 Odor tasteless testing

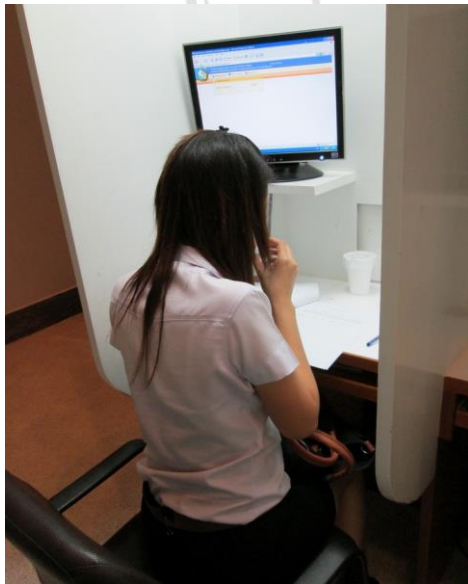
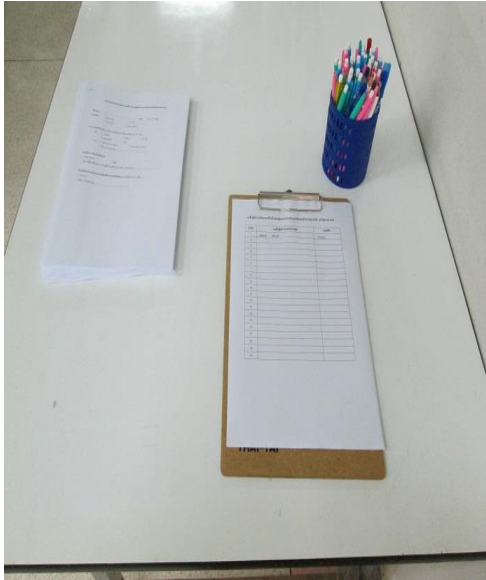


Figure A7 Selection of trained panel members



Figure A8 Training of trained panel members

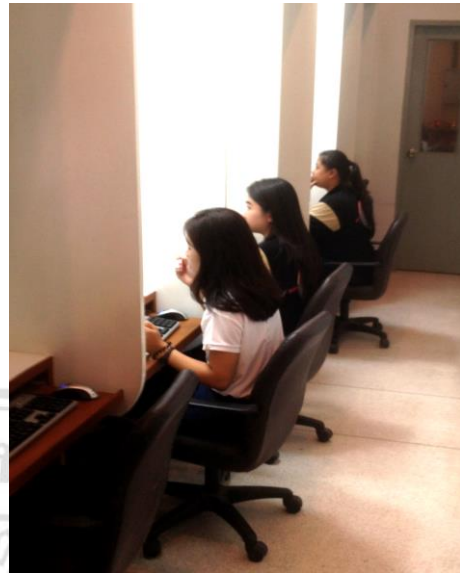


Figure A9 Consumer sensory evaluation

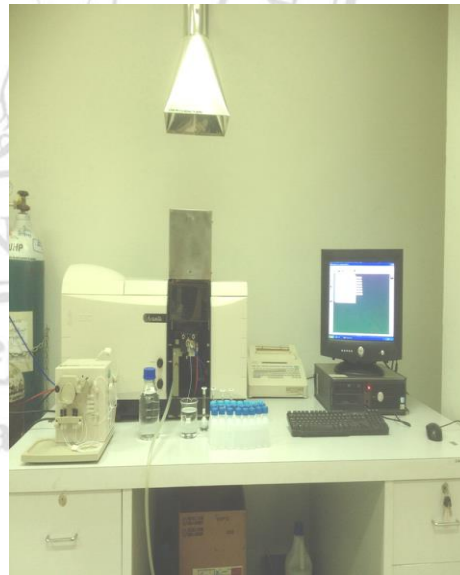


Figure A10 Sodium content analysis



Figure A11 Spray dried salt

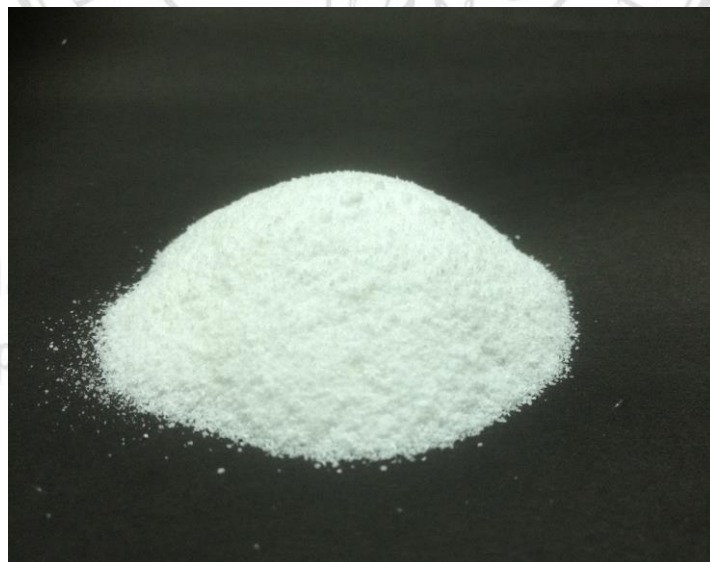


Figure A12 Foam-mat salt



Figure A13 Spray dried salt with soy sauce powder

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright© by Chiang Mai University
All rights reserved

Appendix B

Physical and chemical analysis

Determination of moisture content

Weight approximately 5 g of sample to moisture can. Collect the weight of sample before drying. Place the moisture can with sample in the oven. Place this moisture can in hot air oven at 145 ± 5 °C. Dry the sample until the weight is constant. After drying, transfer the moisture can with sample to the desiccator to cool. Reweight dried sample (Thai Industrial Standard institute, 2001).

$$\text{Calculation Moisture (\%)} = \frac{W1-W2}{W1} \times 100$$

Where W1 = weight of sample before drying (g)

W2 = weight of sample after drying (g)

Determination of sodium content

The sample is blended and dry. Weight approximately 1 g of sample to Erlenmeyer flask. Add 20 ml of Nitric acid/sulfuric acid mixture (6:1) and the flask was covered with a glass lid. The samples were kept in room temperature for 24 hour. Then the sample was heated on a hot plate at 150 °C to dryness. After drying, the sample was quantitatively transferred into a 10.0 mL volumetric flask with HCl/Deionized water (1/4) and measurements were performed in Atomic Absorption Spectrometers (AAS), (Avanta M1, USA).

Working reference solutions of Na was prepared in HCl solution, as the samples were, by serial dilution of a stock solution containing 1000 mg/L. The elemental standard solutions ranged from: 0 to 1.5 ppm (0, 0.4, 0.8, 1.2, 1.5 ppm) (adapt from Kira, and Maihara, 2007; Klaic et al., 2011).

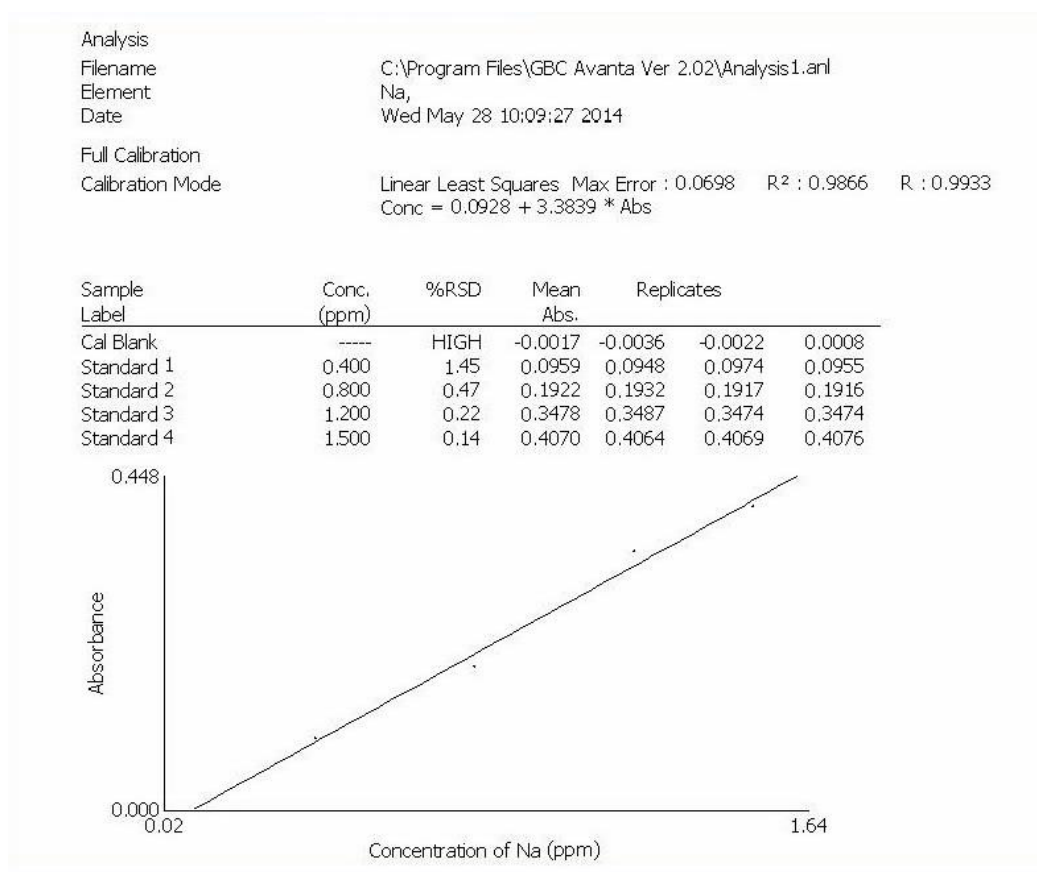


Figure B1 Standard curve for Na concentration analysis

Determination of particle size

Particle size analysis was conducted using a laser diffraction particle size analyzer (Malvern Mastersizer[®]S, Malvern Instruments Ltd, Malvern, UK). The Condition was Range lens: 300 RF mm, He-Ne laser source, λ : 633 nm, Beam length: 2.40 mm, Particle size range analysis: 0.05-900 μm , Small sample dispersion unit: MS1, Refractive index value of sample: 1.5442. Samples were prepared by suspending the spray dried salt powders and foam-mat salt powders in ethanol with aid of sonication for 2 minutes. Measurements were repeated to ensure that no dissolution or agglomeration of the powders obtained. Each sample was determined in triplicate.

Appendix C

Sensory evaluation

Sensory panel member's selection

Recruitment

The candidates were recruited from personal contract and questionnaires. All candidates were students from Agro-industry faculty, Chiang Mai University who have experience about sensory testing. Recruitment criteria of candidates who were chosen to constitute the sensory expert panel include interest, availability, promptness, good health, articulateness, good attitude about peanut product and peanut intolerance without allergy (ASTM, 1981).

Screening

Basic methods were used for panelist screening, including, basic taste recognition, odor identification and intensity ranking. Triangle test of different salt solution also was used to screen panelist. All result from these test with data from questionnaire, give some direction as to which individuals would be best suited as panelist (ASTM, 1981).

Basic taste recognition test

Procedure

Preparation basic taste solution samples include sweet (2% sucrose), sour (0.07% citric acid), salty (0.2% sodium chloride), bitter (0.07%) and mix two basic taste (sweet and sour). All taste solutions were prepared in odorless and tasteless water and present 30 ml amount in random order. The candidates tested each sample and indicated taste of sample.

Analysis

Each of the basic tastes must be correctly identified (100% of score).

Odor identification test

Procedure

Different odor samples were used in this test, for example, normally encountered odorant (strawberry, green tea, soy sauce) and rarely encountered odorant (oyster sauce, peach, taro). All odorants were prepared in a clean, odorless, dark-colored bottle with plastic lined closure and screw cap. Add the piece of cotton in the bottle. Then add a small quantity of the odorant and cover the bottle with aluminum foil and make small puncture. Firmly close the container Allow enough headspace to concentrate the odor. The candidates tested each sample and described odor of sample.

Analysis

70 % of all odorants were correctly described by each candidate.

Intensity ranking

Procedure

Basic taste solution samples were prepare each concentration follow Table C1. Samples that are coded are given to a candidate in a random order. Candidates are asked to rank the samples in order of taste difference from low taste to high taste. Each of the following basic taste test series were replicated at least three times.

Analysis

Each of the basic taste series must be correctly identified (100% of score).

Triangle test

Procedure

Preparation salty solution samples include 0.1% and 0.4% sodium chloride. Each candidate receives three samples: two samples are identical and one is different or odd. Candidates receive all six sample combination and they were asked to select the different sample on taste difference.

Analysis

Candidates scoring more than 60% correct of the response should be considered.

Table C1 Intensity of basic solution for intensity ranking test

Taste	% Concentration in odorless and tasteless water
Bitter	0.035
(caffeine)	0.07
	0.14
Sweet	1.00
(sucrose)	2.00
	4.00
Salty	0.10
(sodium chloride)	0.20
	0.40
Sour	0.035
(citric acid)	0.07
	0.14

Source: ASTM, Committee E-18, 1992

Sensory panel member's training

The ten candidates, seven women and three men were selected for training with respect to discrimination test during approximately 2- hour training sessions/day. This training was operated in three steps.

1) Introducing the method to the panelists.

The first step include of a short talk presenting the procedure to the panelists. No information was given about real objective of this study. The panelists were also introduced to the sensory ballot of each method. General questions about the experiment and how to assign the answer of each method were described to all panelists.

2) Familiarization of the panelists with the triangle task, threshold test and rating scale method using basic taste solutions and odor solution

This section of training procedure was to familiarize the panelists with the actual use of the sensory ballot and the computer system and to train them to discriminate taste. They were presented with thirty milliliters of four basic taste beverages (sweet, salt, bitter and acid) of which the concentrations were shown in Table C2.

3) Training the panelists using the real product: odor/taste solutions and peanut samples

The assessors were trained with the triangle task and threshold test by using odor/taste solutions. Only rating scale method was carried out by using peanut samples.

Table C2 Intensity of basic solution for training

Attribute	Linear scale (mm)	% Concentration in odorless and tasteless water
Sweet (sucrose)	150	16
	100	10
	50	5
	20	2
Salty (sodium chloride)	85	0.50
	50	0.35
	25	0.20
Sour (citric acid)	100	0.15
	50	0.08
	20	0.05
Bitter (caffeine)	100	0.15
	50	0.08
	20	0.05

Source: Meilgaard et al., 2007

Survey Questionnaire

The undersigned will carry out a thesis entitled "Development of modified salt using odor-induced saltiness enhancement". This survey is used in partial fulfillment of graduate study of Agro-Industrial Product Development, Chiang Mai University Thailand. This survey is completely anonymous and confidential. Your responses are a critical part of my research. Please answer all the questions as candidly and completely as possible. Thank you for your kind cooperation in conduct of this research. Your answers will contribute to this academic research.

Section 1 Personal Profile

Instruction Please provide the following information by putting a check that corresponds to your answer.

Gender _____ Male _____ Female
 Age _____ 18-30 years old _____ 31-45 years old
 _____ 46-65 years old
 Occupation _____ Agriculturist _____ Housekeeper
 _____ Student _____ Corporate officer
 _____ Government officer _____ State enterprise employee
 _____ Businessman _____ Other.....

Section 2 Saltiness intensity rating

Instruction Within food odor names, how do you think the following food odor names related saltiness? Please mark the appropriate response to indicate your own personal feeling by circling based on the following scale.

Scales: 0 = Unknown 1 = No salty 2 = No salty-Little salty
3 = Little salty 4 = Little salty-Moderate salty 5 = Moderate salty
6 = Moderate salty-Much salty 7 = Much salty
8 = Much salty-Extremely salty 9 = Extremely salty

No.	Food odor names	Level of salty intensity in your feeling									
		0	1	2	3	4	5	6	7	8	9
1	Fish sauce										
2	Chili sauce										
·	·										
78	Salted fish										

The ballot example of selection of odor on saltiness enhancement by salty intensity rating

Triangle sensory Test

Name.....
Age.....

Date.....

Please take a drink of water and use clip nose before tasting solution samples. Drink solution samples from left to right, and please take a sip of water between samples.

Place circle code of the solution sample which is taste different than the others.

531

642

098

Comments:

**The ballot used to evaluate odor solution and water using triangle test for
odor tasteless testing**

Threshold Determination

Name.....

Date.....

Instruction: There are a set of solution samples in each test row (series of 3) for you to evaluate. You will start by tasting the samples closest to you from left to right; this is row 1. You may swallow or expectorate the solution sample into the designated cup, rinse your mouth well with water, and expectorate the rinse water before moving to the next sample. Within each row (series of 3), write the random three-digit number of the sample which is different from the others and check ✓ to describe taste difference. **WAIT 2 MINUTES BETWEEN ROWS.** Then, proceed to the next row (series of 3) and repeat the tasting sequence.

FOCUS ON DIFFERENCE IN TASTE

Row	Code of different sample	Description of taste difference				
		Sweetness	Sour	Saltiness	Bitter	Not sure
1						
2						
3						
4						
5						
6						
7						

**The ballot used to evaluate saltiness of soy sauce odor with water and water using 3 for odor
tasteless testing**

Threshold Determination

Date.....

Name.....

Instruction: There are a set of solution samples in each test row (series of 3) for you to evaluate. You will start by tasting the samples closest to you from left to right; this is row 1. You may swallow or expectorate the solution sample into the designated cup, rinse your mouth well with water, and expectorate the rinse water before moving to the next sample. Within each row (series of 3), write the random three-digit number of the sample which is saltiness than the others. **WAIT 2 MINUTES BETWEEN ROWS.** Then, proceed to the next row (series of 3) and repeat the tasting sequence.

FOCUS ON SALTINESS DIFFERENCE THAN TWO SAMPLES

Row	Code of different sample
1	
2	
3	
4	
5	
6	
7	

The ballot used to evaluate saltiness of soy sauce odor with 0.02 M salt solution and 0.02 M salt solution using 3 for odor tasteless testing

Consumer Test

Name..... Date.....
Age.....

Please take a drink of water before tasting samples and take a sip of water between samples. Taste the given samples, then write the scale which best describes your feeling.

Scale: 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

Attribute	Code 105
Overall liking	
Overall flavor	
Saltiness	

Example of a consumer sensory ballot used to evaluate oil roasted peanut with different salt

CURRICULUM VITAE

Author's Name Ms. Napapan Chokumnoyporn

Date/Year of Birth 3 May 1985

Place of Birth Phrae Province, Thailand

Education

2011 M.S. in Faculty Agro Industry, Chiang Mai University.
(Food Product Development Technology) GPA: 3.93

2007 B.S. in Faculty Agro Industry, Chiang Mai University.
(Food Product Development Technology) GPA: 3.70

2002 Graduated high school from Nareerat School Phrae
Major in Science and Mathematics

Scholarship December 2012-September 2015

The Thailand Institute of Scientific and Technological Research

Publication

Chokumnoyporn, N., Sriwattana, S., Phimolsiripol, Y. and Prinyawiwatkul, W., "Attitude of Thai consumers toward sodium reduction in food by odor-induced saltiness enhancement," Proceedings: International Graduate Research Conference, Chiang Mai, Thailand, December 12, 2014, pp.ST-126-132.

Experience Production supervisor in Lanna Agro Industry CO.,LTD.

