APPENDIX

APPENDIX A

CHEMICAL ANALYSIS PROCEDURES

1. Determination of Total Nitrogen Content

1.1 Reagents and Equipmens for analysis

- Sulfuric scid (H_2SO_4)
- Potassium sulfate (K_2SO_4)
- Copper sulfate ($CuSO_4$)
- Sodium hydroxide (NaOH)
- Bromocresol green
- Methyl red
- Distillation unit (Model B-324, BÜCHI, Switzerland) with kjeldahl digestion tube

1.2 Method

Total nitrogen content of fish sauce samples was determined using the Kjeldahl method, according to the AOAC procedures (2000). Sample (0.5ml) was pipette in the Kjeldahl digestion tube. Fifteen ml of conc. H_2SO_4 and 15 g of catalyst (mixed $CuSO_4$ with K_2SO_4 in a weight ratio of 0.5:1) were added to the sample and digested in a digester at 420 °C until a clear solution was obtained. Distilled water (55ml) was added to the tube and the mixture steam distilled using a distillation unit (Model B-324, BÜCHI, Switzerland) while 85 ml of 40% NaOH solution were added automatically via a built in dispensing system. The distillate was collected in a 50 ml saturated boric acid with mixed indicator. The mixed indicator solution was prepared by mixing 0.1% (w/v) of bromocresol green with 0.1% (w/v) of methyl red. Titration was done using 1.0 N HCl until the color changed to pink-red. The total nitrogen content was expressed as g nitrogen per 100 ml of fish sauce using the following formula:

$$\text{Total nitrogen (\%w/v)} = \frac{\text{Volume of HCl} \times \text{Normality of HCl} \times 14.007 \times 100}{\text{Volume of fish sauce (ml)}}$$

2. Determination of Sodium Chloride

2.1 Reagents and Equipmens for analysis

- Silver nitrate ($AgNo_3$)
- Nitric acid (HNO_3)
- Ammonium thiocyanate (NH_4SCN)
- Hot plate

2.2 Method

Sodium chloride content in a sample was determined by the method of AOAC (2000). One ml of fish sauce samples were diluted with 9 ml of distilled water. Diluted sample (1.0 ml) was mixed with 30 ml of 0.1 N $AgNo_3$ to precipitate all Cl as AgCl, and then added 20 ml of conc. HNO_3. The mixture was boiled gently on a hot plate until all solids except AgCl were dissolved (usually 15 min). The mixture was then cooled using running water. Then 50 ml of distilled water and 5 ml of ferric alum indicator were added. The mixture was titrated with standardized 0.1 N NH_4SCN until the solution became permanent light brown. The percentage of salt was then calculated using the following formula:

$$\text{Sodium chloride (\%w/v)} = \frac{(\text{Volume of } AgNo_3 - \text{Volume of } NH_4SCN) \times \text{Normality of } gNo_3 \times 0.058 \times 100}{\text{Volume of fish sauce (ml)}}$$

3. Determination of Reducing Sugar

3.1 Reagents and Equipmens for analysis

- Alkaline copper reagent
- Nelson reagent
- Spectrophotometer (Model UV-160A, Shimadzu, Japan) with a path length of 10 mm quartz cuvette cell.

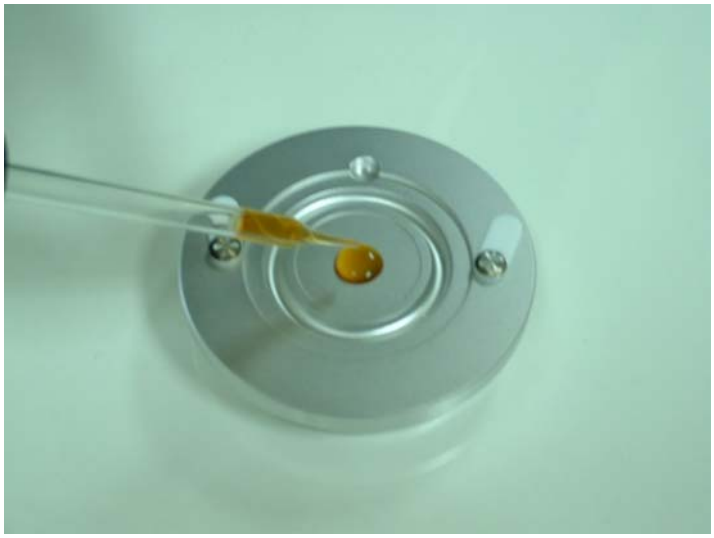
3.2 Method

Reducing sugar was determined by the Nelson-Somogyi reducing sugar method using glucose solutions as standards (Somogyi, 1952). One ml of fish sauce samples were diluted with 9 ml of distilled water. An aliquot of 1.0 ml of diluted sample with 1.0 ml of alkaline copper reagent was heated in a boiling water bath for 15 min. This solution was quickly cooled, and 1.0 ml of Nelson reagent and 10.0 ml of water were then added. After 15 min, the absorbance of the colored solution was measured at 520 nm. The absorbance of the samples was measured using a spectrophotometer (Model UV-160A, Shimadzu, Japan) with a path length of 10 mm quartz cuvette cell. The reducing sugar content was calculated by comparison to a glucose standard curve.

APPENDIX B

NIR INSTRUMENT

(a)



(b)

Appendix Figure B1 NIR instrument was used in this study (a) an InfraAlyzer 500 spectrometer and (b) a 0.3 mm British cup.

APPENDIX C

ARTIFICIAL NEURAL NETWORK

Appendix Table C1 Weights from inputs to four hidden nodes in the hidden layer used for the ANNS model.

Input nodes	Weights from input to hidden node			
(nm)	Hidden node 1	Hidden node 2	Hidden node 3	Hidden node 4
2264	7.77	-17.28	8.05	4.50
2266	4.29	-11.24	17.73	1.97
2268	7.83	-0.60	10.40	10.43
2270	-5.05	-6.31	5.20	0.10
2272	0.87	-12.04	9.69	-9.50
2274	-9.09	0.90	-1.22	6.56
2276	5.97	-4.88	1.84	12.84
2278	-2.16	1.98	15.66	-7.36
2280	-1.20	9.62	12.65	8.08
2282	-4.37	8.38	0.99	0.93
2284	-8.35	0.21	4.54	11.32
2286	-5.65	-13.03	8.86	3.54
2288	2.62	-6.30	7.82	-0.54
2290	10.04	3.35	17.57	-0.72
2292	9.63	-8.66	9.89	2.38
2294	11.03	-0.47	9.01	-1.98
2296	-3.29	-2.02	-3.89	-3.34
2298	8.42	-5.75	8.99	-4.18
2300	5.80	-1.60	5.45	3.06
2302	9.24	-1.07	7.49	1.17
2304	-10.30	-13.69	6.65	10.30
2306	5.41	-13.05	2.08	2.61
2308	-6.58	-9.75	1.95	-6.54
2310	-4.24	-11.86	-0.86	2.85
2312	8.58	-7.92	14.21	8.65
2314	-3.62	-5.60	10.10	-0.34

Appendix Table C1 (Continued)

Input nodes (nm)	Weights from input to hidden node			
	Hidden node 1	Hidden node 2	Hidden node 3	Hidden node 4
2316	-4.05	11.57	8.98	8.80
2318	-5.20	5.62	-6.06	-8.74
2320	5.16	-5.32	10.51	-11.48
2322	-6.15	-2.54	5.85	-1.37
2324	3.42	1.28	0.00	7.70
2326	10.21	-3.07	-11.79	5.52
2328	9.08	15.18	1.00	11.88
2330	-6.63	0.82	15.88	0.04
2332	1.19	-10.46	5.13	6.29
2334	7.49	12.09	-4.46	16.79
2336	0.51	12.02	-2.58	0.17
2338	6.40	5.04	-8.26	-8.38
2340	-4.01	7.19	4.84	-14.05
2342	13.58	-7.19	-6.28	-7.64
2344	-12.18	5.33	4.07	-8.61
2346	-7.29	-11.06	0.81	-4.20
2348	-11.39	5.77	12.82	0.15
2350	-2.41	14.61	0.23	5.50
2352	-0.07	11.15	7.44	-7.84
2354	-10.09	-4.81	5.84	-6.52
2356	9.91	-1.20	-1.80	6.26
2358	9.01	-0.04	-3.26	6.93
2360	3.77	1.82	-11.66	-2.91
2362	3.32	7.69	-12.34	-5.83
2364	-10.57	-3.09	-1.84	-6.08
2366	-9.07	0.30	7.77	-9.14
2368	0.18	-12.84	-1.08	-6.27

Appendix Table C1 (Continued)

Input nodes (nm)	Weights from input to hidden node			
	Hidden node 1	Hidden node 2	Hidden node 3	Hidden node 4
2370	2.39	-12.70	-14.57	5.34
2372	-8.71	2.90	2.16	-8.60
2374	-10.47	-18.62	-6.02	-1.88
2376	-9.75	9.15	2.70	7.71
2378	3.28	1.45	1.35	-6.99
2380	-8.50	-17.15	-11.02	2.48
2382	1.72	-11.09	-11.77	6.23
2384	1.09	-5.20	-14.00	-10.68
2386	4.85	-14.62	3.92	5.89
2388	-0.17	-0.25	-2.84	9.28
2390	6.55	-5.12	-6.74	-3.74
2392	4.18	1.87	-1.45	3.39
2394	5.07	13.37	3.31	2.39
2396	1.47	-5.12	-2.62	3.59
2398	-0.88	11.38	2.87	-1.85
2400	-2.76	3.92	3.84	5.92
2402	2.42	4.17	1.59	-0.80
2404	5.12	-8.00	-5.69	6.58
2406	4.67	12.88	-11.41	-3.05
2408	-6.78	6.63	-11.70	-3.14
2410	-4.61	17.25	-3.98	-1.03
2370	2.39	-12.70	-14.57	5.34
2372	-8.71	2.90	2.16	-8.60
2374	-10.47	-18.62	-6.02	-1.88
2376	-9.75	9.15	2.70	7.71
2378	3.28	1.45	1.35	-6.99
2380	-8.50	-17.15	-11.02	2.48

Appendix Table C1 (Continued)

Input nodes (nm)	Weights from input to hidden node			
	Hidden node 1	Hidden node 2	Hidden node 3	Hidden node 4
2382	1.72	-11.09	-11.77	6.23
2384	1.09	-5.20	-14.00	-10.68
2386	4.85	-14.62	3.92	5.89
2388	-0.17	-0.25	-2.84	9.28
2390	6.55	-5.12	-6.74	-3.74
2392	4.18	1.87	-1.45	3.39
2394	5.07	13.37	3.31	2.39
2396	1.47	-5.12	-2.62	3.59
2398	-0.88	11.38	2.87	-1.85
2400	-2.76	3.92	3.84	5.92
2402	2.42	4.17	1.59	-0.80
2404	5.12	-8.00	-5.69	6.58
2406	4.67	12.88	-11.41	-3.05
2408	-6.78	6.63	-11.70	-3.14
2410	-4.61	17.25	-3.98	-1.03
2412	-6.37	-2.42	-2.53	-0.94
2414	0.74	6.61	-11.18	6.94
2416	-8.27	-4.40	2.32	-6.40
2418	-8.77	2.42	-7.95	-8.93
2420	4.49	14.86	2.67	-2.97
2422	-4.08	14.06	-1.63	6.05
2424	-4.63	14.67	-4.50	0.49
2426	2.55	8.80	0.24	0.47
2428	1.08	-3.30	5.39	5.57

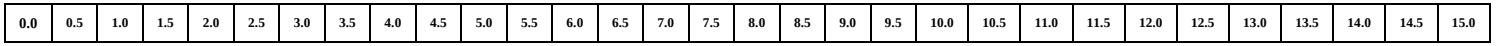
APPENDIX D

BALLOT FOR SENSORY TEST

Name……..Date……..Sample code……..

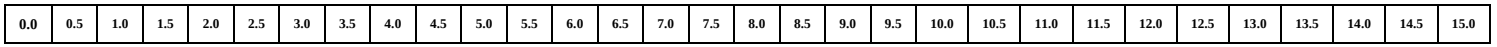
Please indicate the intensity of the following attributes of the sample of fish sauce:

1. Brown Intensity



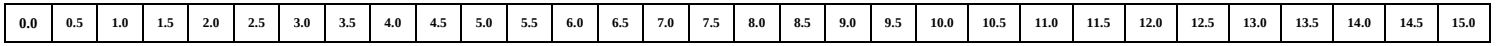
Light Dark

2. Sweet aromatic



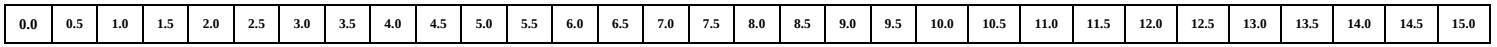
None Extreme

3. Calamelized aromatic



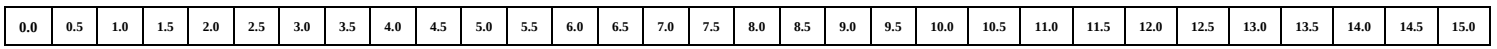
None Extreme

4. Fermented aromatic



None Extreme

5. Fishy aromatic



None Extreme

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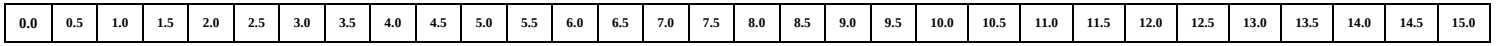
Name……..Date……..Sample code……..

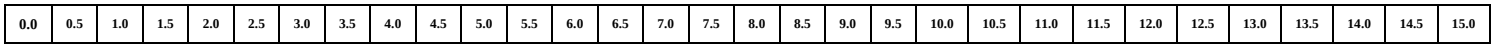
Please indicate the intensity of the following attributes of the sample of fish sauce:

6. Musty aromatic



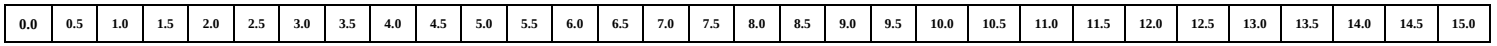
None Extreme

7. Sweet taste



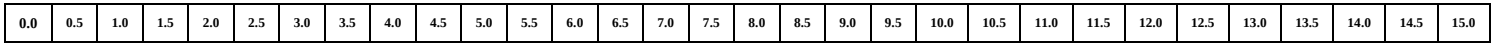
None Extreme

8. Salty taste



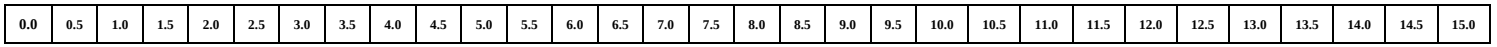
None Extreme

9. Bitter taste



None Extreme

10. Umami taste



None Extreme

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Name……..Date……..Sample code……..

Please indicate the intensity of the following attributes of the sample of fish sauce:

11. Sweet aftertaste

0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10.0	10.5	11.0	11.5	12.0	12.5	13.0	13.5	14.0	14.5	15.0

None Extreme

12. Salty aftertaste

0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10.0	10.5	11.0	11.5	12.0	12.5	13.0	13.5	14.0	14.5	15.0

None Extreme

13. Bitter aftertaste

0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10.0	10.5	11.0	11.5	12.0	12.5	13.0	13.5	14.0	14.5	15.0

None Extreme

14. Caramelized flavor

0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10.0	10.5	11.0	11.5	12.0	12.5	13.0	13.5	14.0	14.5	15.0

None Extreme

15. Fishy flavor

0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10.0	10.5	11.0	11.5	12.0	12.5	13.0	13.5	14.0	14.5	15.0

None Extreme