



Glutamate Content of Selected Traditional Indonesian Foods & Ingredients:

Effect of Processing/Preparation

Purwiyatno Hariyadi
Nuri Andarwulan
Lilis Nuraida

- Southeast Asian Food & Agricultural Science & Technology (SEAFAST) Center *dan*
- Professor at Department of Food Science and Technology Faculty of Agricultural Technology

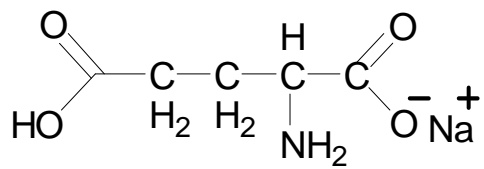
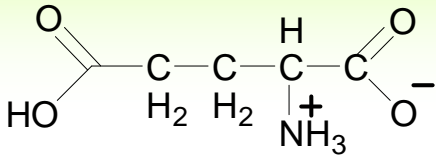
INSTITUT PERTANIAN BOGOR
www.ipb.ac.id

Presented at
 43rd SEAAGS Meeting
 Jakarta 4-5 August 2010

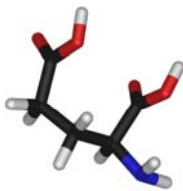


What is glutamate?

L-Glutamic Acid
 MW 147



MSG
 MW 188
 (glutamate= 147,
 Na=23,
 Water=18)



Na content in MSG= 12.2%
Na content in Salt = 39.3%



Presented at 43rd SEAAGS Meeting, Jakarta 4-5 August 2010



Glutamate in foods

- Bound glutamate (protein)
- Free glutamate
→ umami taste



Presented at 43rd SEAAGS Meeting, Jakarta 4-5 August 2010

Natural glutamate content of fresh food (mg/100g food) (Institute of Food Technologists, 1987)

	Bound glutamate	Free glutamate
Milk/Milk products		
Cow	819	2
Human	229	22
Parmesan Cheese	9.847	1200
Poultry products		
Eggs	1.583	23
Chicken	3.309	44
Duck	3.636	69



Presented at 43rd SEAAGS Meeting, Jakarta 4-5 August 2010

Natural glutamate content of fresh food (mg/100g food) (Institute of Food Technologists, 1987)

	Bound glutamate	Free glutamate
Meat		
Beef	2.846	33
Pork	2.325	23
Fish		
Cod	2.101	9
Mackerel	2.382	36
Salmon	2.216	20



**SEAFAST
CENTER**

Presented at 43rd SEAAGS Meeting, Jakarta 4-5 August 2010

Natural glutamate content of fresh food (mg/100g food) (Institute of Food Technologists, 1987)

	Bound glutamate	Free glutamate
Vegetables		
Peas	5.583	200
Corn	1.765	130
Beets	256	30
Carrots	218	33
Onions	208	18
Spinach	289	39
Tomatoes	238	140
Green Peppers	120	32



**SEAFAST
CENTER**

Presented at 43rd SEAAGS Meeting, Jakarta 4-5 August 2010

How about “Glutamate Content of Selected Traditional Indonesian Foods and Ingredients ?”



SEAFAST
CENTER

Presented at 43rd SEAAGS Meeting, Jakarta 4-5 August 2010

ANALYSIS METHOD OF FREE L-GLUTAMIC ACID

Williams ATR and Winfield SA. 1982. Determination of Monosodium Glutamate in Food using High-performance Liquid Chromatography and Fluorescence Detection. Analyst; 107: 1092-1094

1. Extraction

2 g of sample
↓
Add 20 mL H₂O and mix 15 min
↓
Add 20 mL dry acetone and 5 g act. charcoal,
then mix 5 min
↓
Filter through Whatman No 1, and rinse 6 times
with 10 mL acetone 50%
↓
Evaporate (vacuum, 70 °C) to a volume of ± 15 mL
↓
Make up volume by deionized water in a volumetric
flask of 25 mL



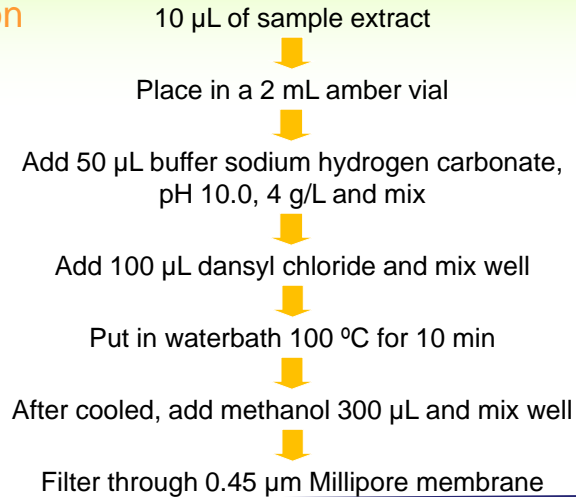
SEAFAST
CENTER

Presented at 43rd SEAAGS Meeting, Jakarta 4-5 August 2010

ANALYSIS METHOD OF FREE L-GLUTAMIC ACID

Williams ATR and Winfield SA. 1982. Determination of Monosodium Glutamate in Food using High-performance Liquid Chromatography and Fluorescence Detection. Analyst; 107: 1092-1094

2. Derivatization



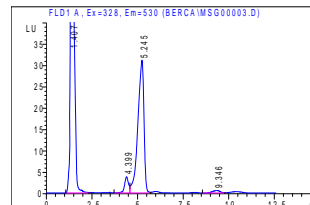
SEAFAST
CENTER

Presented at 43rd SEAAGS Meeting, Jakarta 4-5 August 2010

ANALYSIS METHOD OF FREE L-GLUTAMIC ACID

Williams ATR and Winfield SA. 1982. Determination of Monosodium Glutamate in Food using High-performance Liquid Chromatography and Fluorescence Detection. Analyst; 107: 1092-1094

- LC model: HP Series 1100 (Hewlett Packard)
- Column: C18 (5 μ m, 15 cm x 4.6 mm i.d.)
- Mobile phase: 1% v/v glacial acetic acid in 45% methanol
- Flow rate of mobile phase: 1.1 mL/min
- Detector: fluorescence, excitation wavelength 328 nm, emission wavelength 530 nm
- Sample injection volume: 20 μ L
- Running time: 8 min
- Standard was injected with the same volume but separately from sample



SEAFAST
CENTER

Presented at 43rd SEAAGS Meeting, Jakarta 4-5 August 2010

Free glutamate content in condiment/seasoning in Indonesian kitchen

No	Seasoning / condiment items	Free glutamate content (mg/100g)	
		low	high
1	Premix seasoning : liquid, cubes and powder	6366	7077
2	Ready to use seasoning	1571	
3	Oyster & fish sauce	1233	4676
4	Seasoned flour	1174	
5	Fermented fish/shrimp paste	978	1041
REF	Oyster Sauce (UMAMI Center)	900	
6	Salty soybean sauce	487	
7	Teriyaki & others	202	
8	Tomato sauce	167	196
9	Chili sauce	76	190
10	Sweet soy sauce	29	31
11	Dip and sauce	n.d	
12	Fermented soybean paste	n.d	

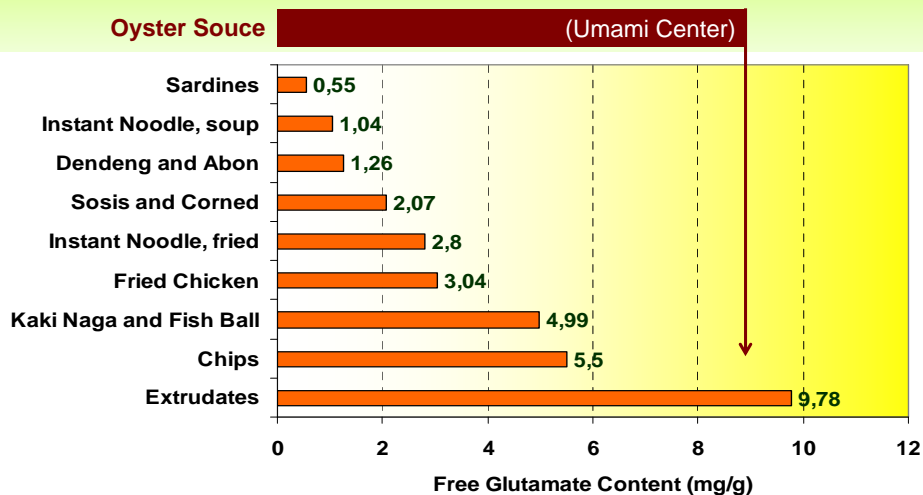


SEAFAST
CENTER

Presented at 43rd SEAAGS Meeting, Jakarta 4-5 August 2010

Free glutamate content in Processed Foods in Indonesian market

Seafast Center, 2007

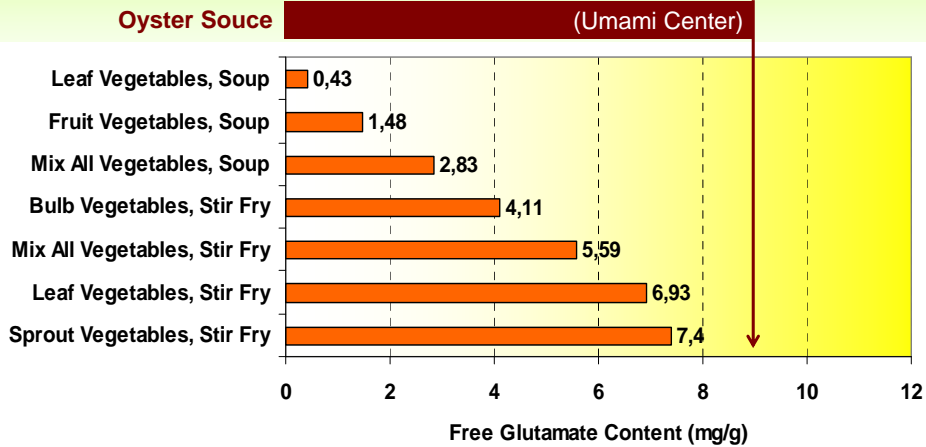


SEAFAST
CENTER

Presented at 43rd SEAAGS Meeting, Jakarta 4-5 August 2010

Free glutamate content in Fruit & Vegetable Products In Indonesian Household Culinary

Seafast Center, 2007

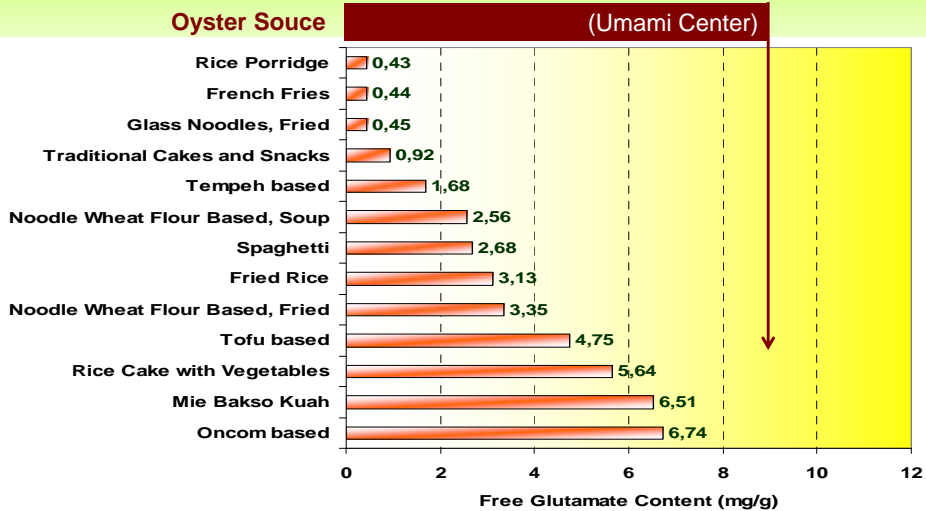


SEAFAST
CENTER

Presented at 43rd SEAAGS Meeting, Jakarta 4-5 August 2010

Free glutamate content in cereals and cereal products in Indonesian kitchen

Seafast Center, 2007

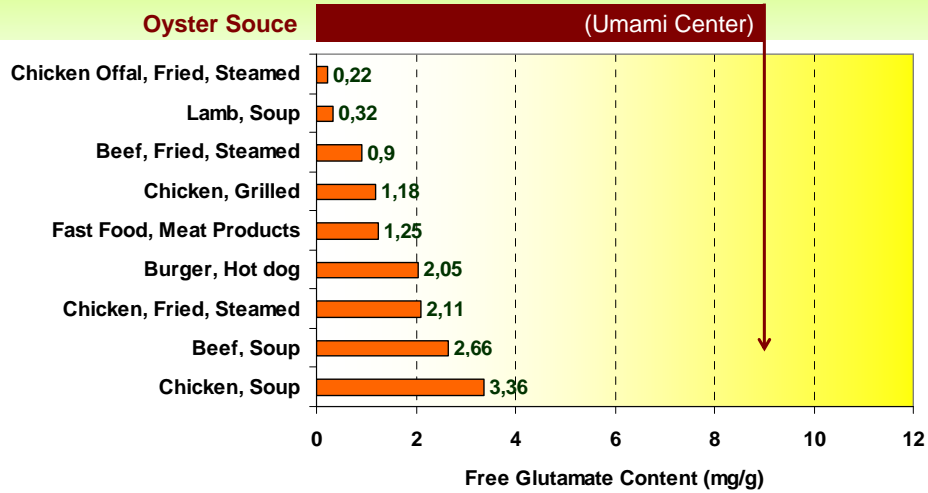


SEAFAST
CENTER

Presented at 43rd SEAAGS Meeting, Jakarta 4-5 August 2010

Free glutamate content in meat and meat products (incl poultry) in Indonesian kitchen

Seafast Center, 2007

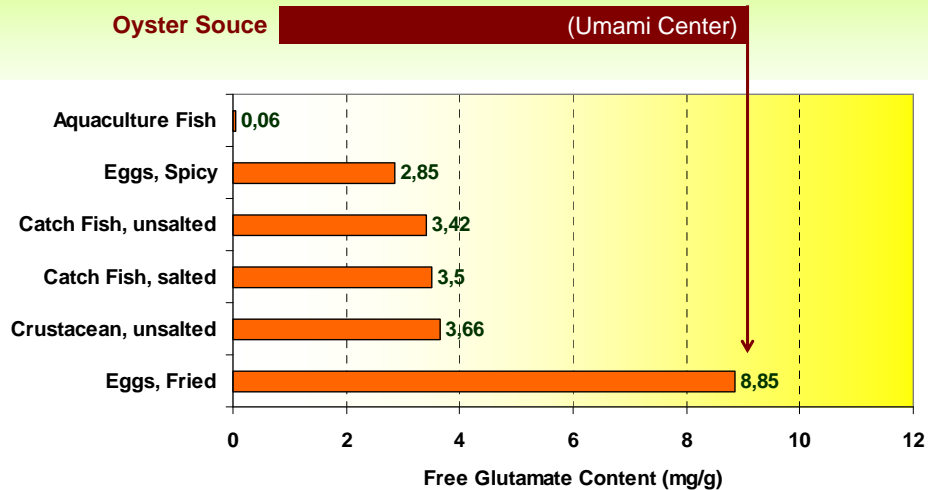


SEAFAST
CENTER

Presented at 43rd SEAAGS Meeting, Jakarta 4-5 August 2010

Free glutamate content in fish/egg products in Indonesian kitchen

Seafast Center, 2007



SEAFAST
CENTER

Presented at 43rd SEAAGS Meeting, Jakarta 4-5 August 2010

How about the effect of Food preparation/processing?



SEAFAST
CENTER

Presented at 43rd SEAAGS Meeting, Jakarta 4-5 August 2010

Free glutamate content in Indonesian Traditional Dishes & Effect of processing/preparation (Seafast Center 2009)

A. Dish menu traditionally prepared with addition of MSG (only) as flavor enhancer

1. Fried tempe (Tempe goreng)
2. Fried mix vegetable and wheat flour based (Bakwan sayur)
3. Spiced chicken soup (Soto ayam)
4. Fried tofu filled with mix vegetables and wheat flour based (Tahu isi)
5. Rice cake with vegetable soup in coconut milk (Lontong sayur)
6. Fried soybean press cake/tofu solid waste with flour (Oncom goreng)
7. Fried chicken (Ayam goreng)
8. Omelet (Telur dadar)

B. Dish menu traditionally prepared with addition of seasoning and/or condiment containing glutamate as flavor enhancer

9. Stir fry water crest (Tumis kangkung)
10. Mixed vegetable in chicken soup (Sayur sup ayam)

C. Dish menu traditionally prepared with addition of MSG, and seasoning and/or condiment containing glutamate as flavor enhancer

11. Fried rice (Nasi goreng)
12. Mixed vegetables sour soup (Sayur asam)
13. Meatball with noodle and vegetable in soup (Mie baso kuah)
14. Chicken noodle (Mie ayam)
15. Chicken rice porridge (Bubur ayam)



SEAFAST
CENTER

Presented at 43rd SEAAGS Meeting, Jakarta 4-5 August 2010

Free glutamate content in Indonesian Traditional Dishes & Effect of processing/preparation

(Seafast Center 2009)



Presented at 43rd SEAAGS Meeting, Jakarta 4-5 August 2010

Free glutamate content in Indonesian Traditional Dishes & Effect of processing/preparation

(Seafast Center 2009)

Results : A

		% effect of MSG added to free glutamate content in dish menu	% effect of seasoning/condiment Added to free glutamate content in dish menu	% effect of raw material to free glutamate content in dish menu	Effect of cooking process	
					Method	% reducing/increasing of free glutamate content in dish menu
A Dish menu with/without addition of MSG only						
1	Fried Tempe (tempe goreng)	142.9	-	nd	marinating; frying	(-) 42.9

Free glutamate content per portion/piece (33,5 g) = 25,66 mg (76,69 mg/100 g)





Presented at 43rd SEAAGS Meeting, Jakarta 4-5 August 2010

Free glutamate content in Indonesian Traditional Dishes & Effect of processing/preparation

(Seafast Center 2009)



Results : A

	Image	% effect of MSG added to free glutamate content in dish menu	% effect of seasoning/condiment Added to free glutamate content in dish menu	% effect of raw material to free glutamate content in dish menu	Effect of cooking process	
					Method	% reducing/increasing of free glutamate content in dish menu
A Dish menu with/without addition of MSG only						
2		86.1	-	nd	frying	(+) 13.9
Free glutamate content per portion/piece (83,25 g) = 70,99 mg (85,27mg/100 g)						
		Presented at 43 rd SEAAGS Meeting, Jakarta 4-5 August 2010				

Free glutamate content in Indonesian Traditional Dishes & Effect of processing/preparation

(Seafast Center 2009)



Results : A

	Image	% effect of MSG added to free glutamate content in dish menu	% effect of seasoning/condiment Added to free glutamate content in dish menu	% effect of raw material to free glutamate content in dish menu	Effect of cooking process	
					Method	% reducing/increasing of free glutamate content in dish menu
A Dish menu with/without addition of MSG only						
3		82.1	-	30.7	frying; stewing	(-) 12.8
Free glutamate content per serving size (249 g) = 256,67 mg (103mg/100g)						
		Presented at 43 rd SEAAGS Meeting, Jakarta 4-5 August 2010				

Free glutamate content in Indonesian Traditional Dishes & Effect of processing/preparation

(Seafast Center 2009)



Results : A

		% effect of MSG added to free glutamate content in dish menu	% effect of seasoning/condiment Added to free glutamate content in dish menu	% effect of raw material to free glutamate content in dish menu	Effect of cooking process	
					Method	% reducing/increasing of free glutamate content in dish menu
A Dish menu with/without addition of MSG only						
4	Fried tofu filled with mix vegetable and wheat flour based (tahu isi)	76.5	-	nd	frying	(+) 23.5
Free glutamate content per portion/piece (52,7 g) = 115,06 mg (218,3mg/100g)						
		Presented at 43 rd SEAAGS Meeting, Jakarta 4-5 August 2010				

Free glutamate content in Indonesian Traditional Dishes & Effect of processing/preparation

(Seafast Center 2009)



Results : A

		% effect of MSG added to free glutamate content in dish menu	% effect of seasoning/condiment Added to free glutamate content in dish menu	% effect of raw material to free glutamate content in dish menu	Effect of cooking process	
					Method	% reducing/increasing of free glutamate content in dish menu
A Dish menu with/without addition of MSG only						
5	Rice cake with vegetable soup in coconut milk (lontong sayur)	117.6	-	nd	stewing	(-) 17.6
Free glutamate content per serving size (436,75 g) = 198,81 mg (455mg/100g)						
		Presented at 43 rd SEAAGS Meeting, Jakarta 4-5 August 2010				

Free glutamate content in Indonesian Traditional Dishes & Effect of processing/preparation

(Seafast Center 2009)



Results : A

		% effect of MSG added to free glutamate content in dish menu	% effect of seasoning/condiment Added to free glutamate content in dish menu	% effect of raw material to free glutamate content in dish menu	Effect of cooking process	
					Method	% reducing/increasing of free glutamate content in dish menu
A Dish menu with/without addition of MSG only						
6	Fried soybean presscake (oncom goreng)	46.5	-	81.1	frying	(-) 27.6
Free glutamate content per serving size (68 g) = 195,72 mg (287.8mg/100g)						
		Presented at 43 rd SEAAGS Meeting, Jakarta 4-5 August 2010				

Free glutamate content in Indonesian Traditional Dishes & Effect of processing/preparation

(Seafast Center 2009)

Results : A

		% effect of MSG added to free glutamate content in dish menu	% effect of seasoning/condiment Added to free glutamate content in dish menu	% effect of raw material to free glutamate content in dish menu	Effect of cooking process	
					Method	% reducing/increasing of free glutamate content in dish menu
A Dish menu with/without addition of MSG only						
7	Fried chicken (ayam goreng)	36.2	-	150.0	stewing frying	(-) 86.2
Free glutamate content per portion/piece (57,17 g) = 202,36 mg (354mg/100g)						
		Presented at 43 rd SEAAGS Meeting, Jakarta 4-5 August 2010				

Free glutamate content in Indonesian Traditional Dishes & Effect of processing/preparation

(Seafast Center 2009)

Results : A

	Image	% effect of MSG added to free glutamate content in dish menu	% effect of seasoning/condiment Added to free glutamate content in dish menu	% effect of raw material to free glutamate content in dish menu	Effect of cooking process	
					Method	% reducing/increasing of free glutamate content in dish menu
A Dish menu with/without addition of MSG only						
8		56.7	-	nd	Frying	(+) 43.3

Free glutamate content per portion (42,83 g) = 86,19 mg
(201mg/100g)



SEAFAST
CENTER

Presented at 43rd SEAAGS Meeting, Jakarta 4-5 August 2010

Free glutamate content in Indonesian Traditional Dishes & Effect of processing/preparation

(Seafast Center 2009)

Results : B





SEAFAST
CENTER

Presented at 43rd SEAAGS Meeting, Jakarta 4-5 August 2010

Free glutamate content in Indonesian Traditional Dishes & Effect of processing/preparation

(Seafast Center 2009)



Results : B

		% effect of MSG added to free glutamate content in dish menu	% effect of seasoning/condiment Added to free glutamate content in dish menu	% effect of raw material to free glutamate content in dish menu	Effect of cooking process	
					Method	% reducing/increasing of free glutamate content in dish menu
B	Dish menu with/without addition of seasoning and/or condiment containing glutamate					
9	Stir fry water crest (tumis kangkung)	-	100.0	nd	stir frying	-
Free glutamate content per serving size (75 g) = 53,11 mg (70.8mg/100g)						
		Presented at 43 rd SEAAGS Meeting, Jakarta 4-5 August 2010				

Free glutamate content in Indonesian Traditional Dishes & Effect of processing/preparation

(Seafast Center 2009)

Results : B

		% effect of MSG added to free glutamate content in dish menu	% effect of seasoning/condiment Added to free glutamate content in dish menu	% effect of raw material to free glutamate content in dish menu	Effect of cooking process	
					Method	% reducing/increasing of free glutamate content in dish menu
B	Dish menu with/without addition of seasoning and/or condiment containing glutamate					
10	Mixed vegetable in chicken soup (sayur sup)	-	92.5	nd	stewing	(+) 7.5
Free glutamate content per serving size (200 g) = 23,59 mg (11.8mg/100g)						
		Presented at 43 rd SEAAGS Meeting, Jakarta 4-5 August 2010				

Free glutamate content in Indonesian Traditional Dishes & Effect of processing/preparation

(Seafast Center 2009)

Results : C



SEAFAST
CENTER

Presented at 43rd SEAAGS Meeting, Jakarta 4-5 August 2010

Free glutamate content in Indonesian Traditional Dishes & Effect of processing/preparation

(Seafast Center 2009)

Results : C

		% effect of MSG added to free glutamate content in dish menu	% effect of seasoning/condiment Added to free glutamate content in dish menu	% effect of raw material to free glutamate content in dish menu	Effect of cooking process	
					Method	% reducing/increasing of free glutamate content in dish menu
C	Dish menu with/without addition of MSG and/or condiment containing glutamate					
¹¹	Fried rice (nasi goreng)	70.5	29.5	nd	frying	-

Free glutamate content per serving size (270 g) = 312,09 mg
(115,6mg/100g)





SEAFAST
CENTER

Presented at 43rd SEAAGS Meeting, Jakarta 4-5 August 2010

Free glutamate content in Indonesian Traditional Dishes & Effect of processing/preparation

(Seafast Center 2009)



Results : C

		% effect of MSG added to free glutamate content in dish menu	% effect of seasoning/condiment Added to free glutamate content in dish menu	% effect of raw material to free glutamate content in dish menu	Effect of cooking process	
					Method	% reducing/increasing of free glutamate content in dish menu
C Dish menu with/without addition of MSG and/or condiment containing glutamate						
12	Mixed vegetable sour soup (sayur asam)	62.2	37.8	nd	stewing	
Free glutamate content per serving size (200 g) = 218,49 mg (109,2mg/100g)						
		Presented at 43 rd SEAAGS Meeting, Jakarta 4-5 August 2010				

Free glutamate content in Indonesian Traditional Dishes & Effect of processing/preparation

(Seafast Center 2009)



Results : C

		% effect of MSG added to free glutamate content in dish menu	% effect of seasoning/condiment Added to free glutamate content in dish menu	% effect of raw material to free glutamate content in dish menu	Effect of cooking process	
					Method	% reducing/increasing of free glutamate content in dish menu
C Dish menu with/without addition of MSG and/or condiment containing glutamate						
13	Meat ball with noodle and vegetable in soup (Mie baso kuah)	9.8	7.9	82.33	portion	-
Free glutamate content per serving size (431,8 g) = 3737,98 mg (865,7mg/100g)						
		Presented at 43 rd SEAAGS Meeting, Jakarta 4-5 August 2010				

Free glutamate content in Indonesian Traditional Dishes & Effect of processing/preparation

(Seafast Center 2009)



Results : C

		% effect of MSG added to free glutamate content in dish menu	% effect of seasoning/condiment Added to free glutamate content in dish menu	% effect of raw material to free glutamate content in dish menu	Effect of cooking process	
					Method	% reducing/increasing of free glutamate content in dish menu
C Dish menu with/without addition of MSG and/or condiment containing glutamate						
14	Chicken noodle (Mie ayam)	47.9	16.2	35.9	portion	-
Free glutamate content per serving size (221,7 g) = 306,13 mg (138mg/100g)						
		Presented at 43 rd SEAAGS Meeting, Jakarta 4-5 August 2010				

Free glutamate content in Indonesian Traditional Dishes & Effect of processing/preparation

(Seafast Center 2009)

Results : C

		% effect of MSG added to free glutamate content in dish menu	% effect of seasoning/condiment Added to free glutamate content in dish menu	% effect of raw material to free glutamate content in dish menu	Effect of cooking process	
					Method	% reducing/increasing of free glutamate content in dish menu
C Dish menu with/without addition of MSG and/or condiment containing glutamate						
15	Chicken rice porridge (Bubur ayam)	10.2	52.5	37.3	portion	-
Free glutamate content per serving size (365 g) = 152,20 mg (41,7mg/100g)						
		Presented at 43 rd SEAAGS Meeting, Jakarta 4-5 August 2010				

Free glutamate content in Indonesian Traditional Dishes & Effect of processing/preparation

(Seafast Center 2009)

Results

	% effect of MSG added to free glutamate content in dish menu	% effect of seasoning/condiment Added to free glutamate content in dish menu	% effect of raw material to free glutamate content in dish menu	Effect of cooking process
				% reducing/ increasing of free glutamate content in dish menu
Min - max	9.8 – 142.9	7.9 – 100.0	30.7 – 150.0	(-) 18.2 – (+) 43.3



SEAFAST
CENTER

Presented at 43rd SEAAGS Meeting, Jakarta 4-5 August 2010

Free glutamate content in Indonesian Traditional Dishes & Effect of processing/preparation

(Seafast Center 2009)

Results

Free glutamate content in dish menu was affected by:

- raw material and its composition,
- the addition of MSG,
- seasoning and/or condiments, and
- cooking process.



SEAFAST
CENTER

Presented at 43rd SEAAGS Meeting, Jakarta 4-5 August 2010

Thanks to

Dr Lilis Nuraida
Dr Nuri Andarwulan
Dr Siti Madaniyah
Zualikah, SP

Seafast center
Bogor Agricultural University
Bogor, Indonesia



SEAFAST
CENTER

Presented at 43rd SEAAGS Meeting, Jakarta 4-5 August 2010

TERIMA KASIH



SEAFAST
CENTER

Presented at 43rd SEAAGS Meeting, Jakarta 4-5 August 2010