

**Experimental Application of Developed Technology for
Commercialization of Korean Traditional Soy Sauce**

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H- 62

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H- 62

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15.5% 가

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SUMMARY

. Title of Research

Experimental Application of Developed Technology for Commercialization of Korean Traditional Soy Sauce

. The Objective and Importance of Research

All the countries in the world have their unique traditional foods that are indispensable for their dietary life. They are somewhat different in shape and identity depending upon the climate and tradition, however, the inherent nature has been inherited without any substantial change. Korean have been enjoying their own traditional foods as well such as Kimchi, Jeotkal, Jang(Fermented soybean products) and Sikhae etc. Jang has been played an important role in Korean dietary life as a good protein source as it contained a lot of degraded protein of good quality. It was prepared on the house-hold scale in the rural area by extracting Meju with saline solution and fermenting, however, faced with immediate need of commercial scale production to meet the massive demand in the urban area. Therefore local factories manufactured Jang on the commercial scale by using wheat Koji that is quite different from traditional process. The traditional technique was not inherited well because it is not suitable for mass production. As the functionality of traditional Jang has been elucidated as they contain anticancer compound, ACE inhibitor etc., consumers' interest has been directed to preferring the traditional one. The traditional Kanjang is very salty and inferior in flavor and taste comparing with commercial one. We developed a novel yeast H-62 which was derived from a traditional fermenting yeast by mutation. We found that this yeast was suitable in enhancing the flavor of fermented soybean products in the previous experiment. The co-worker of this project had interest in introducing this technique for commercialization of traditional Kanjang of good quality. It is desirable for small

house-hold type factories of Kanjang if the flavor would be improved in any means. Therefore, it is very important to apply the developed technology to traditional Kanjang processing.

. The Scope and Content of Research

1. Collection of Literatures

2. Fermentation Study

2.1. *in situ* application of developed technology at the local area

2.2. Optimization of volume of saline

2.3. Optimization of salt concentration

2.4. Optimization of fermentation temperature

2.5. Fermentation of Kanjang with H- 62

3. Analysis

3.1. Physical and chemical analysis

3.2. Microbiological analysis

3.3. Sensory evaluation

3.4. Recommendation for Kanjang preparation

4. Facilities

. Conclusion and Recommendation

Application of developed technology was done on the house-hold scale and laboratory scale by using H- 62 strain for improving the flavor of traditional Kanjang(soy sauce). First of all, we collected 227 papers on fermented soybean products. Only 7 papers dealt with the processing of traditional Kanjang. Optimization of several factors affecting the quality of Kanjang were performed. Optimized condition for Kanjang preparation were: temperature, 30°C; saline volume, 5 liter per meju; salt concentration, 15.5%, starter, 106 cfu/ml. Sensory

evaluation showed that Kanjang prepared with H-62 had better quality than traditional one. The facilities for Kanjang preparation was recommend. For commercialization of this technology on large scale, further support is necessary at this moment, as it was not possible to do a repeated experiment because long period of time was required for fermentation.

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[救荒撮要(1554)] “沈醬法” “造清醬法”
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H- 62

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67. (1957)8

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9-11,

12-16

Aspergillus oryzae, *Mucor sp.* 16

Rhizopus sp. 14 . 17
Bacillus subtilis, B. pumilis, B. licheniformis, B. citreus, Sarcina maxima, Pediococcus acidilactici
B. cirreus . 18,19
galactose> glucose> arabinose> xylose
0.7- 1.35% Sucrose
Stachyose succinic acid
glycolic acid oxalic acid .
20 *Mucor sp,*
Penicillium sp., Aspergillus sp. Scopulariopsis sp. 가
B. subtilis, B. pumilis Staphylococcus sp.,
Rhodotorula flava T. dattila가 (1977)21
Asp. flavus, Candida, Spicaria .
22-27
28 *Asp. oryzae*
Asp. sojae
. 29 , *B. licheniformis*
가 . 1970
가 30-33, 34-37,
38-40 41-44 가
가 .

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25-30 [()] , 1
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NK (45-50 , 1.5 Kg/cm²)
(Dice: 8 x 17 cm, 12 x 18 cm) . 40 ㉔
2 35 ㉔ 40 .
% () 80
100%

2.

(L/M/O, 35/28/20,[13 L], 125/50/35,[55
L]) FRP (60/40/33[80L]) . 鐵
H-62 (300 ml, 50
g, 5 g, 5 g, 5 g, 50 g, 600 g,
pH 5.5) . 50 ml flask, Multigen
Fermentor(NBS, USA) 30 ㉔ .

3.

가. 45-47

(1)

10 g

(2) (Aerobic Plate Count)

		Petridish
Pour Plate Method		(Plate Count Agar)
37	48	[Table 1]
	10 %	NaCl 가

Table-1. Medium composition of Plate Count Agar

Yeast Extract	3.0 g
Tryptone	5.0 g
Glucose	1.0 g
Agar	15.0g
Distilled Water	1
pH	7.0

() Yeast & Mold

	Yeast & Mold Count	pH	10 %
3.5	Potato dextrose Agar		Pouring Method
	48		
	[Table 2]		

Table-2. Medium composition of Potato Dextrose Agar

Potatoes, Infusion from	200 g
Bacto Dextrose	20 g
Bacto Agar	15 g
Distilled Water	1
pH, Adjusted to	3.5

(1)

(가) 48.49

2 g 105 가 1 -
 가 105
 30

$$(\%) = \frac{(\text{g})}{(\text{g})} \times 100$$

() 48.49

10g 40Mℓ 1
 10,000rpm 10 0.1N
 NaOH (end-point) pH meter(Orion 520
 A, U.S.A.) pH 8.4
 Lactic acid

$$(\%) = (0.009008 \times f \times M\ell \times 100) /$$

$$= \quad / (1 - \quad \%)$$

() pH ~~4.9~~

20g 5 1 , 10
10,000rpm
pH pH meter(Orion 520 A, U.S.A.) .

() ~~4.9~~

Crucible 3g 600

() ~~4.50~~

2 g 가
K₂Cr₂O₄ 0.01N AgNO₃

$$(\%) = \frac{0.05845 \times \quad M\ell \times \quad \times \quad \times}{\quad}$$

()

5 g 5 Mℓ

() ~~4.51~~

①

1g 300Mℓ

flask 100Mℓ 25% HCl 10Mℓ
 3 . 1N
 NaOH
 Phenol- sulfuric acid ().

⑤

Dinitrosalicylic acid
 . DNS 3.75g dinitrosalicylic acid 7g NaOH
 0.5 108.05g Rochelle 2.7Mℓ Phenol, 2.95g
 Na2S2O5 . DNS 4Mℓ Sample 1Mℓ
 Vortex mixer . 5
 가 ice- cold water 550nm
 0 - 800 μg glucose/Mℓ

() 48

① 48

2g (1 tablet) 20Mℓ
 가 Boiling chip 6 50Mℓ 가
 (Keltec System 1030, Auto Distilling unit, Tecator,U.S.A.)
 0.1 HCl . 5.71

$$= \{(A-B) \times 0.0014 \times f \times 5.71 \times 100\} / \quad (g)$$

A; Mℓ

B; Mℓ

⑤ 50

10 g 100Mℓ 가 100
 rpm 30 shaking Toyo # 2
 250 Mℓ 20 ml 0.1N NaOH pH 8.4
 가 Formalin 20 ml 가 0.1N

NaOH

$$\text{Formol nitrogen(mg\%)} = \frac{1.4 \times (\text{M}\ell - \text{Blank M}\ell)}{\text{M}\ell}$$

③ (Biuret Method)48

④

⑤

U.S.A.) 3.0mg/Mℓ가 Bovine serum albumin(Sigma Chem. Co.,

⑥

NaOH 1 CuSO4·5H2O 3g , Na- K- tartarate 9g 500Mℓ 0.2N
 KI 5g 가 0.2N NaOH 가

⑦

10 g 50Mℓ 5 가
 (3000 RPM, 5min)

⑧

가 8 가 6Mℓ가 3Mℓ Vortex Mixer 3Mℓ
 30 540nm

(2)

(가)

	5g	100Mℓ	4
			3000rpm
30		5	

() 가

① - amylase 52

	- amylase	Starch- Iodine	
	0.4 Mℓ	0.04M potassium phosphate buffer(pH 5.9)	
0.4Mℓ	1% soluble starch	0.5Mℓ	0.1Mℓ 가
25	10	0.1Mℓ	0.1M HCl
		0.5Mℓ	5ml iodine
	solution(0.05% iodine + 0.5% KI)	가	660nm
		- amylase 1unit	25 pH 5.9 10
1mg			

$$\text{Activity}(\text{unit}/\text{M}\ell) = \left[\frac{D \times (R_0 - R)}{R_0} \right] \times 100$$

R₀ 가 substrate- iodine complex
 R
 D

⑤ - amylase 53

	- amylase	
	Dinitrosalicylic acid method	0.4Mℓ
	0.04M potassium phosphate buffer(pH 5.9)	1% soluble starch solution
0.5Mℓ	0.1Mℓ 가	25 10
	0.1Mℓ	0.1M HCl
1Mℓ	DNS	5
	550nm	Maltose

1Mℓ가 maltose 1mg

1unit

③ Acidic Protease 53

Protease 1.0% Casein(Sigma)
buffer protease acidic protease 0.4M lactic
acid buffer(pH 3.0) , neutral protease 0.5M sodium phosphate
buffer(pH 6.0) , alkaline protease McIlvine buffer ,(0.2M Na2HPO4
·12H2O + 0.1M citric acid, pH 7.0)

1% Casein/0.4M lactic acid buffer(pH 3.0) 1Mℓ 1Mℓ
30 30
1Mℓ 가 10 0.4M trichloroacetic acid(TCA) 3Mℓ
30
2Mℓ 0.55M sodium carbonate(Na2CO3) 5Mℓ 3
Folin-ciocalteu phenol reagent 3Mℓ 30 30
660nm 1unit 1 tyrosine
1 μg 가
0.4M TCA

④ Lipase 54

Lipase
(2.5 Mℓ), (10
Mℓ), Trizma buffer(1 Mℓ) 1Mℓ
5 37 3
95% Ethanol 3Mℓ
Thymolphthalein 6 0.05N
NaOH Mℓ 1 Unit 1
Mℓ

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100 mesh Color Difference Meter(UC
 600- IV, Yasuda Seiki Seisakusho Ltd, Japan)
 L(lightness), a(redness) b(yellowness)

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(가) 55

dynamic headspace, Tekmar Purge
 and Trap System [Fig. 1] Tekmar LSC - 2000 automatic liquid
 sample concentrator[Tekmar Company] 10 g
 [Fig. 2] 100 Mℓ [55 mm O.D. x 120 mm, Schott
 Glasswork, Germany] Inlet Outlet tube
 가 PTEE Screw-top

Tekmar Purge and Trap System original sparge
 outlet 가 Teflon outlet tube, purging gas
 inlet tube [Charcoal]가 Trap
 30 가 30 psi
 50 Mℓ/min. Trap 60/80 mesh Tenax GC(Polymer
 of 2,6- diphenyl- p- phenyl oxide)가 12 x 1/8 Stainless steel
 Trap 30 150 3 desorb
 Capillary column injection Tekmar model 1000
 Capillary interface, interface Trap
 tube Glass insert injector

mount, bottom, valve line 100
 Stand- by temperature 30
 Charcoal 가 Headspace
 volatiles Tenax trap Bubble flow meter
 flow rate 가
 Trap 5 가 가 Flask 1
 Dry purge

Column oven Initial

temperature 5 Column
 . 1 Trap
 225 Baking
 가
 120 Dry Oven
 . Dynamic
 headspace Gas Chromatograph
 [Table 3]

()

Dynamic headspace
 Gas Chromatograph Mass Spectrometer(GC-MS)
 . GC Mass Spectrometer interface
 200 MS [Table 4]
 . GC FID Chromatogram MS
 Total ion Chromatogram index
 n-alkane . n-alkane GC
 Chromatogram [Fig. 3] n-alkane
 n-alkane 1 linear
 relative index[LRI] . n-alkane GC-MS
 system Total ion chromatogram
 GC FID Chromatogram
 [Relative retention time]
 . Dynamic headspace headspace
 GC injector port
 Void volume
 Kovats Retention Index

Table 3. Analytical conditions of gas chromatograph for volatile compounds

Instrument:	Hewlett - Packard 5890 II Gas chromatograph
Column:	DB-5, fused silica capillary column(0.32 mm x 50 m) 5 °C(hold 3 min.) - 3 °C/min. - 220 °C(hold 5 min.)
Carrier gas:	Helium 12 psi
Make-up gas:	Nitrogen, 30 mL/min.
Detector:	Flame Ionization Detector
Attenuator:	1 x 10 ²
Injector Temperature:	120 °C
Detector Temperature:	220 °C
Integrator:	Hewlett- Packard 3396 A
Attenuator:	7
Chart speed:	10 mm/min.
Area reject:	50000
Threshold:	5
Peak width:	0.04

Table 4. Analytical conditions of mass spectrometer for the identification of volatile compounds

Instrument:	Concept II (Kratos Analytical, Manchester, UK)
Setup source:	- Electron voltage: 70 eV - Resolution: 1000
Setup Scan:	- Mass range: 50- 300 m/e - Maximum mass: 1000 - Heat temperature of detector is set to 8000 V - Scan speed: 1 second per decade - Scan using: Digital analog calculator(DAC)
Data collection	- Data collected as: Nominal - Filter: Automatic set to 30 KHZ - Mass defect: 0.5 amu - Accept peaks up to : 3.00 times resolution - Minimum valley depth: 10 mV
Data handling system	- Computer system: Sum Operating system Ver.3.60 - Library: WileyNBS(National Bureau of Standard, Washington, D.C.)
Mass Standardization reagent:	Perfluorokerosene (BDH Limited Poole, England, U.K.)

(5)

Datalog(Agent HT1, Rotronic
ag, Switzerland) 가

(6) 56

HPLC column YMC-Pack
ODS-A(250 mm x 4.6 mm, YMC Co. Ltd., Japan) C-KGC - EF
Precolumn 20 mM Metaphosphoric
acid(pH 2.8) 0.7 ml,
25 μl Waters C18 Sep-pak 0.45 μm

(7) 57

White (1986) 58 Pico-tag method
HPLC

①
20 g 20 % Trichloroacetic acid 40 ml
Homogenizer(Dynamics corp., U.S.A.) 3,000rpm 15
(Beckman, Model J2- 21M/E, U.S.A) 6,000 rpm
20 Separating funnel 20 ml
ethylether 2

⑤

HPLC 50 Mℓ

10 ℎl Sample Tube Workstation .
 (Methanol 200 ℎl 0.2 N Sodium acetate 200 ℎl. triethylamine
 100 ℎl) tube 30 ℎl 가 Voltex
 . (Methanol 350 ℎl, HPLC Grade Water 50 ℎl,
 Triethylamine 50 ℎl, PITC 50 ℎl) 30 ℎl 가 Vortex
 20 Methanol 30 ℎl
 Vortex . Sodium acetate buffer 300 ℎl
 5 10 ℎl .

③

16 (2.5 ℎmol/Mℓ) Cysteine(1.25 ℎmole/Mℓ)
 0.1 N HCl 10 20
 0.45 ℎm Syringe filter 10 ℎl

④

Eluent A (Na)2EDTA(2 mg/Mℓ) 100 ℎl
 Glacial Acetic acid 15 - 20 drops pH
 6.2 Eluent B (Na)2EDTA(2 mg/Mℓ) 100 ℎl

10 ℎl Dual Pump System(Model
 510) Waters HPLC Pico- tag
 Column(3.9 x 150 mm, ϕ 4 ℎm, Waters), Dectetor UV
 Detector(Model 975, JAS) 35 ℃ .
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[Table 5]

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Table 5. Questionnaire for sensory evaluation

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- 5.....
- 4..... ..
- 3.....
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[Table- 6]

가 21.87%, 가 46.60% 가 30.78%,
 가 17.5%

가
 가 pH 7.3
 가

가 2.56%, 가 4.02%, 가 6.80 - 8.488%

Protease가 54.5 - 59.8 Unit/g
 가

- amylase가 116- 118 unit/g β - amylase 가 lipase α
 가 9- 10 unit/g

4.9x10⁸ - 1.4x10⁹ cfu/g,
 6.5x10⁴ - 1.3x10⁵ cfu/ml

Table 6. Characteristics of Meju used in Kanjang preparation

Protein(%)		Moisture(%)		pH		Color					
Inner	Exterior	I	E	I	O	I			O		
						L	a	b	L	a	b
21.87	46.60	30.78	17.5	7.3	7.3	51	7.1	14.1	49.4	6.1	14.2

continued

<u>Total sugar(%)</u>		<u>Soluble N(%)</u>		<u>α- amylase</u>		<u>β- amylase</u>		<u>Lipase</u>	
<u>Inner</u>	<u>Exterior</u>	<u>I</u>	<u>E</u>	<u>I</u>	<u>O</u>	<u>I</u>	<u>O</u>	<u>I</u>	<u>O</u>
2.56	4.02	8.488	6.80	118.9	116.6	0.06	0.26	10	9

continued

<u>Acidic protease</u>		<u>APC</u>		<u>Yeast & Mold</u>		<u>Acidity(%)</u>	
<u>Inner</u>	<u>Exterior</u>	<u>I</u>	<u>E</u>	<u>I</u>	<u>O</u>	<u>I</u>	<u>O</u>
54.5	59.8	4.9x108	1.4x109	6.5x104	1.3x105	0.6	0.8

[Fig. 4]

Total ion chromatogram
12

가

Mass Spectrometer
Wiley Library

[Fig. 5]

[Table- 7] 11

N,N- dimethyl methanamine, 2- propanone, 3- fluoro- 1- propene,
2- butanone, 3- hexanone, Dichloroacetic acid,methyl ester, 3- methyl
butanol, 2- propanone,oxime, 7- octane- 4- ol, 3- octanone,
2,2,3- trimethyl- 1- vinyl- 3- cyclopentane

Table 7. Identity and comparison of abundance of volatile compounds of Meju from Cheongpoong area

PN	RT	LRI	Compound	Identification	Area
1	6.820		N,N- dimethyl methanamine	MS	6833
2	7.505		2- propanone	MS	512
3	8.039		3- fluoro- 1- propene	MS	1015
4	8.542	610.7	2- butanone	MS	425
5	8.752	616.1	3- hexanone	MS	3452
6	9.505	635.3	Dichloroacetic acid,methyl	MS	148
7	10.177	652.5	3- methyl butanol	MS	10986
8	12.322	704.2	2- propanone,oxime	MS	5922
9	13.480	720.5	Unknown	MS	1090
10	31.128	921.3	7- octane- 4- ol	MS	209
11	31.621	925.9	3- octanone	MS	188
12	32.475	933.8	2,2,3- trimethyl- 1- vinyl- 3- cyclopen	MS	1493

2.

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FRP

, 가 ,

가.

18 (Be)

가 .

가

가 .

[Fig. 10] [Fig. 11]

가 . 13 %
 27 0.27%, 0.58% 70
 0.37%, 1.1 % , 27 0.21 % ,
 0.43 % 70 0.35 % , 1.13 % . 15.5 %
 27 0.27 % , 0.56 %
 70 0.35 % , 1.22 % 27 0.31
 % , 0.58 % 70 0.37% , 1.25% . 18 %
 27 0.22 % , 0.53 %
 70 0.35 % , 1.04 % 27 0.23
 % , 0.51 % 70 0.36 % , 1.13 % .
 가 가 가
 15.5 % 가 가 가

[Fig. 12]

18 가 . 13 %
 가 7 , 27 70 0.27 % , 0.36
 % , 0.40 % 가 0.25 % , 0.36 % , 0.40% .
 15.5 % 가 7 , 27 70
 0.29% , 0.36 % , 0.40 % 가 0.30 % , 0.34 %
 0.45% . 18.0 % 가 7
 , 27 70 0.29% , 0.37 % , 0.27 % 가
 0.31 % , 0.37 % 0.37% .

[Fig. 13] [Fig. 14]

18 가
 104 cfu/ml
 18 가 13% , 15.5% , 18%
 7.12, 6.54, 6.16 cfu/ml 6.84, 6.46, 6.43 cfu/ml
 가 18 6.42, 6.20, 6.26 cfu/ml
 7.26, 6.91, 6.39 cfu/ml 가 .

Table 8. Free amino acid composition of Kanjang prepared with saline with different concentration of NaCl at 20

unit : mg%

Amino acids	13% NaCl		15.5% NaCl		18% NaCl	
	Yeast	non-yeast	Yeast	non-yeast	Yeast	non-yeast
Asp	9.9	85.9	7.5	11.8	55.1	19.0
Glu	142.8	103.0	106.5	24.4	87.1	34.9
Ser	12.9	100.0	6.32	9.8	142.5	20.4
Gly	23.1	52.4	10.5	11.8	51.1	16.2
His	37.1	52.1	27.3	22.7	42.7	37.8
Arg	0	113.0	23.1	31.1	105.3	36.5
Thr	27.1	65.1	0	13.5	64.4	26.1
Ala	78.2	88.2	24.8	25.9	82.3	40.1
Pro	34.0	145.9	59.2	33.5	109.8	47.9
Tyr	7.9	82.6	5.44	16.4	89.6	35.7
Val	21.8	57.7	14.9	11.7	57.6	21.5
Met	17.8	24.9	12.5	10.0	47.2	18.1
Cys	6.3	9.2	0	3.73	0	4.1
Iso	30.7	9.2	8.85	0	0	0
Leu	23.3	146.2	20.1	29.9	163.3	60.2
Phe	76.8	71.1	15.0	16.2	63.4	27.2
Lys	75.3	60.0	38.2	14.5	77.59	32.6
TOTAL	624.8	1266.5	380.1	287.2	1239.1	478.3

Table 9. Organic acid content of Kanjang prepared with saline of different NaCl concentration.

unit : mg%

Organic acid	13% NaCl		15.5% NaCl		18% NaCl	
	Yeast	non-yeast	Yeast	non-yeast	Yeast	non-yeast
Oxalic	33.7	28.1	13.39	10.8	6.51	12.4
Glycolic	0	0	10.1	0	11.7	0
Malic	201.1	198.1	187.8	191.1	170.6	201.7
Lactic	22.9	23.2	30.2	28.2	7.52	12.2
Acetic	0	0	0	0	21.5	0
Pyroglutamic	9.24	0	0	0	0	3.28
Propionic	126.4	228.1	304.7	204.1	240.3	159.3
TOTAL	393.3	477.5	546.2	434.2	458.1	388.9

[Table 10- 14] . [Table- 10] 13 %

가

가

가 가

가 가

가 가 가

Table 10. Sensory evaluation data of Kanjang by natural and yeast fermentation in **13% NaCl** solution by laboratory-trained panel members.

Sample	Yeast	non- Yeast	L.S.D
Color	4.27b	4.73a	0.35
Flavor	4.47a	4.40a	0.33
Taste	4.33a	4.27a	0.74
Overall	4.47a	4.40a	0.61

[Table 11] 15.5%

가

가 가

가

가 가

가

Table 11. Sensory evaluation data of Kanjang by natural and yeast fermentation in **15.5% NaCl** solution by laboratory-trained panel members.

Sample	Yeast	non- Yeast	L.S.D
Color	3.87a	4.00a	0.29
Flavor	4.53a	4.53a	0.73
Taste	4.73a	4.13a	0.75
Overall	4.53a	4.53a	0.60

[Table 12] 18%

가

가

가

가

가

Table 12. Sensory evaluation data of Kanjang by natural and yeast fermentation in **18% NaCl** solution by laboratory-trained panel members.

Sample	Yeast	non- Yeast	L.S.D
Color	4.27a	3.40b	0.69
Flavor	4.40a	4.20b	0.94
Taste	4.80a	3.60b	0.89
Overall	4.73a	3.67b	0.95

[Table 13, 14]

가 가 가 가 가 가 가 가 가

Table 13. Sensory evaluation data of Kanjang to different NaCl concentration in yeast inoculation by laboratory-trained panel members.

Sample	13%	15.5%	18%	L.S.D
Color	4.40a	4.47a	3.80a	0.79
Flavor	4.13a	4.27a	3.93a	0.75
Taste	4.67a	4.07ab	4.00b	0.64
Overall	4.40a	4.40a	3.93a	0.75

Table 14. Sensory evaluation data of Kanjang according to different NaCl concentration in non-yeast inoculation by laboratory-trained panel members.

Sample	13%	15.5%	18%	L.S.D
Color	4.07ab	4.67a	3.67b	0.80
Flavor	4.13a	4.07a	4.13a	0.64
Taste	3.80a	4.07a	3.93a	0.77
Overall	3.73b	4.53a	4.00ab	0.72

가

15.5 %

가
 18% 2 - 6 liter 30
 . [Fig. 17, 18] pH

10 pH 가
 10 pH 2, 3,
 4, 5, 6, 7, 8 liter 4.78, 4.89, 5.47, 6.23, 6.30, 5.96, 6.05
 pH 가 1.4, 1.19,
 0.9, 0.17, 0.15, 0.1, 0.1%

[Fig. 19]

가 가 4
 liter 가 가 .

[Fig. 20, 21]

, 2-4 liter 30.℃, 5-8 liter 20 .℃
 18 가
 가 가
 2, 3, 4, 5, 6, 7, 8 liter 1.06, 0.96, 0.75, 0.36, 0.35, 0.24,
 0.21 % 30 .℃ 4 liter 가 0.7%
 20 .℃ 가
 가 가 . 30.℃ 10
 가 2, 3, 4 liter 3.76%, 4.83%, 2.38%
 60 6.24%, 6.34%, 3.87% . 20.℃ 5, 6, 7, 8
 liter 18 가 60
 1.61, 1.04, 0.95 0.81%

[Fig.22, 23]

81.82 - 84.29% 20 .℃
 가 30 .℃ 10
 2, 3, 4 liter 30 83.33%, 73.43% 76.74%
 60 72.14%, 69.03%, 72.71% 10
 가 30 .℃ 2, 3, 4 liter 6.25%, 4.98%, 3.11%
 60 9.03%, 9.89%, 7.39% . 20 .℃ 37
 가 5, 6, 7, 8 liter 4.28%, 5.03%, 5.78% 2.30%

70 6.72%, 6.41%, 3.76% 3.61%
 6.0% 1 6 liter
 [Fig. 24]

[Fig. 25]

가 가
 18 가 30㉔ 2, 3, 4 liter
 0.99%, 0.94% 0.61% 20㉔
 5, 6, 7, 8 liter 0.59%, 0.44%, 0.34% 0.33%
 가 60 2, 3, 4 liter
 0.99%, 0.91% 0.56%

[Fig. 26, 27] 가

30㉔ 가 20㉔
 20 가 30㉔
 7.18- 8.18 cfu/ml 60
 7.67 - 8.23 cfu/ml 6.60- 6.71 cfu/ml
 4.26 cfu/ml 20 ㉔ 4.11 -
 5.74 - 6.16 cfu/ml 가
 가 70 6.0- 6.7 cfu/ml
 1.54 - 2.48 cfu/ml 5.14
 - 6.10 cfu/ml 가 70 1.48 - 2.59
 cfu/ml

[Table 15] 18%

가 가
 5liter 가, 3liter 가
 가 5 liter 가

Table 15. Sensory evaluation data of Kanjang prepared with different volume of 18% saline per one Meju by yeast fermentation.

Sample	2l	3l	4l	5l	6l	7l	8l	L.S.D
Color	4.13a	2.93d	4.13bc	4.87ab	4.13bc	4.07	3.93c	0.81
Flavor	3.47a	3.73bc	4.07bc	3.60c	3.47c	4.00bc	4.40bc	0.76
Taste	3.87a	3.80bdc	4.27abc	4.60ab	3.87bcd	3.47cd	3.20c	0.84
Overall	3.93a	3.40d	4.20bc	4.40ab	3.93bcd	3.60cd	3.53cd	0.77

가 18% 6 liter

[Fig. 28, 29] pH

pH 10 25

가 20 6.3 25, 30, 35 4.61, 4.92,

가 35

가 30 20

가 18 0.22%, 49 0.77%, 70 0.63 % 30

10 0.46 %, 20 0.51%, 70 0.64% [Fig. 30]

lightness, redness

yellowness 가 가 가 35

[Fig 31] 20

가 18 0.13%, 37 0.27%, 57 0.32% 25, 30,

35 10 가 0.36%, 0.22%, 0.23% 30

가 27 0.37% 가 가

0.29%, 0.28%, 0.26% [Fig. 32]

가 27 20, 25, 30, 35 0.53%, 1.36%, 2.21%,

2.77% 57 1.09%, 2.82%, 1.97% 2.95%

[Fig. 33]

가 25, 30 10 0.33% 0.43%

25 30 가 0.57% 20, 30,

35 가 가

[Fig.34, 35]

가 10 가

25-30 가 20 30

가 6.63-

6.90 cfu/ml 20 18 5.9

cfu/ml 1.85 cfu/ml

25 - 35 4.30 - 5.85

cfu/ml 가 30 49

가 2.61 cfu/ml 25, 35

37 2.81 - 2.92 cfu/ml

2.29, 1.30 cfu/ml

Table 17. Free amino acid composition of Kanjang prepared at different temperatures.

unit : mg%

Amino acids	20	25	30	35
Asp	55.1	14.0	35.7	42.1
Glu	87.1	142.7	155.7	136.7
Ser	142.5	18.9	43.3	13.9
Gly	51.1	23.4	26.5	9.65
His	42.7	37.8	48.5	52.1
Arg	105.3	49.8	0	39.6
Thr	64.4	94.7	539.5	80.9
Ala	82.3	28.9	63.6	40.8
Pro	109.8	9.2	26.1	21.1
Tyr	89.6	56.5	82.6	76.5
Val	57.6	15.6	15.8	21.2
Met	47.2	22.6	30.9	17.5
Cys	0	24.1	37.9	11.2
Iso	0	47.3	66.2	101.5
Leu	163.3	29.2	30.2	44.2
Phe	63.4	73.4	118.2	8.01
Lys	77.6	6.73	34.5	7.68
TOTAL	1239.1	694.9	1354.9	724.5

[Table 18] 30 ℃ . glutamic acid, phenylalanine 가 18 147.5 mg%, 50 158.1 mg% phenylalanine 98.7 mg%, 121.4 mg% isoleucine 18 106.3mg%, 60 66.2% . [Table 19] . malic acid propionic acid . [Table 20] 가 . , .

Table 18. Changes of amino acid content of Kanjang during fermentation at 30 .

unit : mg%

Amino acids	18days	30days	40days	50days	60days
Asp	24.8	27.8	33.8	31.4	35.7
Glu	147.5	142.4	165.1	158.1	155.7
Ser	40.5	42.4	47.3	42.5	43.3
Gly	24.6	24.8	27.7	26.7	26.5
His	41.4	42.1	48.5	48.3	48.5
Arg	0	15.0	19.0	0	0
Thr	173.2	41.0	46.6	55.6	539.5
Ala	9.99	78.7	79.7	77.0	63.6
Pro	12.0	12.7	16.3	16.8	26.1
Tyr	75.0	75.5	87.5	86.7	82.6
Val	16.0	16.0	17.5	16.9	15.8
Met	0	10.9	31.1	31.3	30.9
Cys	0	44.7	40.7	41.4	37.9
Iso	106.3	64.7	74.5	74.2	66.2
Leu	33.2	30.9	35.7	35.4	30.2
Phe	98.7	99.9	115.3	121.4	118.2
Lys	27.9	28.6	37.4	36.4	34.5
TOTAL	831.1	798.2	923.8	899.8	1354.9

Table 19. Changes of organic acid content of Kanjang during fermentation at 30 .

unit : mg%

Organic acid	18 days	30 days	40 days	50 days	60 days
Oxalic	0	15.6	0	0	0
Tartaric	4.05	35.4	5.79	39.9	5.64
Glycolic	96.2	96.8	125.9	187.5	127.2
Malic	379.5	470.8	404.1	401.9	391.9
Lactic	12.5	16.0	13.9	15.8	8.92
Acetic	24.3	24.7	25.1	25.2	24.6
Pyroglutamic	31.9	41.4	31.5	32.1	22.2
Propionic	60.9	62.9	59.8	58.1	50.1
TOTAL	609.4	763.7	666.1	760.3	630.5

Table 20. Sensory evaluation data of Kanjang prepared at different fermentation temperatures by laboratory-trained panel members.

Sample	25	30	35	L.S.D
Color	4.13	4.47	4.93	0.96
Flavor	4.47	4.53	4.73	0.89
Taste	4.27	3.93	4.00	0.79
Overall	4.20	4.20	4.33	0.75

가

18%

[Fig.37,38]

pH
pH 4.8~5.6
60
가 0.6~1.3%

[Fig.39]

4 32.4, 12 27.2, 32 34.2, 29.7,
44.8 가 4
24.4, 12 26.9, 32 25.5, 10.1, 11.2
22.6, 12 17.2, 32 23.4, 18.9, 11.2
60 4

[Fig.40]

60 4 77.33%, 12
73.37%, 32 77.19%, 79.25%, 80.03%
16~19%

[Fig.41]

가 60 4 3.36, 12 5.80, 32 4.15,
1.50, 2.20

가 [Fig.42]

60 4 0.38%, 12 1.11%, 32
0.74%, 0.49%, 0.27%

[Fig.43]

106-108 CFU/ml

Yeast & mold count

18% 34] 가 가
 가 20 106 cells/ml
 . [Table 21] 60
 80-95% 35-95.5%, 8-90%,
 53-95% 15-35 9-20 ,
 19-40 , 11.5~26.8 .

Table 21 Changes of temperature and humidity at Cheongpoong area during Kanjang fermentation(April 13 - June 8,1995)

Days	Temperature ()			Humidity (%)		
	02:00AM	12:00	18:00PM	02:00AM	12:00	18:00PM
0	12	23.8	18	35	26.5	82
10	9	33.8	18.3	94.5	25.5	85
20	17	35	15	93	29	95
30	12	19	11.5	95.5	90	91.5
40	15.3	40	26.8	94.5	25.5	86.5
52	20	40	26	92	8	53

[Fig.44,45] pH 가 4.70 가 4.70 가
 60 가 가

[Fig.46] 가 41.5, 가 62.7 가
 가 12.1, 가
 7.60 가 25.7, 가 30.7

[Fig.47,48] 가 가 가 가
 가 가 가 가
 가 가 가 가
 0.31% 가 10 가 0.3%, 가
 가 0.12% 가 60 가 0.26%,
 . [Fig.50] ,
 60

가 78.52%, 가 77.29% .
18- 20% 60 가
0.42- 4.01%, 가 2.23- 2.84% .
[Fig.51]

104-107 CFU/ml Yeast & mold count
가 20 106 CFU/ml
60 103CFU/ml .
가 102CFU/ml 60
50CFU/ml

[Table 22]

. glutamic acid, threonine 가

. [Table 23]

. malic acid, propionic acid
가 가 342, 142 mg% . [Table 24]

가 가

,

.

Table 22. Amino acid content of Kanjang prepared at the Cheongpoong area

unit : mg%

Amino acids	Yeast	Non- yeast
Asp	5.49	4.23
Glu	112.0	91.4
Ser	14.5	10.5
Gly	14.9	10.3
His	36.1	5.09
Arg	24.4	4.62
Thr	104.5	4.96
Ala	0	16.3
Pro	10.7	47.7
Tyr	3.12	6.76
Val	15.1	9.79
Met	15.5	8.66
Cys	5.82	4.52
Iso	0	0
Leu	20.7	13.1
Phe	15.0	10.3
Lys	63.3	49.2
TOTAL	461.2	297.5

Table 23. Organic acid content of Kanjang prepared at the Cheongpoong area

unit : mg%

Organic acid	Yeast	Non- yeast
Oxalic	17.6	15.1
Tartaric	9.39	6.51
Glycolic	0	0
Malic	343.0	283.9
Lactic	23.9	9.62
Acetic	23.4	23.1
Pyroglutamic	24.3	16.2
Propionic	141.9	89.5
TOTAL	583.6	444.0

190 (56.5 × 11 m, 2) 가 .

2)

Aspergillus oryzae *Aspergillus sojae*

가

(*Bacillus* sp.)

가

가

가

가

가

가

[Fig

52 53]

25, 26

25.



"

12

N.K

2.0 2.5 kg/cm

50

"

35

,

40 , 1 2

, Heater

30 , 1

,



26.

15.5%

SS Tank

1	5	SS Tank
H- 62		Flask
30 , 2		(2)
30 , 2		(30)
30 , 60		SS Tank(180)

54 , Fig. 55 Flow sheet LAY- OUT Fig.

3.

1)

- : 800kg/h
- : SUS304
- : 3Hp
- :

2)

- : 800kg/h
- : SUS304
- : 2Hp
- :

3)

- : 1,000kg/hr
- : SUS304
- : 2 Hp
- : 40A
- - : 150
- : N.K (50A)

4) N.K

- : 1,000kg/batch (: 3.7m³)
- : - SUS304(4t), Frame - SS41
- : 3Hp
- :
- : 40A
- : 40A, 40A, 1.5kg/cm²

5) Hopper Screw

- : 200(screw) × 3,500L
- : SUS304
- : 3Hp
- : 가

6) Net C/V

- Belt : 400W × 3,500L SUS Wire Net
- Frame : SUS304
- : 0.5Hp
- :

7)

- Net : 800W, SUS304 Wire Net
- : 3m³/hr ()
- Frame : SUS304
- (Blower) : 2Hp
- : 40 45 , chute , Duct
- 250 × 250, SUS304 × 1.2T, Blower type : Sirooco fan

8) Belt C/V

- Belt :
- : 400W × 2,500L
- Frame : SUS304
- : 0.5Hp

9)

- : 30 ()
- : SUS304
- : 40W
- :

10)

- : 1,000kg/hr
- : - SUS304, Frame - SS41
- : 5Hp
- Head :

11)

- :
- Sensor
- : SUS304

12) C/V

- Belt : , 350W
- : 300W × 2,800L

○Frame : SUS304

○ : 0.5Hp

13)

○Unit heater : 15,000kcal/hr × 2 set

○Fan : 1/8Hp × 2

○ : 20 15A

○ : Sensor

가

,

Unit heater

By-pass

14)

○Unit heater : 10,000kcal/hr × 4 set

○Fan : 1/8Hp × 4

○ : 25 15A

○ : Sensor

가

,

Unit heater

By-pass

15)

○ : SUS304

○ : 1000 × 800 × 1400H

○ : 가

16)

17) Belt C/V

○Belt : SUS304

○ : PVC, 400W × 4,500L

○Frame : SUS304

○ : 0.5Hp

18)

○ : 500kg

○ : Hopper chute - SUS304, Frame - SS41

○ : 5Hp

20)

○ : 200kg/hr

○ : SS41

○Mesh : #25 50

○ : 7.5Hp

21) Bucket E/V

- : 300kg/hr
- : SS41
- : 0.5Hp
- ; 200W × 420L × 4000H

22) SILO

- : 1,000
- : SUS304
- : 1Hp
- : Damper(150)

23)

- : 1,000
- : SUS304
- : 5Hp
- : , Root Blower 50A, Air
- Nozzle Pump 25A × 3Hp, SUS316

24)

- : 3,000 (1550 × 2000H)
- : SUS304
- : level gauge ,
가

25)

26)

- : 25A, 3,000 /hr
- : SUS304
- : 3Hp

27) ()

- : 2m³
- : FRP
- : 1,200 × 1,800H

28)

- : 1,000 /batch
- : SUS304
- :
- :

- - : 2Hp
- : Vertical type 2 , 2 , ,

29) ()

- : 2,000
- : FRP
- : 1,200 × 1,800H

30)

- : 500 /hr
- : 5Hp
- : SUS304
- : 25A
- : Manbrain type

31) ()

- : 2,000
- : SUS304
- : 1,270 × 1,800H

32)

- : 4
- : 400W × 2000L × 700H, SUS304
- : 20A

33)

- : 800W × 1800L × 800H (2t), SUS304

34)

- : capping
- :
- : 500 × 800 × 1400H

35) Screw C/V

- : 200 × 3,500L
- : SUS304
- : 2Hp
- Hopper : 200 × 400H

36)

- : 가 ,

- : 1,000 /batch
- : 5Hp
- : - , 2 ,
가 ,

37) Chopper

- :
- : 300 body 10"
- : 2m³/h
- : Chopper - SUS304, Frame - SS41, Cover - SUS304
- : 10Hp

38) Mono pump

- : 2
- : 3 4m³/hr
- : 2NES (), - 50A
- : SUS304
- : 5Hp

39) Screw C/V

- : 20,000 /hr
- : 200 × 3,500L
- : SUS304
- : 2Hp
- Hopper : 600 × 400H

40)

- : 1200 ,
- : 1.5ton/batch
- : SUS304
- : 5Hp
- : 2 가

41) Chopper

- : 8"
- : 2,000 /hr
- : Chopper - SUS304, Frame - SS41, Cover - SUS304
- : 10Hp

42) Mono Pump : 38)

43,44) ()

- : 1200 × 1500H
- : 1,500
- : SUS304
- : - 3 " ,
- : 2Hp

45)

- : 500g 20EA/min., Air Cylinder
- Hoper : 60 , 30 /min.
- : STS304
- : PVC ()

46)

- : 30EA/min.,
- : Heat - 10kW, C/V Fan -
- 1Hp
- C/V : T.T Chain C/V, SUS304
- Heating Tunnel : SS41

47) Roller C/V

- : 400W × 3,500L
- : Frame - SUS304, Roller -

48) Air Compressor

- : 60 /min.
- Air : 3/8 "
- : 5Hp
- : Air unit (Regulator Oiler) 1set

49) Steam Boiler

- : 500kg/hr
- : 600
- : 990
- : - SUS304, - SS41
- : 3Hp
- : Header - 150A × 1,200L(40A × 2, 32A × 2, 25A × 2)

50) 2 liter(2ea), 30 liter(2 ea)

4

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Table Changes of pH and acidity of Kanjang during fermentation(

Day	Sample	13%		15.5%		18%	
		pH	Acidity(%)	pH	Acidity(%)	pH	Acidity(%)
0	Yeast	8.00	0.013	8.08	0.022	8.16	0.013
	Non	8.14	0.026	8.04	0.022	8.18	0.013
7	Yeast	5.96	0.29	6.77	0.18	6.30	0.16
	Non	5.90	0.11	6.14	0.19	6.26	0.17
18	Yeast	5.10	0.26	5.05	0.22	6.20	0.22
	Non	5.00	0.14	5.33	0.22	5.90	0.22
27	Yeast	4.78	0.32	4.74	0.41	4.90	0.38
	Non	5.08	0.29	4.95	0.39	4.97	0.39
37	Yeast	4.91	0.48	4.87	0.52	4.80	0.44
	Non	4.98	0.43	5.01	0.50	4.78	0.46
49	Yeast	5.07	0.53	5.03	0.53	4.81	0.46
	Non	5.07	0.48	5.11	0.51	4.84	0.45
57	Yeast	5.07	0.61	5.08	0.54	4.86	0.49
	Non	5.05	0.52	5.15	0.56	4.95	0.45
70	Yeast	4.78	0.65	4.75	0.62	4.60	0.59
	Non	4.77	0.61	4.93	0.60	4.66	0.55

Table Changes of color of Kanjang during fermentation

Sample Day		13%				15.5%				18%			
		L	a	b	E	L	a	b	E	L	a	b	E
0	Yeast	57.8	3.38	13.4	44.3	80.3	0.98	9.94	22.0	83.5	0.74	7.85	18.2
	Non	77.7	0.81	9.48	24.2	86.8	0.23	6.53	14.7	83.9	1.12	7.59	17.7
7	Yeast	62.2	2.87	14.9	40.7	39.2	4.63	15.5	62.9	58.0	0.52	13.6	44.0
	Non	82.4	1.13	7.72	19.1	55.2	1.02	17.6	48.0	67.3	0.59	16.9	36.7
18	Yeast	46.6	7.21	22.6	58.4	62.5	3.12	25.4	45.3	57.6	0.11	19.3	46.6
	Non	67.4	0.35	19.7	38.0	52.5	1.72	22.3	52.4	66.6	0.63	23.9	41.0
27	Yeast	59.4	9.47	30.9	51.8	50.3	7.98	27.7	57.4	40.8	5.72	21.4	63.1
	Non	65.8	4.57	29.1	45.1	44.3	4.50	20.3	59.3	46.6	5.32	23.9	58.7
37	Yeast	24.9	7.64	17.4	77.4	49.5	10.0	27.8	58.4	50.1	3.78	14.9	52.1
	Non	39.9	5.16	20.5	63.6	34.1	11.3	21.4	70.1	49.7	5.12	18.7	53.8
49	Yeast	38.2	9.23	23.4	66.6	46.8	8.95	26.5	60.0	40.1	6.23	22.5	64.2
	Non	44.3	8.31	24.6	61.4	39.4	7.79	23.3	65.3	49.5	5.80	21.4	55.0
57	Yeast	43.0	10.2	25.5	63.2	45.6	9.02	26.4	61.1	39.7	7.95	23.2	65.0
	Non	13.9	6.12	4.65	86.4	41.3	8.02	23.8	63.8	49.0	7.87	26.0	57.7
70	Yeast	20.8	11.1	11.9	80.7	37.2	10.8	23.4	67.8	39.4	8.83	23.0	65.3
	Non	23.4	8.50	15.1	78.5	40.1	12.4	24.9	66.0	43.2	9.47	24.7	62.5

Table Changes of total nitrogen and soluble protein of Kanjang during fermentation

Sample Day		13%		15.5%		18%	
		T.N(%)	S o l u b l e protein(%)	T.N(%)	S o l u b l e protein(%)	T.N(%)	S o l u b l e protein(%)
0	Yeast	-	-	-	-	-	-
	Non	-	-	-	-	-	-
7	Yeast	0.03	0.16	0.07	0.21	0.06	0.20
	Non	0.02	0.16	0.07	0.20	-	0.22
18	Yeast	0.19	0.25	0.16	0.36	0.13	0.39
	Non	0.10	0.19	0.17	0.42	0.08	0.32
27	Yeast	0.27	0.58	0.27	0.56	0.22	0.53
	Non	0.21	0.43	0.31	0.58	0.23	0.51
37	Yeast	0.29	0.78	0.29	0.78	0.27	0.73
	Non	0.26	0.68	0.37	0.78	0.27	0.77
49	Yeast	0.33	0.81	0.33	0.82	0.31	0.76
	Non	0.32	0.77	0.36	0.82	0.33	0.77
57	Yeast	0.36	1.09	0.35	1.07	0.34	1.09
	Non	0.35	1.04	0.37	1.00	0.36	1.01
70	Yeast	0.37	1.1	0.35	1.22	0.35	1.04
	Non	0.35	1.13	0.37	1.25	0.36	1.13

Table Changes of total free sugar of Kanjang during fermentation

Sample		13%	15.5%	18%
Day				
0	Yeast	-	-	-
	Non	-	-	-
7	Yeast	0.27	0.29	0.29
	Non	0.25	0.3	0.31
18	Yeast	0.42	0.43	0.44
	Non	0.41	0.44	0.44
27	Yeast	0.36	0.35	0.37
	Non	0.35	0.34	0.33
37	Yeast	0.35	0.34	0.36
	Non	0.35	0.35	0.37
49	Yeast	0.25	0.23	0.26
	Non	0.24	0.25	0.29
57	Yeast	0.39	0.39	0.42
	Non	0.39	0.40	0.48
70	Yeast	0.40	0.38	0.27
	Non	0.40	0.45	0.37

Table Changes of viable cell count and yeast & mold count of Kanjang during fermentation

Sample Day		13%		15.5%		18%	
		APC	Y & M	APC	Y & M	APC	Y & M
0	Yeast	4.30	2.00	4.19	2.15	4.26	1.54
	Non	4.11	2.20	4.20	2.30	4.04	2.18
7	Yeast	6.75	1.30	5.93	1.30	5.90	1.51
	Non	6.11	1.00	6.20	2.15	5.86	2.26
18	Yeast	7.12	1.48(6.30)	6.54	1.30(5.83)	6.16	1.51(6.10)
	Non	6.42	1.00	6.20	2.15	6.26	2.26
27	Yeast	6.95	5.38	6.54	5.47	6.83	5.32
	Non	7.00	2.65	6.38	3.58	6.18	3.00
37	Yeast	7.11	4.05	6.45	3.87	6.72	4.47
	Non	7.32	2.70	6.26	3.63	6.46	4.08
49	Yeast	7.38	4.00	6.69	3.08	6.79	3.23
	Non	6.96	2.30	6.20	3.60	6.40	2.48
57	Yeast	7.03	3.36	6.81	3.20	6.63	1.85
	Non	7.14	2.60	6.79	3.48	6.38	2.30
70	Yeast	6.84	2.80	6.46	2.76	6.43	1.85
	Non	7.26	2.30	6.91	3.32	6.39	1.70

Table Changes of moisture, NaCl and extract of Kanjang during fermentation

Sample		13%			15.5%			18%		
		M.O	NaCl	Ext.	M.O	NaCl	Ext.	M.O	NaCl	Ext.
0	Yeast	87.97	10.62	1.41	85.71	11.79	2.50	84.23	12.24	3.53
	Non	88.66	9.99	1.35	85.51	12.42	2.07	83.99	12.78	3.23
7	Yeast	86.45	9.32	4.23	84.84	11.88	3.28	84.66	12.29	3.05
	Non	88.21	9.81	1.98	85.64	11.84	2.52	83.61	12.15	4.24
18	Yeast	87.59	10.98	1.43	82.16	11.88	5.96	83.86	14.85	1.29
	Non	88.17	10.08	1.75	85.39	12.15	2.46	83.76	11.61	4.63
27	Yeast	87.48	11.25	1.27	85.03	11.79	3.18	83.59	11.34	5.07
	Non	87.93	11.39	0.68	84.71	12.06	3.23	83.18	12.15	4.67
37	Yeast	85.97	11.34	2.69	83.83	12.33	3.84	82.64	12.33	5.03
	Non	86.83	10.44	2.73	83.90	11.79	4.31	83.84	12.51	3.65
49	Yeast	85.93	10.44	3.63	83.74	12.06	4.20	82.61	11.97	5.42
	Non	86.77	11.07	2.16	83.56	11.88	4.56	82.62	12.78	4.60
57	Yeast	85.83	10.89	3.28	83.74	12.51	3.75	82.61	12.42	4.97
	Non	86.44	11.25	2.31	83.45	12.15	4.40	82.31	12.87	4.82
70	Yeast	85.80	10.98	3.22	83.65	12.66	3.69	80.63	12.96	6.41
	Non	86.38	10.53	3.09	82.47	12.15	5.38	82.12	14.76	3.12

Table Changes in pH and acidity of Kanjang during fermentation at different 18% NaCl solution volume

Sample Days.	2l		3l		4l		6l	
	pH	Acidity (%)						
0	6.78	0.04	7.04	0.03	7.39	0.03	8.16	0.013
10	4.78	1.40	4.89	1.19	5.47	0.90	6.30	0.16
20	4.87	1.58	4.85	1.67	5.02	1.05	6.20	0.22
30	4.88	1.65	4.87	1.79	5.06	1.17	4.90	0.38
40	4.94	1.57	4.76	3.77	5.17	2.18	4.80	0.44
50	5.10	1.71	4.68	3.91	5.18	2.59	4.86	0.49
60	5.20	1.73	4.80	2.23	5.46	1.36	4.60	0.59

Table Changes of pH and acidity of Kanjang during fermentation(

Sample Day		25L		30L		35L		40L	
		pH	Acidity (%)	pH	Acidity (%)	pH	Acidity (%)	pH	Acidity (%)
0	Yeast	8.13	0.017	8.16	0.013	8.14	0.022	8.13	0.017
7	Yeast	6.23	0.17	6.30	0.15	5.96	0.1	6.05	0.11
18	Yeast	5.96	0.27	6.20	0.22	6.15	0.13	6.07	0.12
27	Yeast	4.81	0.38	4.90	0.31	4.80	0.25	4.81	0.28
37	Yeast	4.99	0.42	4.80	0.44	4.86	0.31	4.84	0.30
49	Yeast	4.91	0.53	4.81	0.45	4.76	0.40	4.78	0.48
57	Yeast	4.87	0.56	4.86	0.49	4.83	0.39	4.82	0.40
70	Yeast	4.60	0.65	4.60	0.59	4.71	0.41	4.53	0.50

Table Changes of color of Kanjang during fermentation

Sample Day		25L				30L				35L				40L			
		L	a	b	E	L	a	b	E	L	a	b	E	L	a	b	E
0	Yeast	83.8	1.02	7.10	17.6	83.5	0.74	7.85	18.2	71.8	1.79	8.98	29.5	77.4	0.24	4.22	22.9
7	Yeast	81.7	0.11	18.3	25.8	58.0	0.52	13.6	44.0	61.6	1.52	17.0	41.9	54.6	3.43	16.9	48.5
18	Yeast	69.1	5.66	28.9	42.6	57.6	0.11	19.3	46.6	71.1	2.62	27.3	39.8	67.6	4.47	29.2	43.8
27	Yeast	60.1	9.04	31.6	51.6	40.8	5.72	21.4	63.1	68.4	3.34	28.0	42.3	70.0	4.65	30.6	43.0
37	Yeast	62.7	2.39	7.26	38.0	50.1	3.78	14.9	52.1	68.2	5.24	29.9	43.9	59.9	6.40	28.7	49.7
49	Yeast	55.9	5.96	19.3	48.4	40.1	6.23	22.5	64.2	61.9	5.72	28.4	47.8	58.4	7.78	29.1	51.3
57	Yeast	47.0	10.8	26.9	60.3	39.7	7.95	23.2	65.0	54.9	6.67	26.4	52.6	59.2	8.36	30.3	51.4
70	Yeast	42.4	11.7	25.6	64.1	39.4	8.83	23.0	65.3	54.2	7.66	26.8	53.5	51.2	8.79	27.2	56.5

Table Changes of total nitrogen and soluble protein of Kanjang during fermentation at different 18% NaCl solution volume

Sample Day	2l		3l		4l		6l	
	T.N. (%)	Soluble protein(%)	T.N. (%)	Soluble protein(%)	T.N. (%)	Soluble protein(%)	T.N. (%)	Soluble protein(%)
0	0.00	0.19	0.00	0.71	0.00	0.45	0.06	0.20
10	0.47	3.76	0.30	4.83	0.43	4.38	0.13	0.39
20	0.71	4.88	0.61	5.01	0.47	3.78	0.22	0.53
30	1.35	4.76	0.89	5.19	0.53	4.02	0.27	0.73
40	0.83	4.36	0.93	5.12	0.55	5.66	0.31	0.76
50	0.95	5.18	0.92	6.29	0.69	4.88	0.34	1.09
60	1.06	6.24	0.96	6.34	0.75	3.87	0.35	1.04

Table Changes of total nitrogen and soluble protein of Kanjang during fermentation

Sample Day	Yeast	25L		30L		35L		40L	
		T o t a l nitrogen	Soluble protein						
0	Yeast	-	-	-	-	-	-	-	-
7	Yeast	0.14	0.29	0.06	0.19	0.05	0.15	0.02	0.09
18	Yeast	0.20	0.72	0.13	0.39	0.10	0.15	0.09	0.14
27	Yeast	0.26	0.96	0.22	0.53	0.15	0.42	0.16	0.41
37	Yeast	0.28	1.06	0.27	0.73	0.19	0.67	0.19	0.63
49	Yeast	0.32	1.23	0.31	0.76	0.23	0.71	0.20	0.70
57	Yeast	0.34	1.45	0.32	1.09	0.23	0.99	0.21	0.89
70	Yeast	0.36	1.61	0.33	1.04	0.24	0.95	0.21	0.81

Table Changes of total free sugar of Kanjang during fermentation

Sample		25L	30L	35L	40L
Day	Yeast				
0	Yeast	-	-	-	-
7	Yeast	0.31	0.29	0.28	0.25
18	Yeast	0.59	0.44	0.34	0.33
27	Yeast	0.39	0.37	0.26	0.39
37	Yeast	0.34	0.36	0.29	0.50
49	Yeast	0.37	0.26	0.39	0.51
57	Yeast	0.38	0.42	0.47	0.52
70	Yeast	0.46	0.27	0.40	0.53

Table Changes of viable cell count and yeast & mold count of Kanjang during fermentation

Sample Day		25L		30L		35L		40L	
		APC	Y & M						
0	Yeast	4.11	2.00	4.26	1.54	4.11	2.15	4.13	2.48
7	Yeast	6.05	1.48	5.90	1.51	6.05	1.00	5.78	1.48
18	Yeast	6.11	1.48(5.91)	6.16	1.51(6.10)	6.11	1.00(5.14)	5.74	1.48(5.82)
27	Yeast	6.56	5.85	6.83	5.32	6.15	5.59	6.20	5.94
37	Yeast	6.86	5.67	6.72	4.47	6.45	4.38	6.38	5.34
49	Yeast	6.88	3.28	6.79	3,23	6.42	2.30	6.34	4.25
57	Yeast	6.78	2.70	6.63	1.85	6.45	2.30	6.38	1.91
70	Yeast	6.70	2.59	6.43	1.85	6.00	2.30	6.00	1.48

Table Changes of moisture, NaCl and extract of Kanjang during fermentation

Sample Day		25L			30L			35L			40L		
		M.O	NaCl	Ext.									
0	Yeast	83.38	13.95	2.67	84.23	12.24	3.53	84.29	13.14	2.57	83.97	12.69	3.34
7	Yeast	84.82	13.14	2.04	84.66	12.29	3.05	84.71	13.23	2.06	84.70	13.73	2.27
18	Yeast	83.48	13.32	3.2	83.86	14.85	1.29	84.04	13.05	2.91	84.15	14.45	1.4
27	Yeast	83.09	13.32	3.59	83.59	11.34	5.07	84.08	13.50	2.42	83.61	14.95	1.44
37	Yeast	82.31	13.41	4.28	82.64	12.33	5.03	82.97	11.25	5.78	83.39	14.31	2.3
49	Yeast	82.02	12.87	5.11	82.61	11.97	5.42	82.85	10.89	6.26	83.31	13.64	3.05
57	Yeast	82.01	11.25	6.74	82.61	12.42	4.97	82.85	13.32	3.83	83.01	14.58	2.41
70	Yeast	80.45	12.83	6.72	80.63	12.96	6.41	82.87	13.37	3.76	82.98	13.41	3.61

Table Changes of pH and acidity of Kanjang during fermentation at the Cheongpoong area

Sample Day	Yeast		Non- Yeast	
	pH	Acidity(%)	pH	Acidity(%)
0	7.25	0.09	7.43	0.04
11	6.51	0.12	6.48	0.1
20	6.51(6.37)	0.19	6.30	0.17
30	5.31	0.37	5.07	0.31
39	4.97	0.43	4.87	0.35
50	4.70	0.48	4.63	0.37
55	4.70	0.50	4.70	0.37

Table Changes of color of Kanjang during fermentation at the Cheongpoong area

Sample Day	Yeast				Non- Yeast			
	L	a	b	E	L	a	b	E
0	74.3	0.27	16.3	30.4	90.9	1.06	12.0	15.0
11	63.6	3.77	28.8	46.5	72.3	1.88	28.6	39.9
20	72.4	5.38	35.4	45.1	76.0	2.83	32.8	40.6
30	27.8	10.6	19.4	75.5	55.4	6.31	25.9	51.9
39	37.0	12.7	23.6	68.4	62.1	7.15	30.4	49.0
50	33.3	12.0	21.6	71.1	62.8	7.71	30.8	48.8
55	41.5	12.1	25.7	64.9	62.7	7.60	30.7	48.8

Table Changes of total nitrogen and soluble protein of Kanjang during fermentation at the Cheongpoong area

Sample Days	Yeast		Non- Yeast	
	T o t a l nitrogen(%)	S o l u b l e protein(%)	T o t a l Nitrogen(%)	S o l u b l e protein(%)
0	0.00	-	0.00	-
11	0.12	0.69	0.05	0.34
20	0.14	0.76	0.07	0.41
30	0.09	0.76	0.07	0.44
39	0.16	0.86	0.16	0.43
50	0.15	0.95	0.14	0.45
55	0.17	1.05	0.08	0.47

Table Changes of total free sugar of Kanjang during fermentation at the Cheongpoong area

Sample Day	Yeast	Non- Yeast
0	-	-
11	0.30	0.31
20	0.31	0.22
30	0.31	0.13
39	0.27	0.13
50	0.25	0.21
55	0.26	0.12

Table Changes of viable cell and yeast & mold count(cfu/ml,g) of Kanjang during fermentation at Cheongpoong area

Sample Days	Yeast		Non- Yeast	
	A.P.C	Y&M	A.P.C	Y&M
0	4.07	2.00	4.18	2.85
11	6.34	1.82	6.04	1.00
20	7.30	1.65(6.65)	6.01	1.60
30	7.48	5.48	6.32	1.62
39	7.52	3.45	6.48	1.00
50	6.98	3.53	6.32	1.00
55	6.78	3.24	6.09	1.69

Table Changes of moisture, NaCl and extract of Kanjang during fermentation at Cheongpoong area

Sample Days	Yeast			Non- Yeast		
	M.O	NaCl	Extract	M.O	NaCl	Extract
0	80.08	18.24	1.68	84.38	18.40	
11	77.05	18.94	4.01	78.94	18.83	2.23
20	78.88	19.04	2.08	78.40	19.09	2.51
30	78.70	19.25	2.05	77.69	19.47	2.84
39	78.24	19.89	1.87	77.59	19.95	2.46
50	77.83	20.74	1.43	77.30	20.21	2.49
55	78.52	21.06	0.42	77.29	20.27	2.44

Table Changes in pH and acidity of Kanjang during fermentation at different temperatures

Temp Days.	20		25		30		35	
	pH	Acidity (%)						
0	8.16	0.013	7.40	0.05				
7	6.30	0.15						
10			4.61	0.42	4.92	0.46	4.75	1.12
13								
18	6.20	0.22						
23			4.87	0.51	4.75	0.51	4.71	1.56
27	4.90	0.31						
37	4.80	0.44	4.81	0.57	5.04	0.55	5.13	0.80
49	4.81	0.45	4.78	0.61	5.15	0.58	5.44	0.77
57	4.86	0.49	4.80	0.69	5.06	0.58	5.79	0.65
70	4.60	0.59	4.97	0.71	5.11	0.64	5.96	0.63

Table Changes of color of Kanjang during fermentation at different temperatures

Table Changes of total nitrogen and soluble protein of Kanjang during fermentation at different temperatures

Sample Day	20		25		30		35	
	T.N. (%)	Soluble protein(%)	T.N. (%)	Soluble protein(%)	T.N. (%)	Soluble protein(%)	T.N. (%)	Soluble protein(%)
0	-	-	0.00	-	0.00	-	0.00	-
7	0.06	0.19						
10			0.36	0.71	0.22	1.43	0.23	1.89
13								
18	0.13	0.39	0.37	0.93	0.27	1.47	0.24	2.39
23								
27	0.22	0.53	0.38	1.36	0.37	2.21	0.24	2.77
37	0.27	0.73	0.27	2.15	0.35	2.96	0.22	2.49
49	0.31	0.76	0.36	1.90	0.36	3.09	0.24	3.45
57	0.32	1.09	0.29	2.82	0.28	1.97	0.26	2.95
70	0.33	1.04						

Table Changes in total free sugar of Kanjang during fermentation at different temperatures

Temp. Days.	20	25	30	35
0	-	-	-	0.21
7	0.29			
10		0.33	0.43	0.27
13				
18	0.44	0.40	0.45	0.26
23				
27	0.37	0.43	0.43	0.35
37	0.36	0.44	0.41	0.42
49	0.26	0.53	0.40	0.33
57	0.42	0.57	0.36	0.28
70	0.27			

Table Changes of moisture, NaCl and extract of Kanjang during fermentation at different 18% NaCl solution volume

Sample Days	2l			3l			4l			6l		
	M.O	NaCl	Ext.									
0	81.97	17.42	0.61	81.82	17.85	0.33	81.90	17.96	0.14	84.23	12.24	3.53
10	76.22	17.53	6.25	76.84	18.18	4.98	78.61	18.28	3.11	84.66	12.29	3.05
20	74.48	17.75	7.77	75.21	18.18	6.61	77.42	18.39	4.19	83.86	14.85	1.29
30	73.33	18.71	7.96	73.43	19.04	7.17	76.74	18.61	4.65	83.59	11.34	5.07
40	76.20	16.38	7.00	71.37	20.22	8.41	76.24	18.61	5.15	82.64	12.33	5.03
50	73.07	18.62	8.31	70.12	20.33	9.55	75.14	18.82	6.04	82.61	12.42	4.97
60	72.14	18.83	9.03	69.03	21.08	9.89	72.71	19.90	7.39	80.63	12.96	6.41

Table Changes in pH and acidity of Kanjang during fermentation at different 18% NaCl solution volume

Sample Days.	2l		3l		4l		6l	
	pH	Acidity (%)	pH	Acidity (%)	pH	Acidity (%)	pH	Acidity (%)
0	6.78	0.04	7.04	0.03	7.39	0.03	8.16	0.013
10	4.78	1.40	4.89	1.19	5.47	0.90	6.30	0.16
20	4.87	1.58	4.85	1.67	5.02	1.05	6.20	0.22
30	4.88	1.65	4.87	1.79	5.06	1.17	4.90	0.38
40	4.94	1.57	4.76	3.77	5.17	2.18	4.80	0.44
50	5.10	1.71	4.68	3.91	5.18	2.59	4.86	0.49
60	5.20	1.73	4.80	2.23	5.46	1.36	4.60	0.59

Table Changes of color of Kanjang during fermentation at different 18% NaCl solution volume

Sample Day	2l				3l				4l				6l			
	L	a	b	E	L	a	b	E	L	a	b	E	L	a	b	E
0	46.9	10.1	28.2	60.7	50.5	14.2	31.6	60.2	49.9	13.9	31.4	60.5	83.5	0.74	7.85	18.2
10	7.85	19.7	- 11.0	94.7	20.6	19.8	10.2	82.2	25.2	18.4	15.3	78.3	58.0	0.52	13.6	44.0
20	8.50	- 0.92	- 12.7	92.2	12.5	22.6	- 0.44	90.1	23.2	19.9	13.1	80.2	57.6	0.11	19.3	46.6
30	8.50	- 5.90	- 11.0	92.2	15.2	20.9	4.09	87.1	21.0	21.8	11.3	82.4	40.8	5.72	21.4	63.1
40	8.46	- 9.09	- 10.1	92.5	17.0	22.8	6.86	86.1	17.0	22.8	6.86	86.1	50.1	3.78	14.9	52.1
50	8.46	- 5.14	- 10.1	92.2	13.2	25.2	1.68	90.1	21.9	23.7	12.7	82.3	39.7	7.95	23.2	65.0
60	8.46	- 9.09	- 10.1	92.5	7.85	25.1	- 9.24	85.8	23.6	25.3	14.7	81.6	39.4	8.83	23.0	65.3

Table Changes in total free sugar of Kanjang during fermentation
at different 18% NaCl solution volume

Sample Days	2l	3l	4l	6l
0	-	-	-	0.21
10	0.62	0.80	0.54	0.27
20	0.99	0.94	0.61	0.26
30	1.02	0.96	0.67	0.35
40	1.01	0.98	0.71	0.42
50	0.98	0.95	0.72	0.33
60	0.99	0.91	0.56	0.28

Table Changes in viable cell count and Yeast & mold count of Kanjang during fermentation at different 18% NaCl solution volume

Sample Days.	2l		3l		4l		6l	
	APC	Y&M	APC	Y&M	APC	Y&M	APC	Y&M
0	8.18	3.04 (6.60)	7.83	3.42 (6.71)	7.18	3.13 (6.69)	4.26	1.54
10	7.46	4.38	7.48	3.98	7.53	3.60	5.90	1.51
20	7.59	2.78	7.46	3.69	7.38	2.95	6.16	1.51(6.1)
30	7.90	2.90	7.12	3.60	7.63	2.93	6.83	5.32
40	8.25	4.20	7.24	2.41	7.59	2.48	6.72	4.47
50	7.81	4.86	7.44	3.42	7.92	3.35	6.63	1.85
60	7.67	6.78	8.18	3.81	8.23	3.54	6.43	1.85

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Time	4		12		32	
	APC	Y & M	APC	Y & M	APC	Y&M
0	7.88	6.67	8.05	6.89	8.06	6.65
10	7.04	4.78	7.18	4.30	7.11	3.82
20	6.74	5.43	6.36	2.23	6.63	2.54
30						
40						
50						
60						

Time	4		12		32	
	pH	Acidity (%)	pH	Acidity (%)	pH	Acidity (%)
0	5.87	0.06	5.86	0.06	6.10	0.05
10	4.67	1.14	4.64	1.17	4.88	0.85
20						
30						
40						
50						
60						

Sample Day	#14		#15	
	pH	Acidity(%)	pH	Acidity(%)
0	5.97	0.31	6.37	0.16
7	5.81	0.32	6.21	0.25
16	5.75	0.32	6.02	0.35
28	5.09	0.47	5.03	0.49
36	4.74	0.48	4.82	0.60
48	4.61	0.60	4.55	0.71
56	4.78	0.60	4.79	0.75

Sample Day	#14				#15			
	L	a	b	E	L	a	b	E
0	46.4	6.92	24.6	59.3	73.8	3.16	29.0	39.2
7	49.0	7.04	26.2	57.7	73.8	4.26	33.8	42.9
16	43.1	8.24	24.3	62.4	66.7	5.64	32.8	47.0
28	51.6	10.4	28.7	57.2	54.4	8.54	29.3	54.8
36	52.1	9.25	27.6	56.0	51.4	10.3	28.9	57.4
48	35.2	11.7	21.4	69.2	54.2	10.6	30.2	55.8
56	29.7	10.1	18.9	73.4	44.8	11.2	26.3	62.1

Sample Days	#14		#15	
	T o t a l nitrogen(%)	S o l u b l e protein(%)	T o t a l Nitrogen(%)	S o l u b l e protein(%)
0	0.00	-	0.00	-
7	0.09	0.18	0.04	0.23
16	0.15	0.33	0.07	0.42
28	0.15	0.49	0.10	0.76
36	0.16	0.77	0.15	0.93
48	0.17	1.01	0.17	1.24
56	0.17	0.89	0.17	1.66

Total sugar

Sample Day	Yeast	Non- Yeast
0	-	-
7	0.20	0.34
16	0.32	0.28
28	0.36	0.30
36	0.57	0.22
48	0.46	0.13
56	0.49	0.07

Sample Days	(#14)		(#15)	
	Aerobic plate count	Yeast & mold count	Aerobic plate count	Yeast & mold count
0	6.48	5.15	4.32	5.22
7	8.02	5.58	6.68	5.15
16	8.05	5.28	6.69	5.36
28	8.32	5.26	6.88	2.96
36	8.27	4.96	6.95	1.00
48	8.36	3.90	6.92	1.00
56	8.41	2.13	7.03	1.46

Table Changes of moisture, NaCl and extract of Kanjang during fermentation at Cheongpoong area

Sample Days	#14			#15		
	M.O	NaCl(%)	Extract	M.O	NaCl(%)	Extract
0	80.81	18.19	1.00	81.43	17.07	1.50
7	80.00	18.24	1.76	80.99	17.23	1.78
16	80.05	18.24	1.71	80.85	17.29	1.86
28	79.77	18.40	1.83	80.57	17.45	1.98
36	80.07	18.67	1.26	78.79	17.49	3.72
48	80.07	19.04	0.89	79.62	17.66	2.72
56	79.25	19.52	1.50	80.03	17.77	2.20

Table 3. Sensory evaluation data of Kanjang according to yeast and non-yeast inoculation in **13% NaCl** solution by laboratory-trained panel members.

Sample	Yeast	non- Yeast	L.S.D
Color	4.27b	4.73a	0.35
Flavor	4.47a	4.40a	0.33
Taste	4.33a	4.27a	0.74
Overall	4.47a	4.40a	0.61

Table 4. Sensory evaluation data of Kanjang according to yeast and non-yeast inoculation in **15.5% NaCl** solution by laboratory-trained panel members.

Sample	Yeast	non- Yeast	L.S.D
Color	3.87a	4.00a	0.29
Flavor	4.53a	4.53a	0.73
Taste	4.73a	4.13a	0.75
Overall	4.53a	4.53a	0.60

Table 5. Sensory evaluation data of Kanjang according to yeast and non-yeast inoculation in **18% NaCl** solution by laboratory-trained panel members.

Sample	Yeast	non- Yeast	L.S.D
Color	4.27a	3.40b	0.69
Flavor	4.40a	4.20b	0.94
Taste	4.80a	3.60b	0.89
Overall	4.73a	3.67b	0.95

Table 6. Sensory evaluation data of Kanjang according to different NaCl concentration in yeast inoculation by laboratory-trained panel members.

Sample	13%	15.5%	18%	L.S.D
Color	4.40a	4.47a	3.80a	0.79
Flavor	4.13a	4.27a	3.93a	0.75
Taste	4.67a	4.07ab	4.00b	0.64
Overall	4.40a	4.40a	3.93a	0.75

Table 7. Sensory evaluation data of Kanjang according to different NaCl concentration in non-yeast inoculation by laboratory-trained panel members.

Sample	13%	15.5%	18%	L.S.D
Color	4.07ab	4.67a	3.67b	0.80
Flavor	4.13a	4.07a	4.13a	0.64
Taste	3.80a	4.07a	3.93a	0.77
Overall	3.73b	4.53a	4.00ab	0.72

Table 8. Sensory evaluation data of Kanjang according to different volume about 1 Meju in yeast inoculation by laboratory-trained panel members.

Sample	2l	3l	4l	5l	6l	7l	8l	L.S.D
Color	4.13a	2.93d	4.13bc	4.87ab	4.13bc	4.07	3.93c	0.81
Flavor	3.47a	3.73bc	4.07bc	3.60c	3.47c	4.00bc	4.40bc	0.76
Taste	3.87a	3.80bdc	4.27abc	4.60ab	3.87bcd	3.47cd	3.20c	0.84
Overall	3.93a	3.40d	4.20bc	4.40ab	3.93bcd	3.60cd	3.53cd	0.77

Table 9. Sensory evaluation data of Kanjang according to different fermentation temperature by laboratory-trained panel members.

Sample	25	30	35	L.S.D
Color	4.13	4.47	4.93	0.96
Flavor	4.47	4.53	4.73	0.89
Taste	4.27	3.93	4.00	0.79
Overall	4.20	4.20	4.33	0.75

Table 10. Sensory evaluation data of Kanjang during fermentation at Cheongpoong area by laboratory-trained panel members.

Sample	Yeast	non- Yeast	L.S.D
Color	4.67a	3.67	0.69
Flavor	3.67	3.93	0.74
Taste	4.27	4.20	0.80
Overall	4.20	3.93	0.61

DATA

Table . Sensory evaluation data of Kanjang according to different volume about 1 Meju in yeast inoculation by laboratory-trained panel members.

Sample	5l	6l	7l	8l	L.S.D
Color	4.13	4.87	4.07	3.93	0.46
Flavor	3.47	3.60	4.00	4.40	0.71
Taste	3.87	4.60	3.47	3.20	0.78
Overall	3.93	4.40	3.60	3.53	0.59

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Table Changes of pH and acidity of Kanjang during fermentation(

Day	Sample	13%		15.5%		18%	
		pH	Acidity(%)	pH	Acidity(%)	pH	Acidity(%)
0	Yeast	8.00	0.013	8.08	0.022	8.16	0.013
	Non	8.14	0.026	8.04	0.022	8.18	0.013
7	Yeast	5.96	0.29	6.77	0.18	6.30	0.16
	Non	5.90	0.11	6.14	0.19	6.26	0.17
18	Yeast	5.10	0.26	5.05	0.22	6.20	0.22
	Non	5.00	0.14	5.33	0.22	5.90	0.22
27	Yeast	4.78	0.32	4.74	0.41	4.90	0.38
	Non	5.08	0.29	4.95	0.39	4.97	0.39
37	Yeast	4.91	0.48	4.87	0.52	4.80	0.44
	Non	4.98	0.43	5.01	0.50	4.78	0.46
49	Yeast	5.07	0.53	5.03	0.53	4.81	0.46
	Non	5.07	0.48	5.11	0.51	4.84	0.45
57	Yeast	5.07	0.61	5.08	0.54	4.86	0.49
	Non	5.05	0.52	5.15	0.56	4.95	0.45
70	Yeast	4.78	0.65	4.75	0.62	4.60	0.59
	Non	4.77	0.61	4.93	0.60	4.66	0.55

Table Changes of color of Kanjang during fermentation

Sample Day		13%				15.5%				18%			
		L	a	b	E	L	a	b	E	L	a	b	E
0	Yeast	57.8	3.38	13.4	44.3	80.3	0.98	9.94	22.0	83.5	0.74	7.85	18.2
	Non	77.7	0.81	9.48	24.2	86.8	0.23	6.53	14.7	83.9	1.12	7.59	17.7
7	Yeast	62.2	2.87	14.9	40.7	39.2	4.63	15.5	62.9	58.0	0.52	13.6	44.0
	Non	82.4	1.13	7.72	19.1	55.2	1.02	17.6	48.0	67.3	0.59	16.9	36.7
18	Yeast	46.6	7.21	22.6	58.4	62.5	3.12	25.4	45.3	57.6	0.11	19.3	46.6
	Non	67.4	0.35	19.7	38.0	52.5	1.72	22.3	52.4	66.6	0.63	23.9	41.0
27	Yeast	59.4	9.47	30.9	51.8	50.3	7.98	27.7	57.4	40.8	5.72	21.4	63.1
	Non	65.8	4.57	29.1	45.1	44.3	4.50	20.3	59.3	46.6	5.32	23.9	58.7
37	Yeast	24.9	7.64	17.4	77.4	49.5	10.0	27.8	58.4	50.1	3.78	14.9	52.1
	Non	39.9	5.16	20.5	63.6	34.1	11.3	21.4	70.1	49.7	5.12	18.7	53.8
49	Yeast	38.2	9.23	23.4	66.6	46.8	8.95	26.5	60.0	40.1	6.23	22.5	64.2
	Non	44.3	8.31	24.6	61.4	39.4	7.79	23.3	65.3	49.5	5.80	21.4	55.0
57	Yeast	43.0	10.2	25.5	63.2	45.6	9.02	26.4	61.1	39.7	7.95	23.2	65.0
	Non	13.9	6.12	4.65	86.4	41.3	8.02	23.8	63.8	49.0	7.87	26.0	57.7
70	Yeast	20.8	11.1	11.9	80.7	37.2	10.8	23.4	67.8	39.4	8.83	23.0	65.3
	Non	23.4	8.50	15.1	78.5	40.1	12.4	24.9	66.0	43.2	9.47	24.7	62.5

Table Changes of total nitrogen and soluble protein of Kanjang during fermentation

Sample Day		13%		15.5%		18%	
		T.N(%)	S o l u b l e protein(%)	T.N(%)	S o l u b l e protein(%)	T.N(%)	S o l u b l e protein(%)
0	Yeast	-	-	-	-	-	-
	Non	-	-	-	-	-	-
7	Yeast	0.03	0.16	0.07	0.21	0.06	0.20
	Non	0.02	0.16	0.07	0.20	-	0.22
18	Yeast	0.19	0.25	0.16	0.36	0.13	0.39
	Non	0.10	0.19	0.17	0.42	0.08	0.32
27	Yeast	0.27	0.58	0.27	0.56	0.22	0.53
	Non	0.21	0.43	0.31	0.58	0.23	0.51
37	Yeast	0.29	0.78	0.29	0.78	0.27	0.73
	Non	0.26	0.68	0.37	0.78	0.27	0.77
49	Yeast	0.33	0.81	0.33	0.82	0.31	0.76
	Non	0.32	0.77	0.36	0.82	0.33	0.77
57	Yeast	0.36	1.09	0.35	1.07	0.34	1.09
	Non	0.35	1.04	0.37	1.00	0.36	1.01
70	Yeast	0.37	1.1	0.35	1.22	0.35	1.04
	Non	0.35	1.13	0.37	1.25	0.36	1.13

Table Changes of total free sugar of Kanjang during fermentation

Sample		13%	15.5%	18%
Day				
0	Yeast	-	-	-
	Non	-	-	-
7	Yeast	0.27	0.29	0.29
	Non	0.25	0.3	0.31
18	Yeast	0.42	0.43	0.44
	Non	0.41	0.44	0.44
27	Yeast	0.36	0.35	0.37
	Non	0.35	0.34	0.33
37	Yeast	0.35	0.34	0.36
	Non	0.35	0.35	0.37
49	Yeast	0.25	0.23	0.26
	Non	0.24	0.25	0.29
57	Yeast	0.39	0.39	0.42
	Non	0.39	0.40	0.48
70	Yeast	0.40	0.38	0.27
	Non	0.40	0.45	0.37

Table Changes of viable cell count and yeast & mold count of Kanjang during fermentation

Sample Day		13%		15.5%		18%	
		APC	Y & M	APC	Y & M	APC	Y & M
0	Yeast	4.30	2.00	4.19	2.15	4.26	1.54
	Non	4.11	2.20	4.20	2.30	4.04	2.18
7	Yeast	6.75	1.30	5.93	1.30	5.90	1.51
	Non	6.11	1.00	6.20	2.15	5.86	2.26
18	Yeast	7.12	1.48(6.30)	6.54	1.30(5.83)	6.16	1.51(6.10)
	Non	6.42	1.00	6.20	2.15	6.26	2.26
27	Yeast	6.95	5.38	6.54	5.47	6.83	5.32
	Non	7.00	2.65	6.38	3.58	6.18	3.00
37	Yeast	7.11	4.05	6.45	3.87	6.72	4.47
	Non	7.32	2.70	6.26	3.63	6.46	4.08
49	Yeast	7.38	4.00	6.69	3.08	6.79	3.23
	Non	6.96	2.30	6.20	3.60	6.40	2.48
57	Yeast	7.03	3.36	6.81	3.20	6.63	1.85
	Non	7.14	2.60	6.79	3.48	6.38	2.30
70	Yeast	6.84	2.80	6.46	2.76	6.43	1.85
	Non	7.26	2.30	6.91	3.32	6.39	1.70

Table Changes of moisture, NaCl and extract of Kanjang during fermentation

Sample Day		13%			15.5%			18%		
		M.O	NaCl	Ext.	M.O	NaCl	Ext.	M.O	NaCl	Ext.
0	Yeast	87.97	10.62	1.41	85.71	11.79	2.50	84.23	12.24	3.53
	Non	88.66	9.99	1.35	85.51	12.42	2.07	83.99	12.78	3.23
7	Yeast	86.45	9.32	4.23	84.84	11.88	3.28	84.66	12.29	3.05
	Non	88.21	9.81	1.98	85.64	11.84	2.52	83.61	12.15	4.24
18	Yeast	87.59	10.98	1.43	82.16	11.88	5.96	83.86	14.85	1.29
	Non	88.17	10.08	1.75	85.39	12.15	2.46	83.76	11.61	4.63
27	Yeast	87.48	11.25	1.27	85.03	11.79	3.18	83.59	11.34	5.07
	Non	87.93	11.39	0.68	84.71	12.06	3.23	83.18	12.15	4.67
37	Yeast	85.97	11.34	2.69	83.83	12.33	3.84	82.64	12.33	5.03
	Non	86.83	10.44	2.73	83.90	11.79	4.31	83.84	12.51	3.65
49	Yeast	85.93	10.44	3.63	83.74	12.06	4.20	82.61	11.97	5.42
	Non	86.77	11.07	2.16	83.56	11.88	4.56	82.62	12.78	4.60
57	Yeast	85.83	10.89	3.28	83.74	12.51	3.75	82.61	12.42	4.97
	Non	86.44	11.25	2.31	83.45	12.15	4.40	82.31	12.87	4.82
70	Yeast	85.80	10.98	3.22	83.65	12.66	3.69	80.63	12.96	6.41
	Non	86.38	10.53	3.09	82.47	12.15	5.38	82.12	14.76	3.12

Table Changes of pH and acidity of Kanjang during fermentation(

Sample Day		25L		30L		35L		40L	
		pH	Acidity (%)						
0	Yeast	8.13	0.017	8.16	0.013	8.14	0.022	8.13	0.017
7	Yeast	6.23	0.17	6.30	0.15	5.96	0.1	6.05	0.11
18	Yeast	5.96	0.27	6.20	0.22	6.15	0.13	6.07	0.12
27	Yeast	4.81	0.38	4.90	0.31	4.80	0.25	4.81	0.28
37	Yeast	4.99	0.42	4.80	0.44	4.86	0.31	4.84	0.30
49	Yeast	4.91	0.53	4.81	0.45	4.76	0.40	4.78	0.48
57	Yeast	4.87	0.56	4.86	0.49	4.83	0.39	4.82	0.40
70	Yeast	4.60	0.65	4.60	0.59	4.71	0.41	4.53	0.50

Table Changes of color of Kanjang during fermentation

Sample Day		25L				30L				35L				40L			
		L	a	b	E	L	a	b	E	L	a	b	E	L	a	b	E
0	Yeast	83.8	1.02	7.10	17.6	83.5	0.74	7.85	18.2	71.8	1.79	8.98	29.5	77.4	0.24	4.22	22.9
7	Yeast	81.7	0.11	18.3	25.8	58.0	0.52	13.6	44.0	61.6	1.52	17.0	41.9	54.6	3.43	16.9	48.5
18	Yeast	69.1	5.66	28.9	42.6	57.6	0.11	19.3	46.6	71.1	2.62	27.3	39.8	67.6	4.47	29.2	43.8
27	Yeast	60.1	9.04	31.6	51.6	40.8	5.72	21.4	63.1	68.4	3.34	28.0	42.3	70.0	4.65	30.6	43.0
37	Yeast	62.7	2.39	7.26	38.0	50.1	3.78	14.9	52.1	68.2	5.24	29.9	43.9	59.9	6.40	28.7	49.7
49	Yeast	55.9	5.96	19.3	48.4	40.1	6.23	22.5	64.2	61.9	5.72	28.4	47.8	58.4	7.78	29.1	51.3
57	Yeast	47.0	10.8	26.9	60.3	39.7	7.95	23.2	65.0	54.9	6.67	26.4	52.6	59.2	8.36	30.3	51.4
70	Yeast	42.4	11.7	25.6	64.1	39.4	8.83	23.0	65.3	54.2	7.66	26.8	53.5	51.2	8.79	27.2	56.5

Table Changes of total nitrogen and soluble protein of Kanjang during fermentation

Sample Day		25L		30L		35L		40L	
		T o t a l nitrogen	S o l u b l e protein	T o t a l nitrogen	S o l u b l e protein	T o t a l Nitrogen	S o l u b l e protein	T o t a l nitrogen	S o l u b l e protein
0	Yeast	-	-	-	-	-	-	-	-
7	Yeast	0.14	0.29	0.06	0.19	0.05	0.15	0.02	0.09
18	Yeast	0.20	0.72	0.13	0.39	0.10	0.15	0.09	0.14
27	Yeast	0.26	0.96	0.22	0.53	0.15	0.42	0.16	0.41
37	Yeast	0.28	1.06	0.27	0.73	0.19	0.67	0.19	0.63
49	Yeast	0.32	1.23	0.31	0.76	0.23	0.71	0.20	0.70
57	Yeast	0.34	1.45	0.32	1.09	0.23	0.99	0.21	0.89
70	Yeast	0.36	1.61	0.33	1.04	0.24	0.95	0.21	0.81

Table Changes of total free sugar of Kanjang during fermentation

Sample		25L	30L	35L	40L
Day					
0	Yeast	-	-	-	-
7	Yeast	0.31	0.29	0.28	0.25
18	Yeast	0.59	0.44	0.34	0.33
27	Yeast	0.39	0.37	0.26	0.39
37	Yeast	0.34	0.36	0.29	0.50
49	Yeast	0.37	0.26	0.39	0.51
57	Yeast	0.38	0.42	0.47	0.52
70	Yeast	0.46	0.27	0.40	0.53

Table Changes of viable cell count and yeast & mold count of Kanjang during fermentation

Sample Day		25L		30L		35L		40L	
		APC	Y & M						
0	Yeast	4.11	2.00	4.26	1.54	4.11	2.15	4.13	2.48
7	Yeast	6.05	1.48	5.90	1.51	6.05	1.00	5.78	1.48
18	Yeast	6.11	1.48(5.91)	6.16	1.51(6.10)	6.11	1.00(5.14)	5.74	1.48(5.82)
27	Yeast	6.56	5.85	6.83	5.32	6.15	5.59	6.20	5.94
37	Yeast	6.86	5.67	6.72	4.47	6.45	4.38	6.38	5.34
49	Yeast	6.88	3.28	6.79	3,23	6.42	2.30	6.34	4.25
57	Yeast	6.78	2.70	6.63	1.85	6.45	2.30	6.38	1.91
70	Yeast	6.70	2.59	6.43	1.85	6.00	2.30	6.00	1.48

Table Changes of moisture, NaCl and extract of Kanjang during fermentation

Sample Day		25L			30L			35L			40L		
		M.O	NaCl	Ext.									
0	Yeast	83.38	13.95	2.67	84.23	12.24	3.53	84.29	13.14	2.57	83.97	12.69	3.34
7	Yeast	84.82	13.14	2.04	84.66	12.29	3.05	84.71	13.23	2.06	84.70	13.73	2.27
18	Yeast	83.48	13.32	3.2	83.86	14.85	1.29	84.04	13.05	2.91	84.15	14.45	1.4
27	Yeast	83.09	13.32	3.59	83.59	11.34	5.07	84.08	13.50	2.42	83.61	14.95	1.44
37	Yeast	82.31	13.41	4.28	82.64	12.33	5.03	82.97	11.25	5.78	83.39	14.31	2.3
49	Yeast	82.02	12.87	5.11	82.61	11.97	5.42	82.85	10.89	6.26	83.31	13.64	3.05
57	Yeast	82.01	11.25	6.74	82.61	12.42	4.97	82.85	13.32	3.83	83.01	14.58	2.41
70	Yeast	80.45	12.83	6.72	80.63	12.96	6.41	82.87	13.37	3.76	82.98	13.41	3.61

Table Changes of pH and acidity of Kanjang during fermentation at the Cheongpoong area

Sample Day	Yeast		Non- Yeast	
	pH	Acidity(%)	pH	Acidity(%)
0	7.25	0.09	7.43	0.04
11	6.51	0.12	6.48	0.1
20	6.51(6.37)	0.19	6.30	0.17
30	5.31	0.37	5.07	0.31
39	4.97	0.43	4.87	0.35
50	4.70	0.48	4.63	0.37
55	4.70	0.50	4.70	0.37

Table Changes of color of Kanjang during fermentation at the Cheongpoong area

Sample Day	Yeast				Non- Yeast			
	L	a	b	E	L	a	b	E
0	74.3	0.27	16.3	30.4	90.9	1.06	12.0	15.0
11	63.6	3.77	28.8	46.5	72.3	1.88	28.6	39.9
20	72.4	5.38	35.4	45.1	76.0	2.83	32.8	40.6
30	27.8	10.6	19.4	75.5	55.4	6.31	25.9	51.9
39	37.0	12.7	23.6	68.4	62.1	7.15	30.4	49.0
50	33.3	12.0	21.6	71.1	62.8	7.71	30.8	48.8
55	41.5	12.1	25.7	64.9	62.7	7.60	30.7	48.8

Table Changes of total nitrogen and soluble protein of Kanjang during fermentation at the Cheongpoong area

Sample Days	Yeast		Non- Yeast	
	T o t a l nitrogen(%)	S o l u b l e protein(%)	T o t a l Nitrogen(%)	S o l u b l e protein(%)
0	0.00	-	0.00	-
11	0.12	0.69	0.05	0.34
20	0.14	0.76	0.07	0.41
30	0.09	0.76	0.07	0.44
39	0.16	0.86	0.16	0.43
50	0.15	0.95	0.14	0.45
55	0.17	1.05	0.08	0.47

Table Changes of total free sugar of Kanjang during fermentation at the Cheongpoong area

Sample Day	Yeast	Non- Yeast
0	-	-
11	0.30	0.31
20	0.31	0.22
30	0.31	0.13
39	0.27	0.13
50	0.25	0.21
55	0.26	0.12

Table Changes of viable cell and yeast & mold count(cfu/ml,g) of Kanjang during fermentation at Cheongpoong area

Sample Days	Yeast		Non- Yeast	
	A.P.C	Y&M	A.P.C	Y&M
0	4.07	2.00	4.18	2.85
11	6.34	1.82	6.04	1.00
20	7.30	1.65(6.65)	6.01	1.60
30	7.48	5.48	6.32	1.62
39	7.52	3.45	6.48	1.00
50	6.98	3.53	6.32	1.00
55	6.78	3.24	6.09	1.69

Table Changes of moisture, NaCl and extract of Kanjang during fermentation at Cheongpoong area

Sample Days	Yeast			Non- Yeast		
	M.O	NaCl	Extract	M.O	NaCl	Extract
0	80.08	18.24	1.68	84.38	18.40	
11	77.05	18.94	4.01	78.94	18.83	2.23
20	78.88	19.04	2.08	78.40	19.09	2.51
30	78.70	19.25	2.05	77.69	19.47	2.84
39	78.24	19.89	1.87	77.59	19.95	2.46
50	77.83	20.74	1.43	77.30	20.21	2.49
55	78.52	21.06	0.42	77.29	20.27	2.44

Table Changes in pH and acidity of Kanjang during fermentation at different temperatures

Temp Days.	20		25		30		35	
	pH	Acidity (%)						
0	8.16	0.013	7.40	0.05				
7	6.30	0.15						
10			4.61	0.42	4.92	0.46	4.75	1.12
13								
18	6.20	0.22						
23			4.87	0.51	4.75	0.51	4.71	1.56
27	4.90	0.31						
37	4.80	0.44	4.81	0.57	5.04	0.55	5.13	0.80
49	4.81	0.45	4.78	0.61	5.15	0.58	5.44	0.77
57	4.86	0.49	4.80	0.69	5.06	0.58	5.79	0.65
70	4.60	0.59	4.97	0.71	5.11	0.64	5.96	0.63

Table Changes of color of Kanjang during fermentation at different temperatures

Table Changes of total nitrogen and soluble protein of Kanjang during fermentation at different temperatures

Sample Day	20		25		30		35	
	T.N. (%)	Soluble protein(%)	T.N. (%)	Soluble protein(%)	T.N. (%)	Soluble protein(%)	T.N. (%)	Soluble protein(%)
0	-	-	0.00	-	0.00	-	0.00	-
7	0.06	0.19						
10			0.36	0.71	0.22	1.43	0.23	1.89
13								
18	0.13	0.39	0.37	0.93	0.27	1.47	0.24	2.39
23								
27	0.22	0.53	0.38	1.36	0.37	2.21	0.24	2.77
37	0.27	0.73	0.27	2.15	0.35	2.96	0.22	2.49
49	0.31	0.76	0.36	1.90	0.36	3.09	0.24	3.45
57	0.32	1.09	0.29	2.82	0.28	1.97	0.26	2.95
70	0.33	1.04						

Table Changes in total free sugar of Kanjang during fermentation at different temperatures

Temp. Days.	20	25	30	35
0	-	-	-	0.21
7	0.29			
10		0.33	0.43	0.27
13				
18	0.44	0.40	0.45	0.26
23				
27	0.37	0.43	0.43	0.35
37	0.36	0.44	0.41	0.42
49	0.26	0.53	0.40	0.33
57	0.42	0.57	0.36	0.28
70	0.27			

Table Changes of moisture, NaCl and extract of Kanjang during fermentation at different 18% NaCl solution volume

Sample Days	2l			3l			4l			6l		
	M.O	NaCl	Ext.									
0	81.97	17.42	0.61	81.82	17.85	0.33	81.90	17.96	0.14	84.23	12.24	3.53
10	76.22	17.53	6.25	76.84	18.18	4.98	78.61	18.28	3.11	84.66	12.29	3.05
20	74.48	17.75	7.77	75.21	18.18	6.61	77.42	18.39	4.19	83.86	14.85	1.29
30	73.33	18.71	7.96	73.43	19.04	7.17	76.74	18.61	4.65	83.59	11.34	5.07
40	76.20	16.38	7.00	71.37	20.22	8.41	76.24	18.61	5.15	82.64	12.33	5.03
50	73.07	18.62	8.31	70.12	20.33	9.55	75.14	18.82	6.04	82.61	12.42	4.97
60	72.14	18.83	9.03	69.03	21.08	9.89	72.71	19.90	7.39	80.63	12.96	6.41

Table Changes of color of Kanjang during fermentation at different 18% NaCl solution volume

Sample Day	2l				3l				4l				6l			
	L	a	b	E	L	a	b	E	L	a	b	E	L	a	b	E
0	46.9	10.1	28.2	60.7	50.5	14.2	31.6	60.2	49.9	13.9	31.4	60.5	83.5	0.74	7.85	18.2
10	7.85	19.7	- 11.0	94.7	20.6	19.8	10.2	82.2	25.2	18.4	15.3	78.3	58.0	0.52	13.6	44.0
20	8.50	- 0.92	- 12.7	92.2	12.5	22.6	- 0.44	90.1	23.2	19.9	13.1	80.2	57.6	0.11	19.3	46.6
30	8.50	- 5.90	- 11.0	92.2	15.2	20.9	4.09	87.1	21.0	21.8	11.3	82.4	40.8	5.72	21.4	63.1
40	8.46	- 9.09	- 10.1	92.5	17.0	22.8	6.86	86.1	17.0	22.8	6.86	86.1	50.1	3.78	14.9	52.1
50	8.46	- 5.14	- 10.1	92.2	13.2	25.2	1.68	90.1	21.9	23.7	12.7	82.3	39.7	7.95	23.2	65.0
60	8.46	- 9.09	- 10.1	92.5	7.85	25.1	- 9.24	85.8	23.6	25.3	14.7	81.6	39.4	8.83	23.0	65.3

Table Changes of total nitrogen and soluble protein of Kanjang during fermentation at different 18% NaCl solution volume

Sample Day	2l		3l		4l		6l	
	T.N. (%)	Soluble protein(%)	T.N. (%)	Soluble protein(%)	T.N. (%)	Soluble protein(%)	T.N. (%)	Soluble protein(%)
0	0.00	0.19	0.00	0.71	0.00	0.45	0.06	0.20
10	0.47	3.76	0.30	4.83	0.43	4.38	0.13	0.39
20	0.71	4.88	0.61	5.01	0.47	3.78	0.22	0.53
30	1.35	4.76	0.89	5.19	0.53	4.02	0.27	0.73
40	0.83	4.36	0.93	5.12	0.55	5.66	0.31	0.76
50	0.95	5.18	0.92	6.29	0.69	4.88	0.34	1.09
60	1.06	6.24	0.96	6.34	0.75	3.87	0.35	1.04

Table Changes in total free sugar of Kanjang during fermentation at different 18% NaCl solution volume

Sample Days	2l	3l	4l	6l
0	-	-	-	0.21
10	0.62	0.80	0.54	0.27
20	0.99	0.94	0.61	0.26
30	1.02	0.96	0.67	0.35
40	1.01	0.98	0.71	0.42
50	0.98	0.95	0.72	0.33
60	0.99	0.91	0.56	0.28

Table Changes in viable cell count and Yeast & mold count of Kanjang during fermentation at different 18% NaCl solution volume

Sample Days.	2l		3l		4l		6l	
	APC	Y&M	APC	Y&M	APC	Y&M	APC	Y&M
0	8.18	3.04 (6.60)	7.83	3.42 (6.71)	7.18	3.13 (6.69)	4.26	1.54
10	7.46	4.38	7.48	3.98	7.53	3.60	5.90	1.51
20	7.59	2.78	7.46	3.69	7.38	2.95	6.16	1.51(6.1)
30	7.90	2.90	7.12	3.60	7.63	2.93	6.83	5.32
40	8.25	4.20	7.24	2.41	7.59	2.48	6.72	4.47
50	7.81	4.86	7.44	3.42	7.92	3.35	6.63	1.85
60	7.67	6.78	8.18	3.81	8.23	3.54	6.43	1.85

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Time	4		12		32	
	APC	Y & M	APC	Y & M	APC	Y&M
0	7.88	6.67	8.05	6.89	8.06	6.65
10	7.04	4.78	7.18	4.30	7.11	3.82
20	6.74	5.43	6.36	2.23	6.63	2.54
30						
40						
50						
60						

Time	4		12		32	
	pH	Acidity (%)	pH	Acidity (%)	pH	Acidity (%)
0	5.87	0.06	5.86	0.06	6.10	0.05
10	4.67	1.14	4.64	1.17	4.88	0.85
20						
30						
40						
50						
60						

Sample Day	(#14)		(#15)	
	pH	Acidity(%)	pH	Acidity(%)
0	5.97	0.31	6.37	0.16
7	5.81	0.32	6.21	0.25
16	5.75	0.32	6.02	0.35
28	5.09	0.47	5.03	0.49
36	4.74	0.48	4.82	0.60
48	4.61	0.60	4.55	0.71
56	4.78	0.60	4.79	0.75

Sample Day	(#14)				(#15)			
	L	a	b	E	L	a	b	E
0	46.4	6.92	24.6	59.3	73.8	3.16	29.0	39.2
7	49.0	7.04	26.2	57.7	73.8	4.26	33.8	42.9
16	43.1	8.24	24.3	62.4	66.7	5.64	32.8	47.0
28	51.6	10.4	28.7	57.2	54.4	8.54	29.3	54.8
36	52.1	9.25	27.6	56.0	51.4	10.3	28.9	57.4
48	35.2	11.7	21.4	69.2	54.2	10.6	30.2	55.8
56	29.7	10.1	18.9	73.4	44.8	11.2	26.3	62.1

Sample Days	(#14)		(#15)	
	T o t a l nitrogen(%)	S o l u b l e protein(%)	T o t a l Nitrogen(%)	S o l u b l e protein(%)
0	0.00	-	0.00	-
7	0.09	0.18	0.04	0.23
16	0.15	0.33	0.07	0.42
28	0.15	0.49	0.10	0.76
36	0.16	0.77	0.15	0.93
48	0.17	1.01	0.17	1.24
56	0.17	0.89	0.17	1.66

Total sugar

Sample Day	Yeast	Non- Yeast
0	-	-
7	0.20	0.34
16	0.32	0.28
28	0.36	0.30
36	0.57	0.22
48	0.46	0.13
56	0.49	0.07

Sample Days	(#14)		(#15)	
	Aerobic plate count	Yeast & mold count	Aerobic plate count	Yeast & mold count
0	6.48	5.15	4.32	5.22
7	8.02	5.58	6.68	5.15
16	8.05	5.28	6.69	5.36
28	8.32	5.26	6.88	2.96
36	8.27	4.96	6.95	1.00
48	8.36	3.90	6.92	1.00
56	8.41	2.13	7.03	1.46

Table Changes of moisture, NaCl and extract of Kanjang during fermentation at Cheongpoong area

Sample Days	(#14)			(#15)		
	M.O	NaCl(%)	Extract	M.O	NaCl(%)	Extract
0	80.81	18.19	1.00	81.43	17.07	1.50
7	80.00	18.24	1.76	80.99	17.23	1.78
16	80.05	18.24	1.71	80.85	17.29	1.86
28	79.77	18.40	1.83	80.57	17.45	1.98
36	80.07	18.67	1.26	78.79	17.49	3.72
48	80.07	19.04	0.89	79.62	17.66	2.72
56	79.25	19.52	1.50	80.03	17.77	2.20

Table 9. Sensory evaluation data of Kanjang according to yeast and non-yeast inoculation in **13% NaCl** solution by laboratory-trained panel members.

Sample	Yeast	non- Yeast	L.S.D
Color	4.27b	4.73a	0.35
Flavor	4.47a	4.40a	0.33
Taste	4.33a	4.27a	0.74
Overall	4.47a	4.40a	0.61

Table 10. Sensory evaluation data of Kanjang according to yeast and non-yeast inoculation in **15.5% NaCl** solution by laboratory-trained panel members.

Sample	Yeast	non- Yeast	L.S.D
Color	3.87a	4.00a	0.29
Flavor	4.53a	4.53a	0.73
Taste	4.73a	4.13a	0.75
Overall	4.53a	4.53a	0.60

Table 11. Sensory evaluation data of Kanjang according to yeast and non-yeast inoculation in **18% NaCl** solution by laboratory-trained panel members.

Sample	Yeast	non- Yeast	L.S.D
Color	4.27a	3.40b	0.69
Flavor	4.40a	4.20b	0.94
Taste	4.80a	3.60b	0.89
Overall	4.73a	3.67b	0.95

Table 12. Sensory evaluation data of Kanjang according to different NaCl concentration in yeast inoculation by laboratory-trained panel members.

Sample	13%	15.5%	18%	L.S.D
Color	4.40a	4.47a	3.80a	0.79
Flavor	4.13a	4.27a	3.93a	0.75
Taste	4.67a	4.07ab	4.00b	0.64
Overall	4.40a	4.40a	3.93a	0.75

Table 13. Sensory evaluation data of Kanjang according to different NaCl concentration in non-yeast inoculation by laboratory-trained panel members.

Sample	13%	15.5%	18%	L.S.D
Color	4.07ab	4.67a	3.67b	0.80
Flavor	4.13a	4.07a	4.13a	0.64
Taste	3.80a	4.07a	3.93a	0.77
Overall	3.73b	4.53a	4.00ab	0.72

Table 14. Sensory evaluation data of Kanjang according to different volume about 1 Meju in yeast inoculation by laboratory-trained panel members.

Sample	2l	3l	4l	5l	6l	7l	8l	L.S.D
Color	4.13a	2.93d	4.13bc	4.87ab	4.13bc	4.07	3.93c	0.81
Flavor	3.47a	3.73bc	4.07bc	3.60c	3.47c	4.00bc	4.40bc	0.76
Taste	3.87a	3.80bdc	4.27abc	4.60ab	3.87bcd	3.47cd	3.20c	0.84
Overall	3.93a	3.40d	4.20bc	4.40ab	3.93bcd	3.60cd	3.53cd	0.77

Table 15. Sensory evaluation data of Kanjang according to different fermentation temperature by laboratory-trained panel members.

Sample	25	30	35	L.S.D
Color	4.13	4.47	4.93	0.96
Flavor	4.47	4.53	4.73	0.89
Taste	4.27	3.93	4.00	0.79
Overall	4.20	4.20	4.33	0.75

Table 16. Sensory evaluation data of Kanjang during fermentation at Cheongpoong area by laboratory-trained panel members.

Sample	Yeast	non- Yeast	L.S.D
Color	4.67a	3.67	0.69
Flavor	3.67	3.93	0.74
Taste	4.27	4.20	0.80
Overall	4.20	3.93	0.61

DATA

Table . Sensory evaluation data of Kanjang according to different volume about 1 Meju in yeast inoculation by laboratory-trained panel members.

Sample	5l	6l	7l	8l	L.S.D
Color	4.13	4.87	4.07	3.93	0.46
Flavor	3.47	3.60	4.00	4.40	0.71
Taste	3.87	4.60	3.47	3.20	0.78
Overall	3.93	4.40	3.60	3.53	0.59

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