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#### Need for Codex Standardization of Fermented Soybean paste (*Doenjang*)

#### I. Introduction

Fermented soybean paste (*Doenjang*) is pasty fermented seasoning food of yellow or yellowish brown color, which uses soybean as the main ingredient. It has been consumed as is or as ingredient of various foods like stew and soup for 1,400 years. In recent years, fermented soybean paste has been mass produced thanks to its unique taste and functional characteristics. As such, its domestic consumption and global trade amount are gradually increasing.

Fermented soybean paste has a unique taste with a combination of savory taste of amino acid from protein hydrolysis, sweet taste from the saccharification of starch source, sour taste from organic acid, and salty taste from salt. Also, fermented soybean paste is known to have an antioxidative effect by some brown materials produced during fermentation and anti-cancer effect by isoflavons.

Fermented soybean paste distributed in Korea and abroad can be classified according to the raw materials used, microorganisms participating in fermentation, and manufacturing process and is exported to more than 30 countries around the world. The total trade amount of fermented soybean paste in Korea was 2,189 (export : 1,364 tons, import ; 825 tons) as of 2000, showing 220% increase compared with 972 tons (export : 743tons, import : 229) produced in 1990. China and Japan also produce similar products to fermented soybean past in Korea. Thus, if we also include their soybean past products, the international trade amount and countries participating in the trade are expected to dramatically increase.

With the increased international trade of fermented soybean paste, it is necessary to elaborate a worldwide Codex Standard for fair trade practice and consumer protection.

#### II Nutritional characteristics

Fermented soybean paste has different nutritional components depending on the raw material used, microorganisms participating in fermentation, and manufacturing process. The range of the components of fermented soybean paste are generally 45~60% of moisture, 8~14% of crude protein, 6~9% of crude lipid, and 10~14% of carbohydrate. It also contains other components like high content of fiber, minerals and vitamins.

Fermented soybean paste is known to have high digestion ratio because it degrades the macromolecules such as carbohydrates and proteins into free sugar, amino acid and oligopeptides. Unsaturated fatty acids, organic acids, peptides, brown materials and isoflavons in the paste also prevent aging skin, cancer and hypertension.

The Combination of the savory taste of amino acid from protein hydrolysis, sweet taste from the saccharification of carbohydrates, sour taste from organic acids, and salty taste from salt results in characteristic taste of fermented soybean paste. As the fermentation process continues, the taste becomes more natural with decreased bitter taste of the amino acid such as valine and leucine and increased savory and sweet taste of the amino acid such as glycine and glutamic acid. Moreover, the alcohol and ester produced during fermentation process results in very unique flavor of the fermented soybean paste.

### III Manufacturing process

Fermented soybean paste can be classified into traditional fermented soybean paste and modern style fermented soybean paste depending on the raw materials used, microorganisms participating in fermentation, and manufacturing process.

For traditional fermented soybean paste, soybean is selected, washed and soaked in the water. It is then boiled, cooled, crushed, formed into certain shapes or block or balls, dried for 2~3 days and fermented with natural microorganisms for more than two months under 30°C to make *Mejoo*. *Mejoo* is placed in salt water (15~25 % wet basis) and fermented and aged for 1~2 months at room temperature. Then, yellow or yellowish brown colored fermented soybean paste is made when only the solid part is taken, salted, and re-fermented. The range of consumer choice increases with traditional fermented soybean paste since it gives different flavor and taste depending on the production conditions and environmental microorganisms (in soybean and air.)

Modern style fermented soybean paste is produced using soybean, starch source like rice and wheat, salt, and starter (*Aspergillus* sp., *Bacillus* sp.). As in traditional method, soybean is selected, washed, soaked in the water, boiled, and cooled. The starch source is separately boiled, cooled, and mixed with starter (*Aspergillus* sp., *Bacillus* sp.), adjusting temperature and humidity for certain period of time. The boiled soybean and starch source with starter are grounded after adding salt, placed in fermentation tank, and fermented for a certain period of time at fixed temperature. Then additives are added into the resulting product depending on the product characteristics, and the product is packaged with or without sterilization. After these processes, fermented soybean paste can be produced in mass with uniform flavor and taste; thus its production and consumption are steadily increasing.

### IV Packaging

Fermented soybean paste could discolor during distribution since it contains abundant sugars, amino acids, phenolic compounds, and carbonyl compounds. Thus, caution is needed in selecting the packaging materials.

For retail packaging, fermented soybean paste is packaged in small containers of PP, PP/EVOH/PP, glass and porcelain. In most cases, net weight ranges from 200g to 3kg. For wholesale packaging, fermented soybean paste is packaged in PE film, then placed in a tin can or PP. In most cases, net weight ranges from 7kg to 17kg.

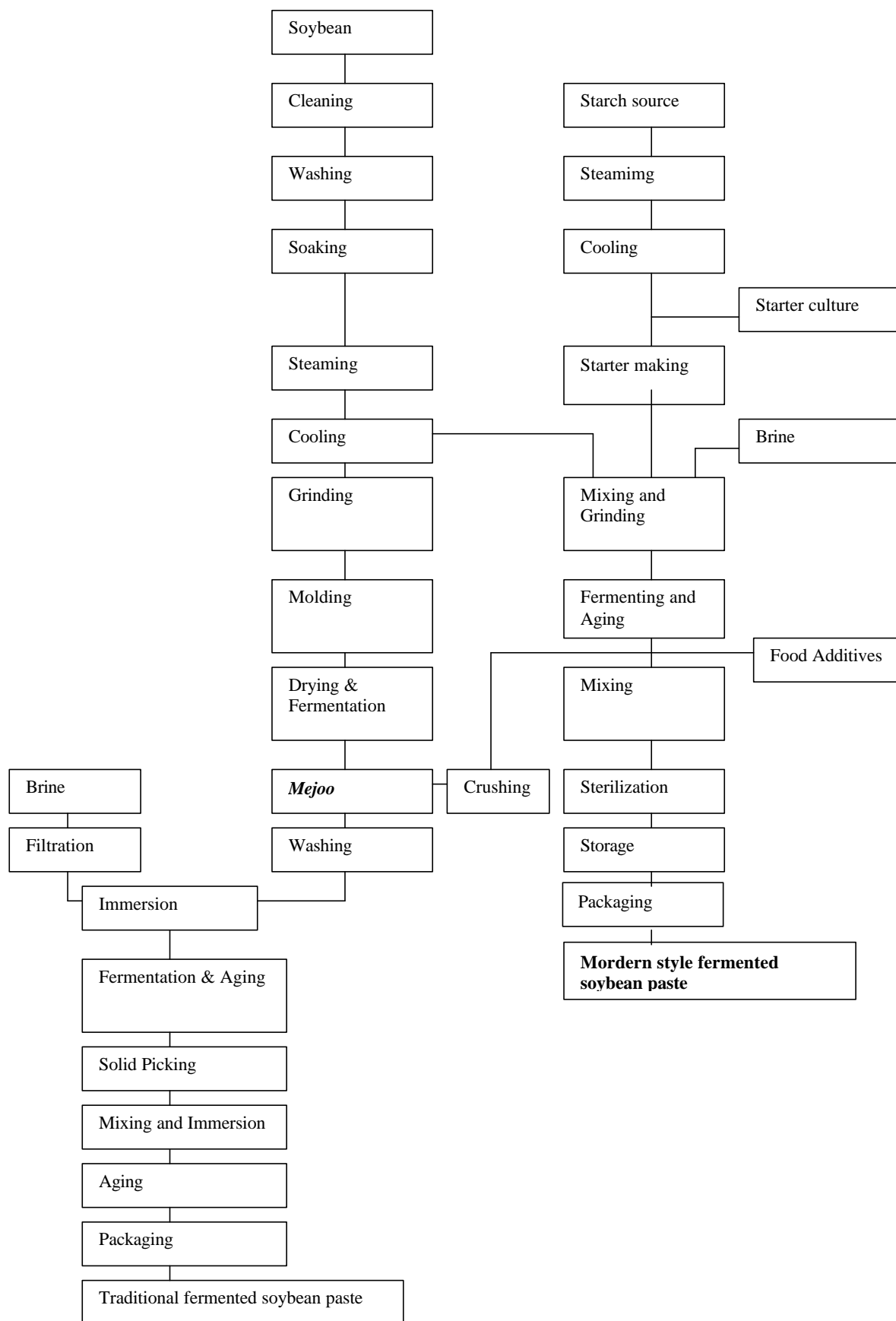
Fermented soybean paste is generally distributed at room temperature, but it is recommended to be distributed below 10°C for shelf life extension.

### V. Trade

The amount of import-export of fermented soybean paste, currently 4,230 tons, is about 10% of the amount mass produced and consumed in Korea. Korea exported and imported fermented soybean paste to more than 30 countries, including the U.S. A., Japan, and China (Table 1).

According to trading statistics, the amount exported was 1,726 tons in 2001, which increased by 130% compared with 1990, and the amount imported was 1,055 tons in 2001, which increased by 360% compared with 1990. Further, international trade amount and countries are expected to increase dramatically if we include the trade amount and countries of similar products from Japan and China.

As stated above, global trade scale of fermented soybean paste has reached significant levels. Nevertheless different standards are applied by each nation. Thus, it is necessary to elaborate a Codex standard based on international consensus for fair trade practices.



**Fig. 1. Typical Production Flowchart for Fermented Soybean Paste (*Doenjang*)**

**Table 1: Trade Status of Major Export-Import Countries of Fermented Soybean Paste (*Doenjang*) in Korea** (Unit: Kg, US\$)

Country		1990		1995		2000		2001	
		Volume	Amount	Volume	Amount	Volume	Amount	Volume	Amount
Export	Australia	6 200	7 407	19 070	34 083	3 623	12 616	11 038	37 282
	Belgium	4 734	3 724			8 080	6 950	12 996	11 101
	Canada	1 645	2 511	6 276	10 990	20 722	27 908	77 517	108 826
	Spain	8 590	11 712	3 869	6 609	13 336	14 968	3 512	4 198
	Guam	7 249	9 971	9 901	47 308	20 570	59 128	14 451	42 260
	Hong Kong	16 361	4 378	3 155	4 730	15 520	7 007	18 123	26 697
	Indonesia	5 720	5 331	590	1 023	38 268	62 016	11 2911	15 075
	Japan	9 008	23 515	48 737	231 341	99 003	199 210	108 917	137 482
	Kenya					9 638	12 936		
	Libya	25 290	19 078	5 420	18 726	8 010	6 854	37 494	49 879
	Malaysia			10 769	17 159	890	1 316		
	Mexico					1 300	1 425		
	Netherlands	22 209	41 181	2 140	2 897			20 662	23 538
	N. Zealand	4 478	12 275	16 140	40 831	2 098	7 654	3 697	2 290
	PR. China					50 403	70 366	103 135	225 544
	Russia			32 928	63 387	13 464	14 310	55 225	53 340
	Saudi Arabia	24 690	16 645	3 700	4 441				
	Singapore	28 956	22 516	10 433	18 109	11 057	15 765		
	Sri Lanka			5 946	16 543	522	1 481	4 806	11 009
	Taiwan							1 400	2 071
	Turkey					6 000	8 322		
	U.A.E.	15 491	21 675						
	U.S.A.	382 645	472 916	516 049	803 203	984 109	1 585 579	1 202 727	1 690 463

Country		1990		1995		2000		2001	
		Volume	Amount	Volume	Amount	Volume	Amount	Volume	Amount
Export	Spain	68 436	91 369	25 864	119 573	2 120	2 467	3 680	1 616
	U.K.					4 720	9 435	1 800	1 457
	Kazak.					11 414	18 251	13 702	19 598
	Vietnam			8 003	15 078				
	India					722	2 103		
	Italy			1 840	2 461	10 000	10 256		
	Ivory Coast					3 150	6 008		
	Qatar					1 091	1 591		
	Surinam			2 382	2 860	16 500	48 603		
	Microne							1 200	13 400
	Georgia							5 738	6 119
	Mongolia							4 787	4 120
	Others	111 606	185 225	169 745	434 847	8 480	24 142	9 559	17 074
	Sub-total	743 308	951 129	903 357	1 896 189	1 364 810	2 238 667	1 726 077	2 504 439
Import	Hong Kong			180	1 683				
	Japan	229 822	320 508	294 739	631 237	607 379	899 808	722 477	952 763
	PR.. China					216 190	81 751	321 609	109 993
	U.S.A.					1 635	3 207		
	Others					105	324	11 075	3 569
Sub-total		229 822	320 508	294 919	632 920	825 309	985 090	1 055 161	1 066 0325
Total		973.130	1 271 637	1 198 276	2 529 109	2 190 119	3 223 757	2 781 238	3 570 764

Source : from the Statistical Yearbook of Foerign Trade, Korea Customs Service, 2001

## **Need for Standardization of *Gochujang* (fermented hot pepper soybean paste)**

### **I. Introduction**

*Gochujang* (fermented hot pepper soybean paste) is a red colored fermented seasoning food made with red pepper powder, soybean, starch source and *mejoo* (mixture of rice and soybean at certain ratio after boiling, forming, fermenting and drying) as main ingredients. It has been consumed as it is or as ingredient of various foods. *Gochujang* has a unique flavor and taste produced during fermentation process. And its flavor and texture are different depending on the raw materials used, microorganisms participating in fermentation, and manufacturing process.

*Gochujang* is a traditional food which became popular throughout the nation since 17<sup>th</sup> century. With the mass production of *Gochujang* by the industrialization, not only its consumption in Korea but also the global trade is increasing. *Gochujang* produced in Korea is exported to more than 35 countries around the world including the U.S. A., Japan, and Australia, Canada, and China. The total trade amount of *Gochujang* in Korea was 4,215 tons (export : 3,811 tons, import : 404 tons) as of 2000, showing a 210% increase compared with 1,946 tons (export : 3,811 tons, import : 404 tons) produced in 1990.

With the increased global trade of *Gochujang* it is necessary to elaborate a Codex international standard for fair trade practices.

### **II. Nutritional characteristics**

*Guchujang* is a fermented seasoning food made with red pepper powder, starch source (rice, glutinous rice), enzyme source and salt. *Guchujang* has a hot taste from red pepper, sweet taste from starch source, and savory taste from protein, so it not only gives abundant flavor in food but also naturally stimulates the appetite by its taste and color.

*Gochujang* shows its characteristic flavor during the fermentation process according to the action of enzymes produced by microorganisms, in which abundant sugars such as glucose, fructose, and rhamnose from carbohydrates, amino acids including glutamic acid, proline, leucine, and aspartic acid from proteins, and organic acids newly produced such as succinic acid, citric acid, and lactic acid form harmonious taste with hot taste from red pepper powder and salty taste from salt. In addition ethanol, acetic acid-ethyl ester, butanoic acid-ethyl ester, 1-butanol, 2-methy-1-propanol, and 3-methyl-1-butanol produced during the fermentation process. Which result from the action of yeast or lactic acid bacteria also give unique flavor to *Gochujang*.

### **III. Manufacturing process**

*Guchujang* can be classified into traditional *Gochujang* and modern style *Gochujang* depending on the raw materials used, microorganisms participating in fermentation, and manufacturing process (Figure 1).

Traditional *Guchujang* is made with red pepper powder, glutinous rice, and *mejoo* powder. After the starch source (glutinous rice) is soaked and boiled, it is saccharified with enzyme source. The red pasty *Gochujang* is made by mixing this saccharified sticky rice and already prepared red pepper powder, *mejoo* powder, and salt, then it undergoes a fermenting and aging process for a certain period of time at room temperature.

Modern style *Gochujang* is made with red pepper powder, starch source (wheat, glutinous rice) using selected strain. Starch source is prepared by soaking, boiling and cooling. Wheat flour is boiled and cooled, separately. And, the selected strain (*Aspergillus* sp.) is placed into this wheat flour and fermented under controlled temperature and humidity for a certain period of time to make the starter. Wheat flour, prepared starch source, and salt are mixed, ground, fermented and aged for a certain period of time. Then, the mixture is mixed with red pepper powder, starch syrup, and other additives, heat treated, and packaged.

Traditional *Gochujang* is mainly made by complex fermentation of various microorganisms in the air and saccharification of grain starch, whereas modern style *Gochujang* is made by simple fermentation of single strain (*Aspergillus* sp.) and starch syrup instead of grain starch. Thus, these two differ in quality, taste, flavor, and texture.

#### IV. Packaging

*Gochujang* could discolor by oxidation during distribution. Thus, caution is needed in selecting the packaging materials.

For retail packaging, *Gochujang* is packaged in small containers of PP, PP/EVOH/PP, glass, procelin. In most cases, net weight ranges from 2000g to 3 kg. For wholesale packaging, *Gochujang* is packaged in PE film, then placed in a tin can or PP. In most cases, net weight ranges from 7kg to 20 kg.

*Gochujang* is generally distributed at room temperature, but it is recommended to be distributed below 10°C for shelf life extension.

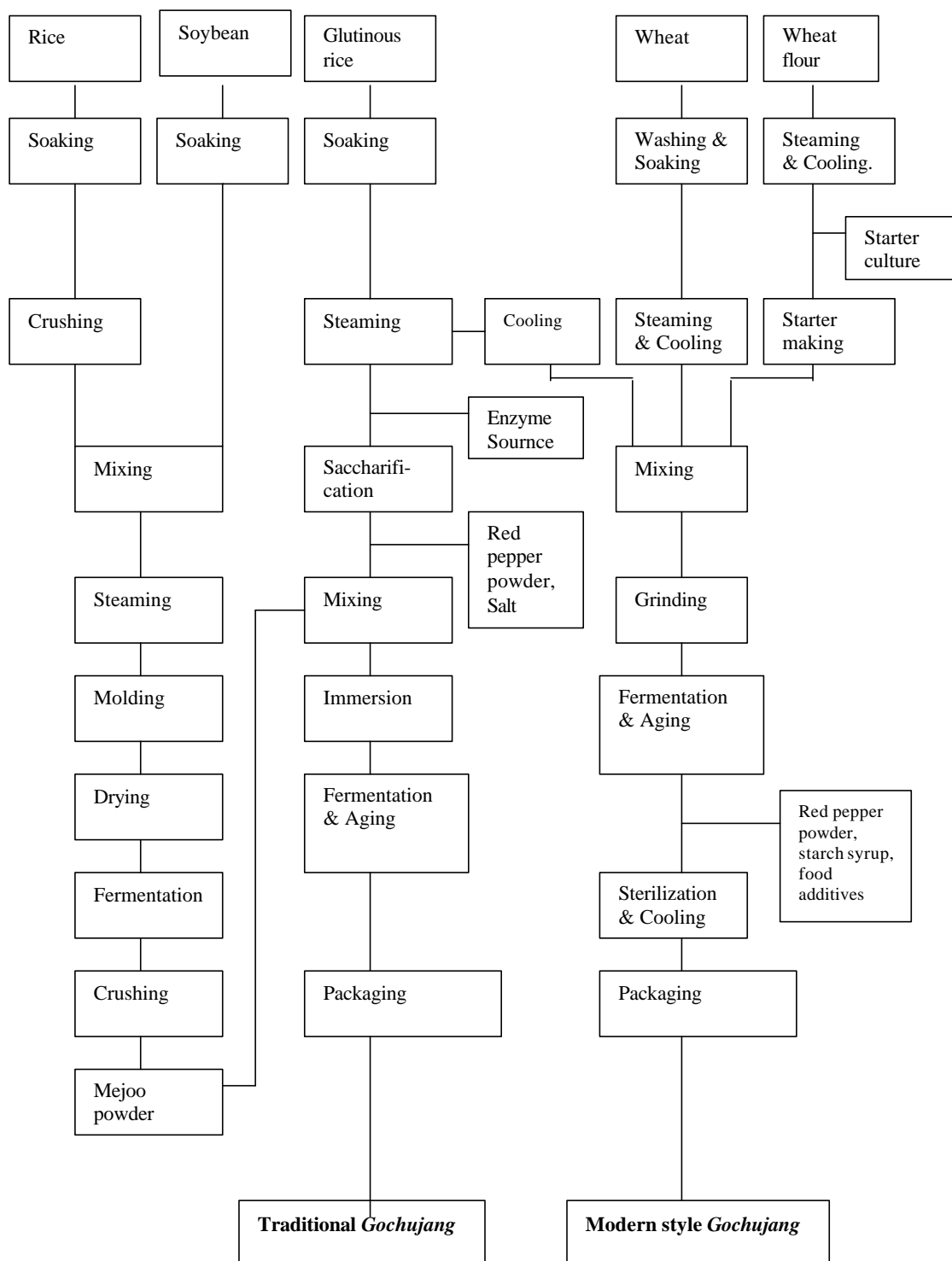
#### V. Trade

A total of approximately 90,000 tons of *Gochujang* were produced in Korea as of 2000 among which 4,215 tons, which is about 5 percent of the total production amount, were exported to more than 35 countries including the U.S.A., Japan, Australia, Canada, and China.

The total trade amount of *Gochujang* has increased annually, and showed 210 % increase (export: 3,811 tons, import: 404 tons) in 2000 compared with the amount (export : 1,422 tons, import : 524 tons) in 1990 (Table 1). Major countries involved in trade of *Gochujang* are Japan, China, Australia, Canada, and the U.S.A.

With characteristic flavor and taste of *Gochujang*, global trade nations and scale are steadily rising. Although consumer demand and global trade scale of *Gochujang* have risen to a significant level, an international standard suitable for this project has not been established yet. Therefore, it is necessary to elaborate a Codex standard based on international consensus for fair trade practices.





**Fig. 1. Typical Production Flowchart for *Gochujang***

**Table 1. Trade Status of Major Export-Import Countries of Gochujang in Korea**  
(Unit Kg,US\$)

Country		1990		1995		2000		2001	
		Volume	Amount	Volume	Amount	Volume	Amount	Volume	Amount
Export	Argentina			5 708	13 058	26 735	93 610	1 342	4 451
	Australia	35 270	78 617	63 175	137 145	141 701	304 789	69 735	113 275
	Belgium	1 350	1 437	985	1 235	12 223	24 968	15 195	29 662
	Brazil			15 295	31 627	19 610	59 676	11 486	35 629
	Canada	17 920	28 304	36 263	61 778	123 135	202 371	136 875	185 996
	Egypt	960	1 641	560	1 103	18 215	32 939		
	France					1 560	3 388	3 330	5 720
	Germany	20 115	44 471	19 485	47 918	43 983	67 384	75 178	124 380
	Guam	13 716	22 888	26 061	97 914	11 439	18 828	21 660	79 778
	Hong Kong	12 168	33 666	3 046	7 145	5 350	7 621	20736	72 356
	Indonesia	22 848	36 178	32 241	104 299			2 322	3 296
	Japan	37 111	89 567	176 534	614854	816 004	1 977 617	1 136 286	2 307 457
	Kuwait	10 283	17 278					24 433	35 965
	Libya	62 002	91 998	42 012	83 338	9 504	11 321	11 520	14 853
	Malaysia			36 999	59 662	39 619	66 498	59 133	77 413
	Mexico					1300	2 894		
	Morocco			2 160	2 450	5 870	56 172	4 776	44 550
	Netherlands	7 250	14 375	12 575	31 984	1 524	1 926	18 453	31 499
	N. Zealand	810	2 387	10 617	20 838	27 486	60 574	26 008	64 753
	P.R. China					115 329	333 091	227 674	603 388
	Russia			25 770	78 335	30 504	96 958	25 920	41 253
	South Africa			11 435	18 643				
	Saudi Arabia	41 358	41 249	16 793	36 502	2 250	4 116	2 475	3 705

Country		1990		1995		2000		2001	
		Volume	Amount	Volume	Amount	Volume	Amount	Volume	Amount
Export	Singapore	68 558	84 610	38 030	90 640	72 771	121 607	30 657	65 693
	Spain	74 760	69 246	57 038	95 569	14 994	56 281	1 820	1 386
	Sri Lanka					1 238	8 189		
	Taiwan					20 048	39 635	8 683	11 932
	U.A.E.	8 048	15 624			14 410	26 568	32 187	62 682
	U.K.	980	2 621			11 471	25 195	24 020	44 354
	U.S.A	871 706	1 532 623	1 231 817	2 223 018	2 033 436	3 330 237	2 258 868	3 239 814
	Uzbek							13 777	15 515
	Vietnam			1 518	4 584				
	Eritrea					27 900	90 390		
	Fiji			1 410	3 899	900	1 368	458	1 049
	Gabon	393	1 103	10 260	45 992	7 640	20 823		
	Ghana	486	1 076	8 330	40 861	1 400	5 613	4 420	6 170
	Guinea					14 630	26 289		
	Italy			4 000	9 576	6 680	17 335		
	Jordan					927	4 211		
	Kazak					61 920	829 244		
	Mongolia			3 513	9 510	2 100	4 530	4 422	6 950
	Norway					4 037	12 303		
	Philippines					36 423	99 125	2 390	2 345
	Surinam			3 414	6 216	6 395	11 000		
	Others	114 437	205 813	134 085	361 276	18 975	71 206	28 972	53 422
	Sub-total	1 422 799	2 416 782	2 031 219	4 340 969	3 811 636	8 227 890	4 305 210	7 390 691
Import	PR. China			201 450	241 720	404 408	413 193	36 080	23 035
	Japan			708	6 388			400	2 162
	Hong Kong	524 750	399 346	2 404	8 772				
	Others					319	899	1 600	7 990
	Sub-total	524 750	399 346	204 562	256 880	404 727	414 092	38 080	33 187
Total		1 947 549	2 816 128	2 235 781	4 597 849	4 216 363	8 641 982	4 343 290	7 423 878

Source : from the Statistical Yearbook of Foreign Trade, Korea Customs Service, 2001