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Innovative Egg Products and Future Trends in Korea

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한국의 계란 가공제품 개발 동향

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적 요

한국의 계란 생산량은 1990년도에 39만 3천톤에 달하였으며 연간 1만톤 이상이 수입되었다. 이러한 수입량은 해마다 늘어가는 추세이다. 국내 계란 소비는 가정용 계란이 차지하는 비중이 높아 가공식품의 비중이 증가하는 소비경향에도 불구하고 향후 추가 수요를 기대하기는 어려울 것으로 전망된다.

한국에서의 계란 가공제품은 크게 두가지로 나눌 수 있는데 그 중 하나는 액란과 난분 등 1차 가공품이며 또 다른 하나는 계란 후레이크, 계란 두부 등과 같이 보다 가공된 2차 가공품이 그것이다. 이상의 난가공제품 이외에도 특정 영양소 등이 강화된 특수란이 사료의 배합과 사양기술의 개발을 통하여 생산되고 있다.

본고에서는 그 밖에도 계란과 관련하여 현재까지 공고된 한국 특허를 정리 소개하였다. 앞으로는 영양소를 조절한 계란을 비롯하여 계란을 이용한 편이식품이 점차 일반화 될 것으로 전망된다. 특히 저콜레스테롤 계란과 다중불포화지방산이 강화된 계란이 소비자의 요구에 부응하기 위하여 생산될 것이다. 그러나 보다 당면한 문제는 계란의 품질등급제의 도입과 세척란의 저장성 향상 등과 같이 일반 계란의 유통과 관련된 점들일 것으로 사료된다.

(중심어 : 한국, 영양소 강화계란, 특수란, 난가공제품, 가공란)

INTRODUCTION

Since 1981, the amount of egg production has been increased consistently and egg production in 1990 was 393 thousand M/T in Korea. Per capita consumption was 168 eggs, 9.2kg(Table 1).

Egg consumption shows an increasing tendency as well as production, so egg production in Korea has great future. In 1990, more than 10 thousand M/T eggs were imported from other countries and the amount imported has increased every year. There are three egg processing industries which have a 90 M/T production capacity per day but they produce only about 30 M/T eggs per day until 1988. From 1989 the efficiency of operation of egg processing industry was improved to over 60% as

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Table 1. Production and per capita consumption of egg by year

Year	Production		per capita Consumption	
	M/T	Million eggs	Gram	Eggs
1981	253,000	4,431	6,270	114
1982	257,960	4,505	6,325	115
1983	283,565	4,939	6,795	124
1984	283,194	4,936	6,695	122
1985	309,302	5,390	7,200	131
1986	332,000	6,029	7,977	145
1987	361,539	6,573	8,590	156
1988	397,124	7,220	9,460	173
1989	380,543	6,919	8,919	163
1990	393,305	7,151	9,191	168

Ref. : National Livestock Cooperatives Federation(1991)

Table 2. Production and capacity of processed egg*

Year	Production Capacity(M/T)	Production(M/T)
1985	1,080	167
1986	3,625	1,838
1987	14,451	2,698
1988	15,070	5,259
1989	84,920	58,834
1990	86,277	55,092

* Liquid egg including egg power

Ref. : Ministry of Health and Social Welfare(1985~1990)

Table 3. Change of monthly egg prices during the year

(unit : won/10eggs)

Prices	Monthly prices in 1990												Avg.
	1	2	3	4	5	6	7	8	9	10	11	12	
A	564	553	596	634	660	567	464	461	657	645	559	561	577
B	610	590	628	675	708	636	513	528	707	703	610	602	626
C	650	654	672	698	737	703	674	647	709	763	717	715	695
A/C	.87	.85	.89	.91	.90	.81	.69	.71	.93	.85	.78	.78	.80
B/C	.94	.90	.93	.97	.96	.90	.76	.82	1.0	.92	.85	.84	.90

A : Farmer's price

B : Wholesaler's price

C : Consumer's price

shown in Table 2. Monthly egg prices in Korea fluctuated severely during the year because the production of processed eggs is too small to create a buffer(Table 3). Confectionery products have changed from the usual hard biscuits to the soft cookies recently; as a

results, the egg content of the products has increased from 3~5 to 7~10%.

The meat and fishery industry are increasing the production of imitated crab meat every year. Bakery industries consume more than 50 M/T egg products per day, and this demand is expected to be increased by 20~30% compared with present consumption in the near future (Yoo, 1990). However, domestic egg consumption mainly depends upon table eggs. Considering the tendency to increased demand for processed food, creation of additional demand for eggs is not anticipated. Therefore, to promote egg consumption could include production of eggs retaining biological function, egg products from liquid egg which could be raw materials for convenient food or intermediate materials.

In this symposium, I would like to review the current status of the Korean egg market, new egg products and technology and Korean patents registered including those applied for in the last decade.

EGG PRODUCTS AND PROCESSING EQUIPMENT

1. Table Eggs Fortified with Special Components

Recently, several new kinds of table eggs have been marketed in Korea. Eggs fortified with micro components such as minerals and vitamins are popular. Ginseng, known as healthy food, is used to improve the quality of egg. Attempts to modify fatty acid composition were successful. Several specially fortified eggs have been marketed, as follows.

1) Nutrition eggs(produced by Purina Korea Co.). These eggs contain at least 20% more vitamin D, E, B_{12} than ordinary eggs. Guaranteed duration for sale is 3 days which is decided by the producer for the purpose of quality control.

2) Vita-iodine eggs(produced by Mannawon Farm). These eggs contain more than 7 mg% vitamin E and 1.3 mg% iodine. According to the producer, or dinary eggs contain no iodine and 1 mg% vitamin E.

3) Omega eggs(produced by Mannawon Farm). Omega eggs are fortified with ω3 fatty acids. The ω3:ω6 fatty acid ratio is modified to conform with requirements for good health. Omega eggs are produced by hens consuming the specially formulated feed containing high level of ω3 fatty acids. While eggs produced by hens on ordinary feed contain 0.33% ω3 fatty acids, eggs produced by hens on specially formulated feed contain 2.30% ω3 fatty acids which is around 7 times higher than that. With regard to the ω6:ω3 ratio, the omega egg was 5:1 which is close to the ideal ratio for health, while ordinary eggs were 39.8:1. 6.5:1 which is close to the ideal ratio for health, while ordinary eggs were 39.8:1.

4) Iodine eggs(produced by Dongwha Livestock Co.).

More than 0.3 mg of iodine is contained in each lodine egg. According to the producer, active iodine which is contained in the iodine egg is easily digested and effectively absorbed. The iodine content is at least 20 times higher than ordinary eggs.

5) Ginseng eggs(produced by Mannawon Farm).

Korean ginseng by-products from ginseng extract processing plant is used to produce Ginseng eggs. Consumers believe ginseng eggs contain saponin, which is the effective component of Korean ginseng.

6) The others

Ginseng-herb egg which is produced by

feedixng ginseng leaves and medical herbs.

2. Egg Products from Liquid Egg

Liquid egg including egg powder and frozen egg could be used widely by the food industry. The confectionery and bakery industries are the main consumers for liquid eggs. But aside from the confectionery and bakery industries, other uses exist for egg products. Egg flake, dried egg sheet, egg curd and rolled egg sheet were developed several years ago. However, only egg flake and dried egg sheet are marketed today. The main uses of egg flake and egg sheet are as follows.

1) Egg flake

Egg flake is mainly used in instant noodles. The main component is egg yolk. It is also used in frozen fish paste(Kim and Yoo, 1990). Egg flake can be produced by two drying methods. One is hot air blast drying at 55~90℃. The other is extrusion technology.

2) Dried egg sheet

Dried and strip type egg sheet is often to used in cooked noodle and the other dishes. It is similar to egg flake(Kim and Yoo, 1990), but the process for producing egg sheet is slightly different. Extrusion technology could be used to produce the egg sheet. If we have specially designed nozzle attached stuffer, we could use it as a alternative of extrusion.

3) The others

Egg curd and rolled egg sheet were marketed but they are no longer produced because of short shelf-life and incomplete cold chain systems. Jerky type egg products was developed by Lee et al.(1988), but it is not yet marketed yet. The main component of jerky type egg product is egg yolk, starch and fish paste.

3. Processed Shell Egg

Injection of pickles into the egg through the egg shell pores under pressure was attempted in order to produce a seasoned shell egg(Lee and Park, 1989; Lee, 1989). Conventionally seasoned shell eggs were produced by soaking the eggs in pickle solution for a relatively long period. But using high pressure, the processing time to produce seasoned shell eggs was reduced. Alkaline gelled and fermented eggs are now produced using hens' eggs. It was previously manufactured using duck eggs.

1) Seasoned shell egg

The main composition of curing solution is 30% salt, 20% soy sauce and the additives including spices. The process takes place at 50~120℃, 3 kg/cm^2. Seasoned shell eggs are maintained for 4 weeks by coating the shell with oil after the cooking process(Fig. 1).

2) Alkaline fermented egg

Egg albumen tends gel in alkaline conditions. Traditionally duck eggs were used to make alkaline fermented eggs using limestone, tea leaves and other coating materials at ambient temperature. But such a method requires a long time to complete the fermentation and gelation. Now several alkaline media such as calcium hydroxide, calcium oxide etc. are used to shorten the process, combined with high temperature. Hens eggs are now commonly used to make alkaline fermented eggs.

4. Other Processed Eggs

In Korea, people have accepted the vinegar pickled eggs for many years, but they were manufactured by beverage companies and sold

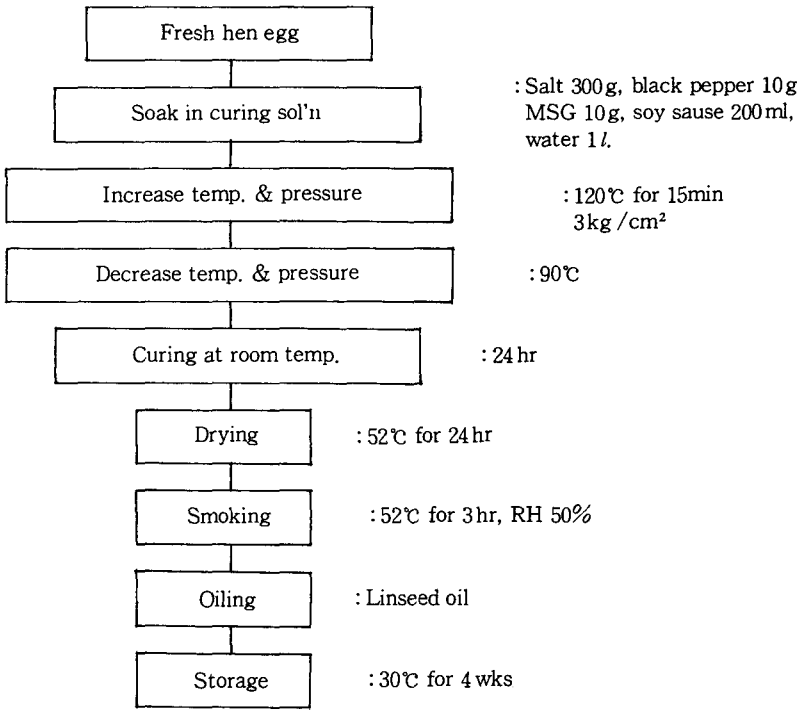

Fig. 1. Flow sheet of seasoned shell-eggs processing

in small bottles. Quail eggs are marketed in this way but peeling the quail egg is tedious work. Therefore, the peeled cooked quail egg product with brine is produced by the industry.

1) Vinegar pickled eggs

5~6 days after immersing shell eggs in vinegar, the egg shell disappears. But the product tastes somewhat sour. Therefore, one of the beverage companies improved the quality, and produced a commercial product.

2) Pickled quail eggs

Cooked and peeled quail eggs with brine were marketed after sterilization, packed in a retort pouch.

5. Cooked Egg Equipments

Cooked egg vending machines and fried egg cooking devices are developed and introduced recently.

1) Cooked egg vending machines

A microwave oven is incorporated in the vending machine, which will cook the egg in only 20 seconds. When the cooked egg is served from the machine, it is presented along with seasoned salt and a disposable spoon.

2) Egg cooking devices

The device is designed to cook two fried eggs at the same time in a microwave oven. It is made of plastic materials. The Korean Poultry Association developed the devices to promote egg consumption.

QUALITY IMPROVEMENT TECHNOLOGY

The main functional properties of eggs are co-

agulation, foaming and emulsification. These functions are always very important in the manufacturing process of egg products. Attempts to improve the functional properties of eggs during the last decade in Korea are introduced here.

1) Frozen egg

The best way to preserve the egg for long periods while retaining quality is frozen storage. The problem when whole egg and egg yolk is frozen is the gelation which detracts from the functional properties. Kim et al.(1989) suggested 5% NaCl added to egg yolk instead of 10% NaCl would prevent the gelation of egg yolk at −8℃. They suggested storage at −8℃ could save energy when users do not want to keep the products more than 6 months. Trials to depress the freezing point by using cryoprotectants were attempted by Lee and Lee(1988). They stored egg yolk and whole egg at −15℃ in the unfrozen state by adding 45.2% and 70.3% cryoprotectants(45% fructose and 55% glucose), respectively. They also found that treating liquid egg with 0.15% papain could inhibit gelation during storage to some extent.

2) Egg powder

Kim et al.(1980) found that as pH of egg was increased before drying, the functional properties such as whippability and emulsion capacity were improved.

3) Retorted whole egg

Prevention of the green-grey discoloration of retorted liquid whole eggs was accomplished by the addition of about 0.015% of Na_2EDTA. Palatability of retorted eggs was not affected by the addition of 0.02% Na_2EDTA(Song et al., 1984).

4) Mayonnaise

The minimum amount of egg yolk to prepare mayonnaise was found to be 6.5%(Cha et al., 1988). Kim et al.(1990) investigated changes in functional properties of salted egg yolks as affected by amount of egg white contaminated to egg yolk.

5) Lysozyme separation

Egg white lysozyme separation was attempted by several researchers(Yoo et al., 1989c; Lee et al., 1989; Park et al., 1990) and lysozyme activity and stability at different pH and temperature conditions were investigated(Lee et al., 1990).

6) Lysozyme as a preservative

Effect of lysozyme and sodium ultraphosphate on the lysis of *Lactobacillus plantarum* was investigated in MRS broth and 0.06M phosphate buffer(pH 6.3) at 32℃ by Lee et al.(1991b). Lysozyme and sodium ultraphosphate have synergistic effects on the growth inhibition and lysis of *L. plantarum*. Lee et al.(1992) found that the growth of *L. plantarum* could be almost completely inhibited in 120 ppm lysozyme with at least 0.8 mM EDTA. Kim et al.(1991) reported the addition of 100 ppm of lysozyme and 0.2% of sodium ultraphosphate was no different from 1.5% κ-sorbate when used to extend the shelf-life of pressed ham. In the Vienna sausage preservation, lysozyme and ultraphosphate addition was effective in extending shelf-life(Lee et al., 1991a).

7) Heat coagulation of egg albumen

Yoo et al.(1990a) reported heat-set albumen gel showed the maximum hardness at pH 4.5~5.0 and pH 9.0 Yoo et al.(1990b) found that hardness of albumen gels was decreased by the addition of over 2.5% sucrose. Yoo et al.(1990c) reported that the initial heat denaturation temperature of egg albumen was increased by 11℃ by acetylation, by 12.5℃ by maleylation and 5℃ by succinylation.

8) Heat sensitivity of egg albumen

Yoo(1988) studied the effect of heating time and temperature, pH and NaCl concentration on heat sensitivity of egg albumen during heat treatment in terms of turbidity and whippability. In order to reduce heat sensitivity of egg albumen, effects of metal ions were investigated on it's functional properties(Yoo et al., 1989a). Yoo et al.(1989b) studied the effect of egg albumen concentration and addition of sugars on the functional properties of egg albumen before and after heat treatment.

KOREAN EGG PATENT

Title & Patent No. : Manufacturing Method for Aseptic Shell Eggs, Korean Patent 89-4363 (Lee and Kim, 1989). Principle & Purpose : Manufacturing method for seasoned shell egg by penetration seasoning into the shell egg through shell pore under pressure and smoking and coating processes. Procedure : there are two ways to manufacture aseptic seasoned shell egg. One is heating followed by seasoning method and the other, seasoning followed by heating method. The latter method is as follows; washing(20℃) → pickling(pH 4~6) → retaining(positioning reversely) → equilibrium (50~60℃, 15~20 min) → lst seasoning(60℃, 15~60 min, 1.5~3.0 kg/cm²) → 2nd seasoning (60℃, 12~36 hr, 1 atm) → lst heating(100℃, 5 min) → 2nd heating(60℃, 15~20 min) → dipping(15~20 min in water) → drying(30℃, 20 min, 40℃, 20 min and 50~60℃, 2~3 hr) → smoking(50~60℃, 2~4 hr, RH 65~75%) → coating(spraying linseed oil or mineral oil).

1) Title & Patent No : Semi-cooking Method of Eggs, Korean Patent 177(Sim, 1968). Principle & Purpose : Manufacturing semi-cooking egg good for eating without egg shell damage after cooking procedure. Procedure : In order not to flow out egg contents coagulate partially, dipping 50℃ water for 5 min to harden the shell membrane. And then, dipping in 70~72℃ water for 10 min again.

Title & Patent No. : Manufacturing Method for Fermented Egg, Korean Patent 79-1(Ueda, 1979). Principle & Purpose : Dipping in alkali solution not only to shorten the coagulating period but also to accelerate manufacturing the fermented and uniform colored egg. Procedure : When the white of shell eggs are coagulated after dipping in 24~45℃ alkali solution for about 15 days, avian shell eggs are taken out from the solution and heated up to at 58℃ environment for 10 min-2 hr.

Title & Patent No. : Processing Method for Nutrient Fortified Beverage of Egg and Soybean Milk, Korean Patent 82-1701(Seo, 1982). Principle & Purpose : To eliminated the flavor of soybean milk or to restrain the action of lipoxygenase which causes fish-like smell, soybeans are peeled, ground through 30~40 mesh, heated with rotary toaster and then extracted soybean protein after 50~100℃ water dipping. Procedure : Mixing coagulate-separated soybean milk from 0.05~0.5 wt% alginate and coagulated egg → stirring the mixture for 20~30 min with peptizer → homogenizing at 80℃, 100~250 kg/cm² → UHT pasteurization (121℃, for 30 min, 1 kg/cm²)

Title & Patent No. : Processing Method of Eggs, Korean Patent 72-161(Kang, 1972). Principle & Purpose : Manufacturing jelly type fermented shell eggs with tea, pine tree leaves and other seasonings in 100℃ water, which has characteristic flavor and long term preservation ability. Procedure : Boiling water with tea and pine tree leaves → mixing other seasonings in 100℃ water → fermenting shell egg at 15℃, for 50 days in the mixture of the sealed up bottle →

coating 3~5 mm clay to prevent evaporation of moisture.

Title & Patent No. : Seasoning Method of Egg, Korean Patent 85-357(Yoo, 1984). Principle & Purpose : Eating cooked eggs is inconvenient for handling, preparing seasoning, controlling salt content and keeping its cleanliness. So liquid season is injected to the air cell of the egg to get a desirable salt content. Procedure : Injecting liquid seasoning through the egg shell with fine needled injector → standing at 15℃ over 8 hr → cooking at 70~75℃ for 30 min for semi-cooking method or cooking 75~80℃ for 40 min-1 hr for full-cooking method.

Title & Patent No. : Manufacturing Method of Processed Eggs, Korean Patent 91-6921 (Hayashi, 1991). Principle & Purpose : Manufacturing good taste and scramble style processed egg product which restores the original state only in hot water. Procedure : Cooking protein, starch, grain and their processed material → milling the edible part under 4 mesh → separating 4~100 mesh granule which has over 60 wt% of gross granule weight → mixing granule with non-denatured egg → manufacturing extrudation rate 5~60%

Title & Patent No. : Egg Yolk Centering Method, Korean Patent 89-1560(Yoo, 1989). Principle & Purpose : Specific gravity of avian shell egg is about 1.08~1.09 and thr shell egg keeps afloat in 12% saline solution as specific gravity go down day by day so the air cell faces upside at this salt content. Egg is heated at 80℃ for 3~5 min to center the egg yolk because ovomucoid, one of the protein of white, which has best heat stability of egg white protein would coagulated at 80℃. Procedure : After the first cooking of avian shell eggs in 80℃, 12% saline solution, for 3~5 min, the second cooking in 95℃ solution of salt for 5~20 min will make egg yolk centered.

Title & Patent No. : Condensation Method of Eggs, Korean Patent 89-3251(Namkoong, 1989). Principle & Purpose : To improve quality of semi-dry powder state of egg yolk when boiling in 1 atm, dipping shell-free hard-boiled eggs in the wood vinegar and other seasonings. According to wood vinegar action, the moisture in the white moves to the yolk, so the white has sticky mouth feel and yolk has moist structure. Procedure : Dipping shell-free boiled eggs in the solution of 90% wood vinegar and 5% spice and seasoning for 10~20 hr. After penetrating the solution to the inside of the egg, boiling the egg in the pressure jar 0.70 kg/cm^2~1.4 kg/cm^2, for 40~70 min.

Title & Patent No. : Egg Shell Removing Method for Semi-Cooking Eggs, Korean Patent 90-4273(Namkoong, 1990). Principle & Purpose : Method how to get rid of egg shell of semi-cooking egg, the best cooking condition of semi-cooking eggs is to boil at 69~71℃. The acidity of glacial acetic acid is generally 4~5, but when dipping in the acidity 20~40 glacial acetic acid the calcarious egg shell melts perfectly without damage of egg white. Procedure : After semi-cooking the egg shell at 70℃ water for 1~3 min → cooling → dipping in acidity 20~40 glacial acetic acid and 3% saline solution for 30~60 min → making shelless egg

Title & Patent No. : Processing Method for Duck Eggs, Korean Patent 91-2480(Hyun, 1991). Principle & Purpose : Solidifying process for duck eggs not by boiling but by dipping in alkaline solution, as to prevent the loss of nutritive value and to gain good flavor. Procedure : Dipping duck egg in the 1,300~1,500 cc water with 30~50 g $MgCO_3$, 45~60 g Na_2CO_3, 25~35 g NaCl → leaving at 23℃~28℃ for 18~21 days → drying with 40℃ steam for 2~3 min.

Title & Patent No. : Isolating Method of Specific Antibody Containing Materials from Eggs, Korean Patent 91-5409(Dogor, 1991). Principle & Purpose : Manufacturing method of materials containing specific antibody obtain from eggs of hen which has immunity against selective antigens and method of isolating materials containing activated specific antibody which can be obtained easily and inexpensively during the year. To immunize a hen, antigens are injected or given by oral administration. Procedure : Making emulsified antibody from homogenized or severely stirred egg yolk(or white, or whole egg) → making powder from spray drying or freeze drying → making powdered materials containing antibody used for oral administration.

Title & Patent No. : Manufacturing Method of Fish Meat Eggs, Korean Patent applied 84-8757(Kim, 1984). Principle & Purpose : Manufacturing method of two colored extruded fish meat of which the shape is similar to the sliced cooking eggs. The color of center in this product is yellow like egg yolk and outer part is white like egg white. Procedure : Mixture of 52% fish meat, 41% yolk, 2.3% white, 2.6% starch, and other additives is heated, sliced and extruded by sausage extruder.

Title & Patent No. : Manufacturing Method for Egg Yoghurt and Egg Beverage, Korean Patent applied 85-5758(Kim, 1985). Principle & Purpose : Manufacturing method for egg yoghurt and egg drink made from eggs and skim milk by the process of mixing, stirring, homogenization, pasteurization, cooling and fermenting. Procedure : Separating whole egg, egg white or egg yolk → pasteurization 60~64.5℃, 2~3 min → mixing and homogenization egg white or egg yolk → pasteurization 90~93℃, 10 min → starter 0.1~1%(*Lactobacillus bulgaricus*) → fermenting 32~44℃, 4~18 hr → stirring curd → homogenization 150~200 kg/cm² homogenizer → mixing with syrup and pasteurized water(egg soft drink) or mixing with fruit(egg fruit drink).

Title & Patent No. : Manufacturing Method for Egg Yolk Oil, Korean Patent applied 87-6843 (Kim, 1987). Principle & Purpose : Manufacturing method of non-offensive smell and non-denaturalized good quality egg yolk oil preservative from pure extraction of pasteurized egg with sanitizer. Procedure : Sanitization(sodium chlorite 200 ppm) → pure separation yolk from shell egg → homogenization and filtering yolk under the vacuum state → pasteurization (60~70℃ plate heat exchanger) → drying(150℃ high temp. Spray dryer with N_2) → yolk powder(2~5% moisture content) → stationing for several hours(soaking n-Hexane, anaerobic state) → centrifuging(removing non fatted yolk and organic solvent) → vacuum evaporation → product(transparent yellow egg yolk oil)

Title & Patent No. : Seasoning Method of Cooked Egg, Korean Patent 88-2454(Kim, 1988). Principle & Purpose : Manufacturing method of seasoning cooked egg by using osmosis of brine through the egg shell and shell membrane to the egg yolk and white, and then cooking eggs in the brine. Procedure : Dipping fresh eggs 10~15 minutes in Be" 10~24 Brine 1000 ml → rotating eggs in 20℃ room temperature for 7~10 days off and on → product.

Title & Patent No. : Dried Egg Flake for Instant Noodle, Korean Patent 85-1808(Lee, 1985). Principle & Purpose : Manufacturing dried egg flake for instant noodle suitable for Korean taste, which can easily recover its structure only with hot water after freezing under −14℃ for 12 hr and drying for 30 min with hot wind. Procedure : Boiling the shell-free eggs and

other seasonings → freezing under −14℃, for 12 hr. → drying for 30 min with hot blast.

SUMMARY

Egg production in Korea was 393 thousand M/T in 1990. More than 10 thousand M/T egg was imported and the amount imported has increased every year. Despite consumption tendency of increasing processed food, creation of additional demand is not likely because domestic egg consumption mainly depends upon table eggs. Processed eggs for marketing in Korea could be classified into two kinds. One is primary processed eggs including liquid eggs and egg powders. The other is secondary processed eggs which are further processed such as egg flake and egg curd. In addition to the above egg products, specific nutrient fortified eggs are produced through the modified feed formula and breeding techniques. The technologies developed so far including Korean patents are introduced. Convenient foods using egg and nutrient controlled eggs will be popular in the near future. For example, low cholesterol egg and polyunsaturated fatty acid fortified egg will be produced to meet the consumer demand. However, facing problems such as introducing egg quality grading systems and extending the short shelf-life of washed eggs should be solved as well.

(Key words : Korea, nutrlent fortified egg, processed egg, egg products)

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