FONKSİYONEL GIDA OLARAK
YUMURTA ÜRÜNLERİ
(YUMURTA BİLEŞENLERİ, FONKSİYONEL ÖZELLİKLERİ VE FONKSİYONEL ÜRÜN ÜRETİMİNDE KULLANIM POTANSİYELLERİ)

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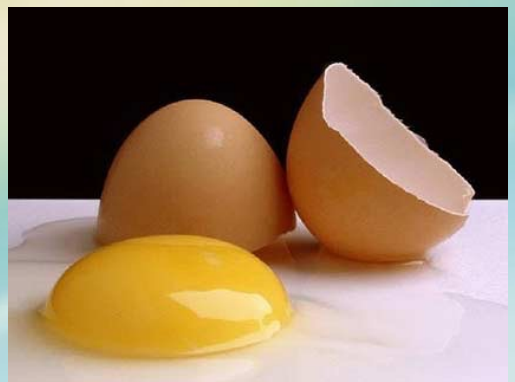
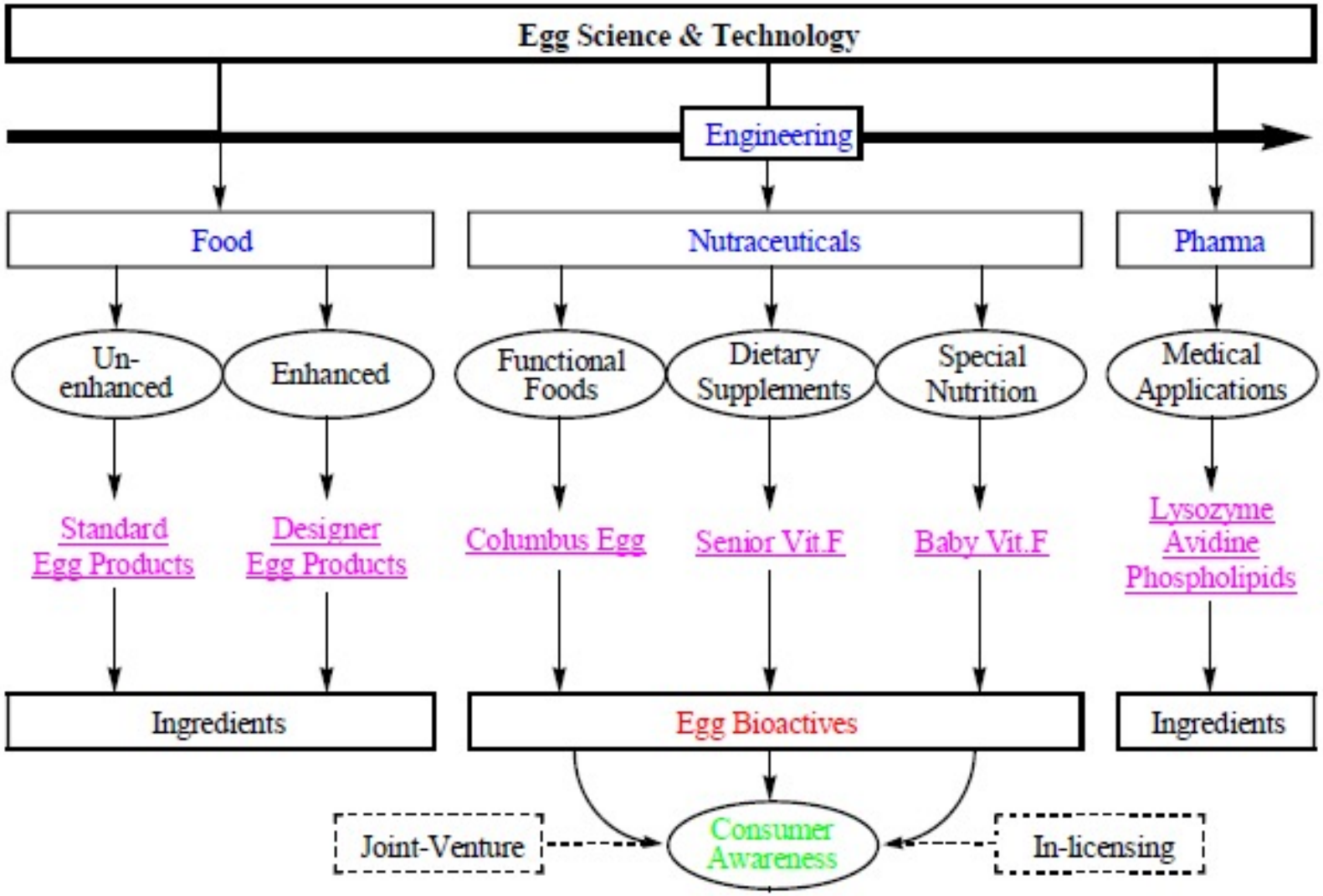


İçerik

- Yumurta Bileşimi ve Yapısı
- Yumurta Proteinleri (Ak, Sarı ve Kabuk)
- Fonksiyonel Ticari Yumurta Ürünleri
- Proseste Fonksiyonel Yumurta ve Önemi
- Yeni Gelişmeler ve Gelecekteki Trendler

Yumurta Bilimi – Genel Yaklaşım



Dünya Yumurta Üretimi – İstatistik & Sektörel veri

Dünya Yumurta Üretimi (2010)	
	Yumurta Üretimi (ton)
Dünya	63.575.115
Afrika	2.668.482
Asya	37.488.180
Avrupa	10.471.844
Amerika	12.692.856
Okyanusya	253.753

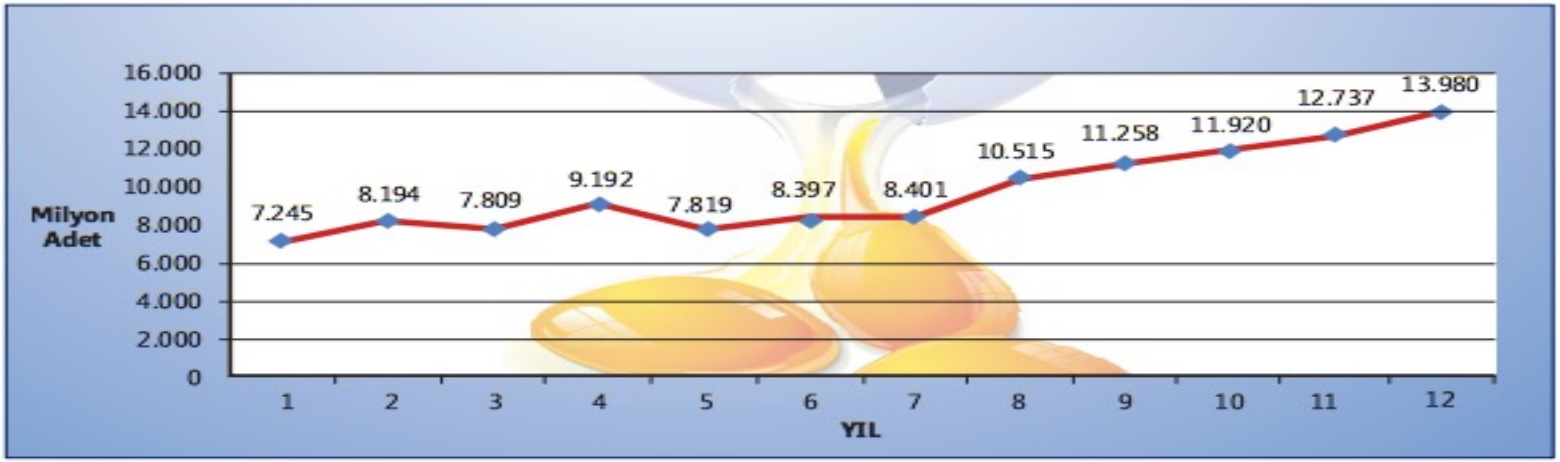
Kaynak: *http://faostat.fao.org/Ocak 2012*

Dünya Yumurta Üretiminde İlk 11 Ülke (2010)			
Sıra	Ülkeler	Üretim (000 ton)	Üretimdeki payı(%)
	Dünya	63.575.115	100
1	Çin	23.827.390	37,48
2	ABD	12.692.856	19,97
3	Hindistan	3.414.000	5,37
4	Meksika	2.381.380	3,75
5	Japonya	2.515.000	3,96
6	Rusya	2.260.600	3,56
7	Brezilya	1.948.000	3,06
8	Endonezya	1.117.800	1,76
9	Ukrayna	973.900	1,53
10	Fransa	946.600	1,49
11	Türkiye	740.024	1,16

Kaynak: *FAO (Ocak 2012-Resmi, yarı resmi ya da hesaplanmış verilerdir.)*

Ülkemizde Yumurta Üretimi – İstatistik & Sektörel veri

Türkiye Yumurta Üretimi *(Milyon Adet)*



Kaynak: *Yum-Bir*

Türkiye Yumurta Üretiminin Seyri**				
Yıl	Üretim (Milyon Adet)	Nüfus (000)	Kişi Başına Üretim (Adet)	2000 Üretim=100
2000*	7.245	67.803	106	100,0
2001*	8.194	68.838	116	109,4
2002*	7.809	69.770	112	105,7
2003*	9.192	70.692	130	122,6
2004*	7.819	71.610	109	102,8
2005*	8.397	72.520	115	108,5
2006	8.401	73.423	114	107,5
2007	10.515	70.587	149	140,6
2008	11.258	71.517	157	148,1
2009	11.920	72.561	164	164,5
2010	12.737	73.223	174	175,8
2011	13.980	74.224	188	193,0

Kaynak: *Yum-Bir /* Besd-Bir **Köy yumurtası dâhil edilmemiştir.*

Yumurta Tüketimi – İstatistik & Sektörel veri

Dünya Yumurta Üretimi Sıralamasındaki Değişim			
Sıra	1990	2000	2010
1	Çin	Çin	Çin
2	Rusya	ABD	ABD
3	ABD	Japonya	Hindistan
4	Japonya	Hindistan	Japonya
5	Brezilya	Rusya	Meksika
6	Hindistan	Meksika	Rusya
7	Meksika	Brezilya	Endonezya
8	Almanya	Fransa	Fransa
9	Fransa	Almanya	Ukrayna
10	İspanya	Türkiye	Türkiye
11	İtalya	İtalya	İspanya
12	Hollanda	Hollanda	İran
13	İngiltere	İspanya	İtalya
14	Tayland	Endonezya	Almanya
15	Polonya	İran	Hollanda

Kaynak: *2011 WATT Executive Guide to World Poultry Trends*

Seçilmiş Ülkelerde Yumurta Tüketimi (Kg/Kişi//Yıl)				
	Ülke	2007	Ülke	2007
1	Brunei	20,99	Kanada	10,98
2	Danimarka	19,61	Norveç	10,71
3	Hollanda	17,94	İsviçre	10,50
4	Çin	17,41	Arjantin	10,35
5	Macaristan	15,79	Kore	10,34
6	İspanya	14,89	İngiltere	10,27
7	Fransa	14,70	İsrail	9,54
8	Ukrayna	14,57	Türkiye	9,08
9	ABD	14,29	B.A.E	8,75
10	Rusya	14,28	Yunanistan	8,74
11	Avusturya	13,93	İran	7,96
12	Belarus	13,04	Brezilya	7,48
13	Almanya	12,02	Tunus	7,48
14	İtalya	11,62	Kazakistan	7,32
15	Polonya	11,55	Türkmenistan	6,32
16	Uruguay	11,39	Avustralya	6,28
17	Bulgaristan	11,20	Azerbaycan	5,43
18	İsveç	11,17	Gürcistan	5,06

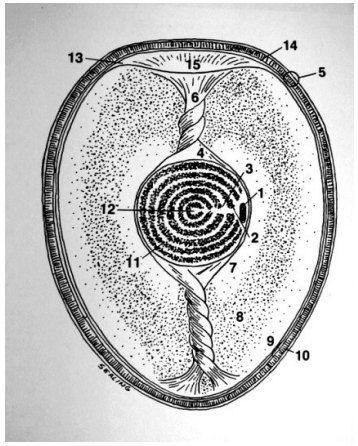
Kaynak: *http://faostat.fao.org/site/610/DesktopDefault.aspx?PageID=610#ancor-Ocak 2012*

Yumurta ve Yapısı

- **Yumurta, anne sütünden sonra insanın temel ihtiyacı olan tüm besin öğelerini yapısında bulunduran tek besin kaynağıdır. Bu yönüyle yumurta temel ve eşsiz ikamesi olmayan bir besin olma özelliğini taşımaktadır.**

- **Yumurta insan sağlığı için son derece elzem olan esansiyel amino asitler, A, D, E ve B grubu vitaminleri, kolin ve ksantofil gibi yüksek biyoyararlı bileşenleri içermektedir.**

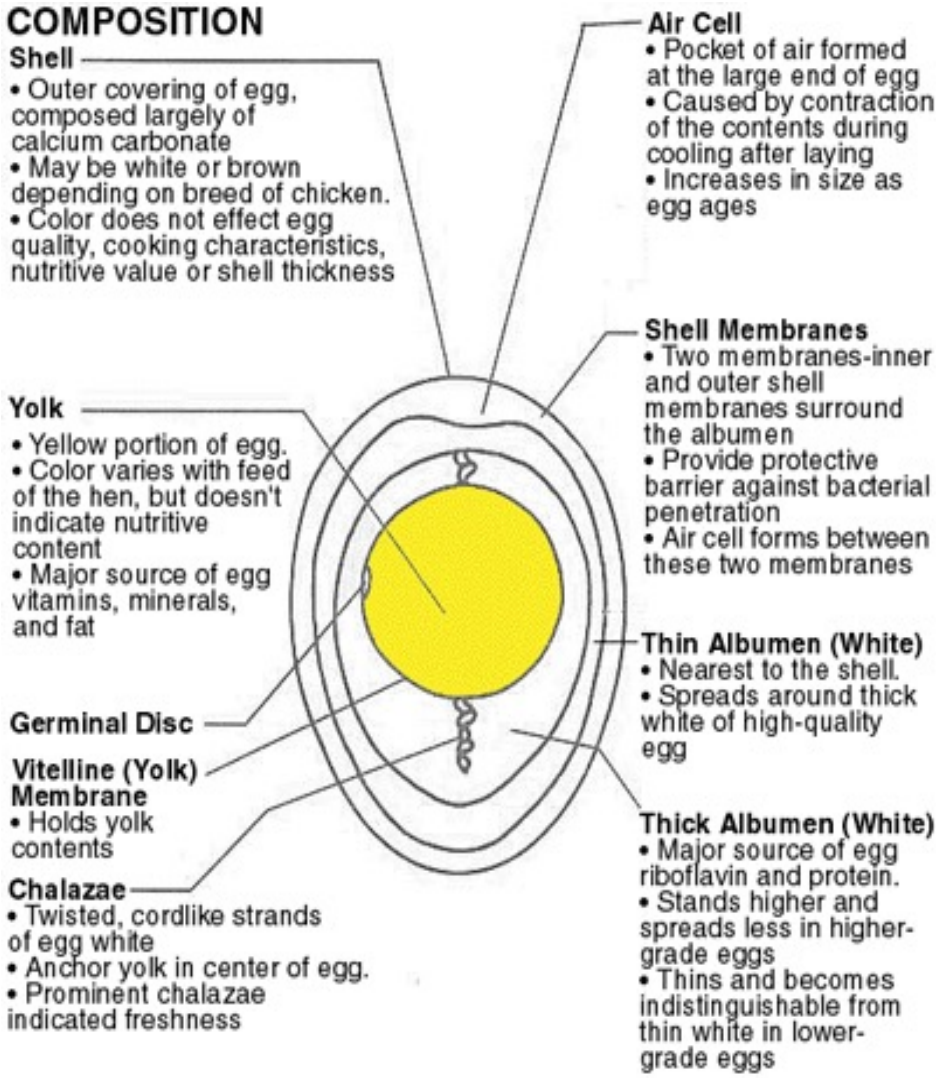
- **Yumurta içerisindeki biyoaktif fonksiyonel bileşenleri yumurta akında, sarısında ve kabuk kısmında olanlar şeklinde değerlendirilebilir.**

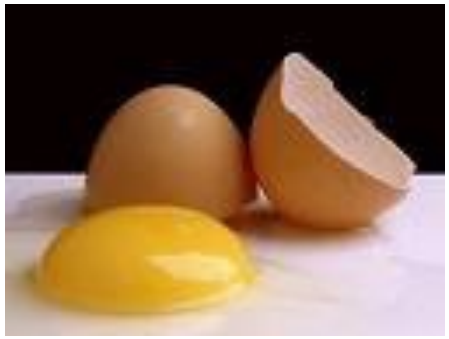


Yumurta Bileşimi

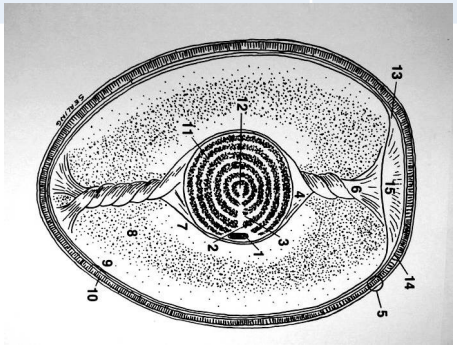
- **Gallus domesticus**
  - ✓ %9,5 kabuk,
  - ✓ %63 Beyaz
  - ✓ %27,5 Sarı

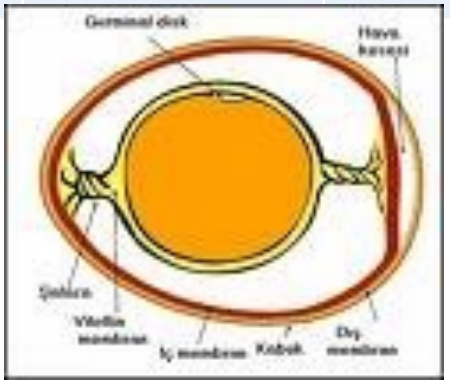
- **<u>Yumurta Yapısı:</u>**
- **Sarı**
- **Albumin (Ak)**
- **Membran**
- **Chelazia**
- **Chorioallantoic Membrane**
- **Hava Boşluğu**
- **Kabuk**





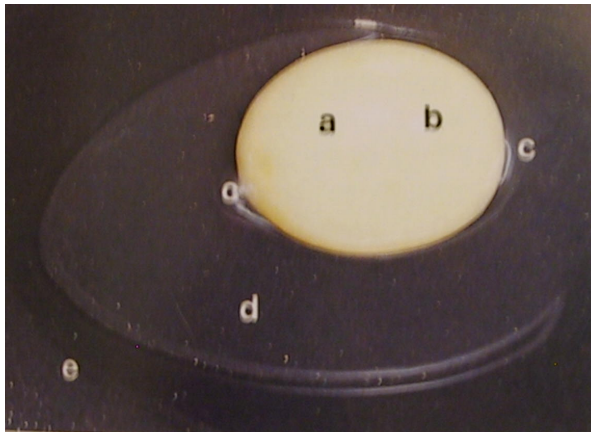
Besin Öğeleri* (100 gr.)	Bütün Yumurta	Yumurta Sarısı	Yumurta Akı
Protein – gr	12,0	15,3-16,1	9,3-10,2
Nem – gr	75,2-75,5	56,0-56,8	88,0-89,0
Yağ – gr	9,7-10,9	23,0-34,0	0-0,076
Kül – gr	0,8-1,0	1,4-1,69	0,4-0,68
Karbonhidrat – gr	2,2	3,6	1,3
Kalori - cal	144,0-152,0	282,0-377,0	43,0-50,0
pH	7,6	6,6	8,2-9,0
Kolesterol – mg	400,0-425,0	991,0-1280	0-3,3





Yumurta Bileşimi ve Yapısı (Yumurta Akı-Albümin)

- **4 Farklı Katman:**
  - Çok Yoğun İç Albumin (Chalaziferous)
  - Az Yoğun Dış Albumin
  - Çok Yoğun Dış Albumin
  - Az Yoğun Dış Albumin



Proteinler (~%11)- Başlıca Glikoprotein:

- **Ovalbumin (% 54):** Amino asit deposudur, pişirilmiş ürünlerde yapısal görevi (köpük oluşturma) bulunur.
- **Ovotransferrin (% 12-13):** Demir bağlama (şelat) özelliğiyle bakteri gelişimini önlemektedir.
- **Ovomucoid (%11):** Proteaz inhibitörüdür.
- **Ovomucin (%1,5):** Yumurta akına kendine has viskozitesini verir, köpük stabilitesinden sorumludur.
- **ovoglobulin ve avidin**

  Avidin, biotin inhibitörüdür (ısıya dayanımı bulunmuyor) – bakteri gelişimini sınırlandırmaktadır.

Yumurta Bileşimi ve Yapısı (Yumurta Akı-Albümin)

- Globulin (%8): lisozim – köpük oluşumunda fonksiyonel görev alır
- Lisozim: Bazı bakterilerde hücre duvarında bulunan polisakkaritleri hidrolize eder ve bakteri kaynaklı bozulmayı önler.
- Diğer: ovoinhibitor, ovoflavoprotein, ovomicroglobulin.

- **Su (~%88)**
- **Karbonhidrat(~%1)**
  Başlıca glukoz olup, yumurta tozunda ve haşlanmış yumurtada Maillard reaksiyonuna neden olmaktadır.
- **Yağ (iz)**

Protein	Yumurta Akı içerindeki Oranı (%)	Fonksiyonel Özelliği
Ovalbumin	51-54	Fosfoglikanoproteindir
Ovotransferrin (Conalbumin)	12	Metal iyonlarını bağlar.
Ovomucoid	11	Tripsin'i inhibi eder.
Ovomucin	3,5	Sialoproteindir. Yumurta akına viskoz yapısını verir.
Lisozim	3,4	Proteinleri "Lyze" eder
Globulin	8,0	-
Ovoinhibitor	1,5	Serin proteazları inhibe eder
Ovoglikoprotein	1,0	Sialoproteindir.
Ovoflavoprotein	0,8	Riboflavini bağlar.
Ovomacroglobulin	0,5	Güçlü antigenik özelliğe sahiptir.
Cystatin	0,05	Tiol preoteazları inhibe eder
Avidin	0,05	Biotini bağlar.

Kaynak: Li-Chan ve ark, 2005'ten adapte edilmiştir.

Yumurta Proteini

- **Biyolojik Değer (BD):**
- **Vücuda alınan bir besin kaynağından yüzde kaç oranında faydalanıldığını ifade eden bir ölçüdür. Bu değer vücutta 94 g protein oluşması için 100 g yumurta proteininin alınması anlamına gelir.**
- **Yumurta proteini diğer proteinlerin kalitesini ölçmede standart olarak kullanılır. Yumurta proteininde eksojen amino asitlerin tamamı dengeli bir şekilde bulunur. Bu nedenle diğer yiyeceklerle birlikte yenildiğinde bu gıdaların biyolojik değerlerinin yükseltilmesine yardımcı olur.**

Ürün	Biyolojik değer
Bütün yumurta	**94.0**
Süt	84.5
Balık	**76.0**
Sığır eti	74.3
Soya fasülyesi	**72.8**
Pirinç, temizlenmiş	64.0
Buğday, bütün	**64.0**

Yumurta Amino Asitleri

Yumurta'nın Amino Asit Profili

Amino asit	yumurta akı	sığır eti	tavuk	peyniraltı suyu	kazein	soya	maya
alanin	**6.6**	**6.1**	**5.5**	**5.2**	**2.9**	**4.2**	**8.3**
arjinin	5.6	6.5	6.0	2.5	3.7	7.5	6.5
aspartik asit	**8.9**	**9.1**	**8.9**	**10.9**	**6.6**	**11.5**	**9.8**
sistein	2.5	1.3	1.3	2.2	0.3	1.3	1.4
glutamik asit	**13.5**	**15.0**	**15.0**	**16.8**	**21.5**	**19.0**	**13.5**
glisin	3.6	6.1	4.9	2.2	2.1	4.1	4.8
histidin *	**2.2**	**3.2**	**3.1**	**2.0**	**3.0**	**2.6**	**2.6**
izolösin *	6.0	4.5	5.3	6.0	5.1	4.8	5.0
lösin *	**8.5**	**8.0**	**7.5**	**9.5**	**9.0**	**8.1**	**7.1**
lizin *	6.2	8.4	8.5	8.8	3.8	6.2	6.9
metionin *	**3.6**	**2.6**	**2.8**	**1.9**	**2.7**	**1.3**	**1.5**

Yumurta akı proteininin insan beslenmesi için en iyi amino asit profillerinden birine sahip olduğu kabul edilir

Yumurta Bileşimi ve Yapısı (Yumurta Sarısı)

- **Protein (%16.4):**
  - Plazma (%78): livetin & LDL (protein içeriği ~ 10%)
  - Granüler Fraksiyon: fosvitin (%16, demir taşıyıcısıdır), lipovitellin (%70) & LDL (%12)
- **Su (%48)**
- **Yağ (%32 - 34)**
  - Trigliserol (%66)
  - Fosfolipit (%28) lesitin dahil (emülsiyon oluşturma kapasitesine sahiptir)
  - Kolesterol (%3)

- **Yumurta sarısının rengi karatenoitlerin varlığına bağlı olarak değişim göstermektedir.**

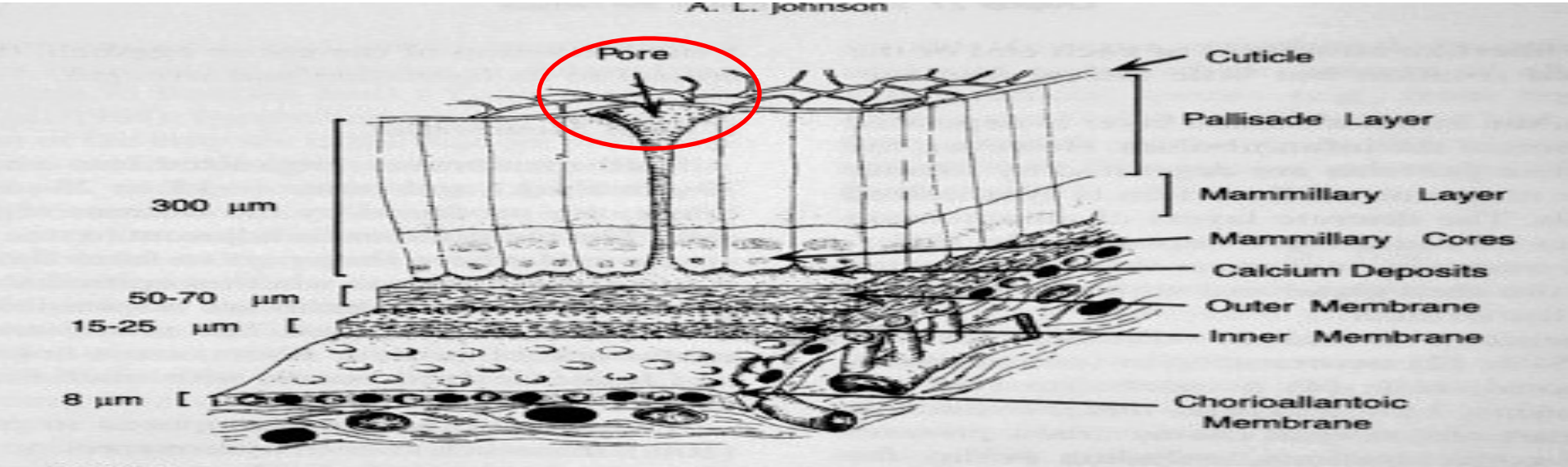
Yumurta Sarısının Moleküler Yapısı

	Yağ	Protein	Mineral
Yumurta Sarısı	*63,5*	*32,4*	*2,1*
-Granül (1,0-1,3 µm)	*6,9*	*16,1*	*1,4*
• Lipovitelin(HDL)	*3,5*	*12,3*	*-*
• Fosvitin	*-*	*4,6*	*-*
• LDL	*2,5*	*0,3*	*-*
-Plazma (20-40 µm)	*59,3*	*13,9*	*1,5*
• Livetin	*-*	*10,6*	*-*
• LDL	*59,4*	*6,6*	*-*

- Chang ve ark., 1977, Microstructure of Egg Yolk. J. of Food Science 42(5): 1193-1200.
- Causeret ve ark., 1991, Ionic Strength and pH effects on composition and microstructure of yolk granules,, J. of Food Science 56(6): 1532-1535.
- Belitz ve ark., 2004, Food Chemisty, Springer-Verlag Inc. Berlin, s.557. adlı kaynaklardan kısmen alıntı yapılarak hazırlanmıştır.

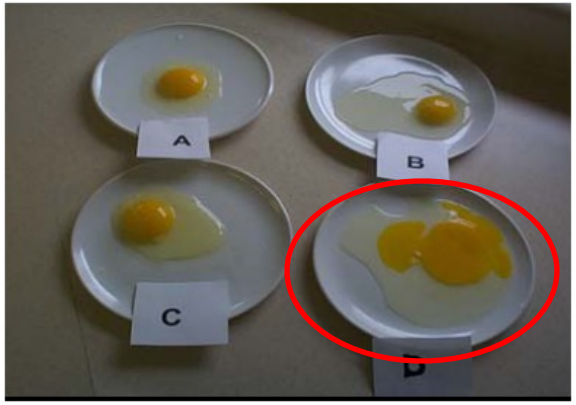
Yumurta Bileşimi ve Yapısı (Yumurta Kabuğu)

- **Membran**
- **Por**
- **Solunum (gaz değişimi)**
  - Oksijen
  - Karbon Dioksit
- **Depolamada ağırlık kaybı**

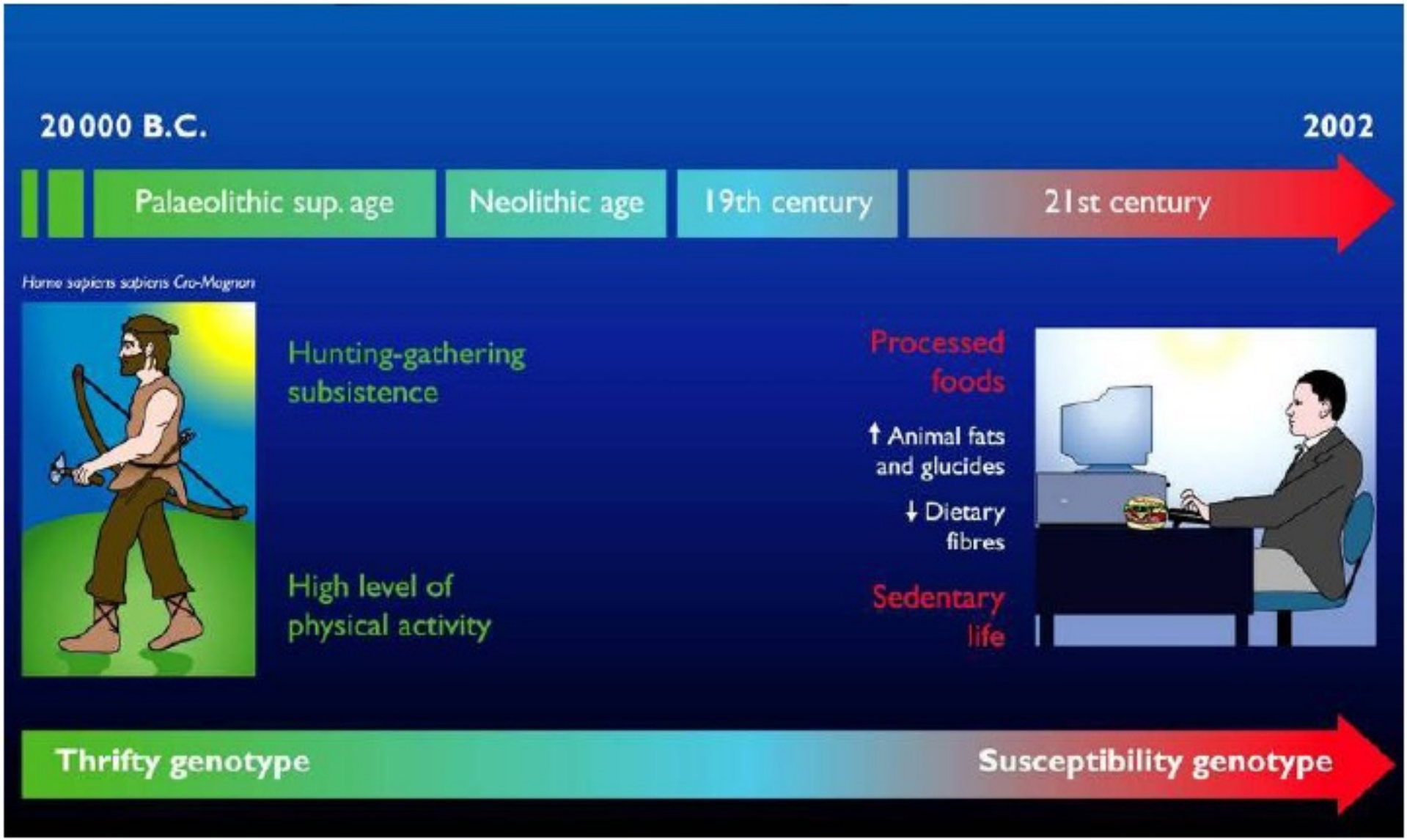


Depolama ile Yumurtanın Kalitesinde Meydana Gelen Değişimler

- **Hava boşluğunun hacmi artar**
  su yumurta kabuğundan buharlaşmaktadır (su buharı geçişi)
- **Yumurta akının yoğunluğu değişmektedir.**
  ovomucin yapısal bozunmaya başlar
- **Yumurta akının pH değerinde nisbi artış kaydedilir (pH~ 8'den ~9'a)**
  Porlar üzerinden CO_2 kaybından kaynaklanır
- **Yumurta sarısı ve membranında değişiklikler oluşur**
  (su yumurta akından sarısına doğru geçiş eğilimindedir, sarının viskozitesi azalır ve kalitesinde değişim olur)
- **Yumurtanın aroma ve kokusunda değişimler olur**
- **Sıcaklık artış hızı ile kalitedeki kayıplarda artmaktadır.**



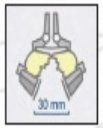
Yeni Yaşam Tarzı ve Tüketim Alışkanlıkları



Yumurta İşleme – Yumurta Kırma

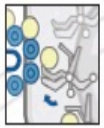
Do you empty your shells or send product down the drain?

Long and forced draining of shells



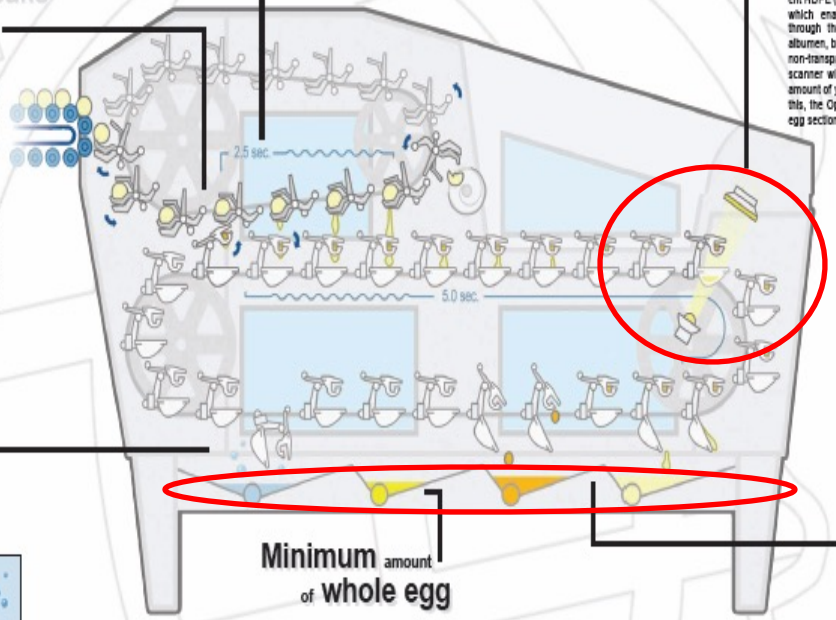
After breaking and opening the shell the entire breaking unit is tilted in order to drain the shell as much as possible. Due to the special design of the OptiBreaker, it is possible to reach a draining time of a minimum of 2.5 seconds for each egg. The distance between the breaker bars and separation cups is gradually increased with the effect of forcing the albumen out of the shells.

Minimum amount of no-breaks and product loss



In order to remove any stress on the egg, the breaker bar is tilted against the direction of movement thus synchronising the speed of the breaker unit with the roller table. Furthermore, the breaker unit has been redesigned to make sure that no shells are lost.

The entire process is monitored by a patented surveillance system which will register any loss of egg as well as keep track of the amount of whole egg. If a certain breaker unit continues to fail, e.g. drop or not break the egg, an alarm will show up, and the unit identified can be brought to the service section for easy and fast replacement. All production data including egg counting, amount of whole egg, etc. are collected by the control unit and can be monitored on the 10.4" screen.



Scanning with Computer vision system

The OptiBreaker is equipped with a new and highly efficient scanning system which identifies even the smallest spot of yolk in the albumen.

The separation cup is made of transparent HDPE (High Density Poly Ethylene), which enables the scanner to look through the entire cup including the albumen, but not the yolk. To the scanner any yolk will appear non-transparent, and if any yolk is found in the albumen, the scanner will measure the volume. The operator decides the amount of yolk accepted in the albumen – if any, and based on this, the OptiBreaker will bring the individual egg to the whole egg section.

Highest operator safety in the industry

The SANOVO OptiBreaker has the highest operator safety in the industry and complies fully with all regulations in the CE Directive. All risk areas are fully capsulated by fences or doors with safety switches. All fences are incorporated in the machine design so there will be no extra cost for separate safety fence and gates.

Low maintenance and few operators

The OptiBreaker is designed with only a few and easy exchangeable mechanical parts. In order to avoid frequent adjustments, two timing belts are used to drive the OptiBreaker.

If a separation cup or breaker unit continues to produce undesirable whole egg or no-breaks, the OptiBreaker will bring it to the service position and allow the technician to release this single unit with one bolt and replace it. This means less down time on machinery due to reduced maintenance.

Intelligent cup wash system

In order to avoid any product loss, the separation cups are kept in a horizontal position all around the machine and only tilted at the point of emptying. At the same time an "intelligent cup wash" system has been introduced. The system can be set only to wash the cup if it continues to create a whole egg more than once in a row. Thereby the waste of product in the wash section will be reduced to a minimum, and at the same time minimling water consumption.

Minimum amount of whole egg

The yolk is fragile and must be handled as gently as possible. In order to avoid cutting the yolk, the knife is held horizontally at the point of breaking the shell. Subsequently the entire breaker unit is tilted in order to allow optimal draining of the shell.

The breaker unit and separation cup are two separate units. However, at the point of breaking and opening the shell, the breaker unit is inside the separation cup allowing the albumen and yolk to slide gently direct into the separation cup.

Clean albumen and dry yolk

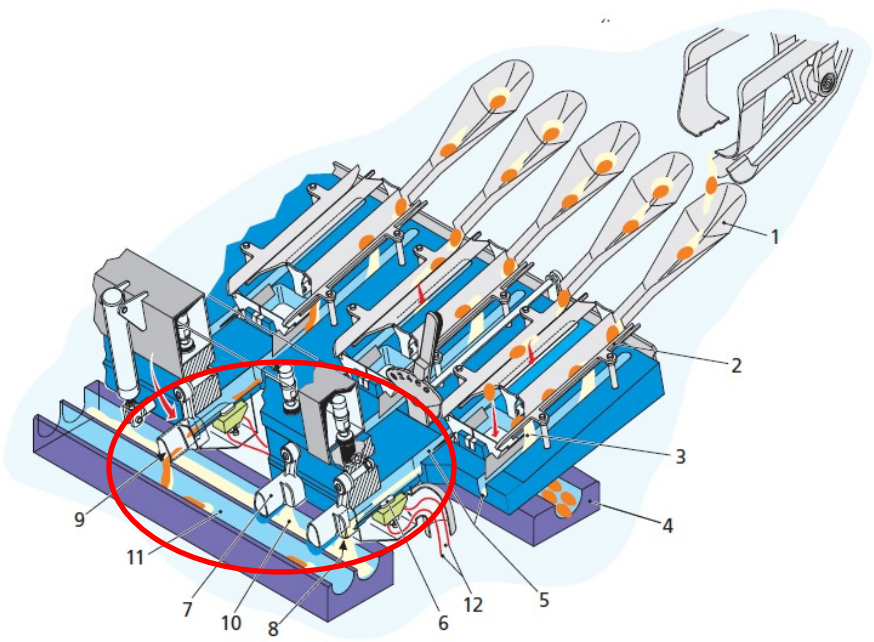
The OptiBreaker is equipped with a new separation cup which is unique in its shape and material. At the point of receiving the product from the breaker unit, the entire separation cup is tilted. This allows the albumen and yolk to slide gently down into the separation cup ensuring that the fragile yolk remains intact. The separation cup is designed to allow the thicker part of the albumen to slip over the edge while the thinner part of the albumen will drain out through passages in the lower part of the cup. The OptiBreaker allows a staggering separation time of no less than 5.0 seconds.

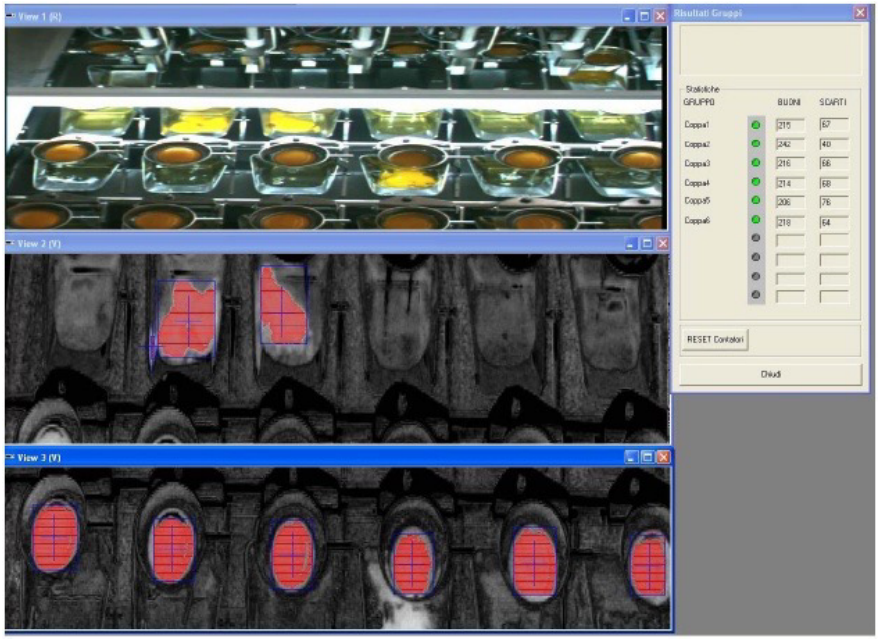
100% CIP cleanable

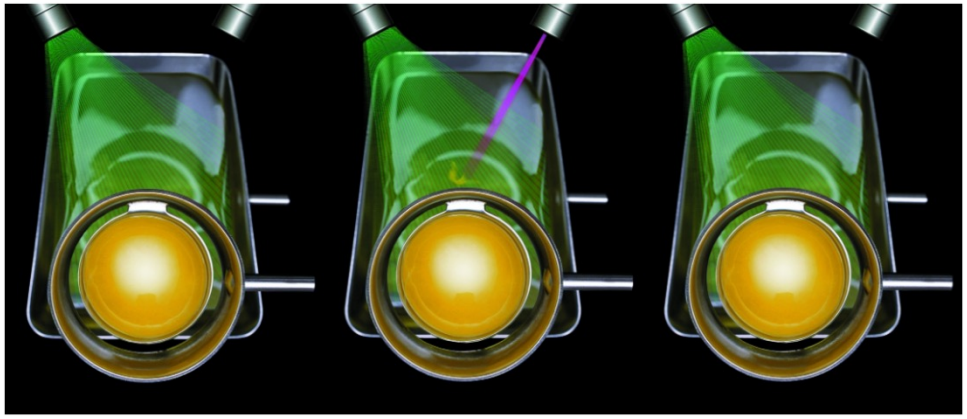
All internal parts of the SANOVO OptiBreaker are CIP cleaned.

CIP cleaning is made possible by a very hygienic design allowing only vertical or round parts. In this process the CIP liquids are collected and recycled, reducing manpower and water requirements to a minimum.

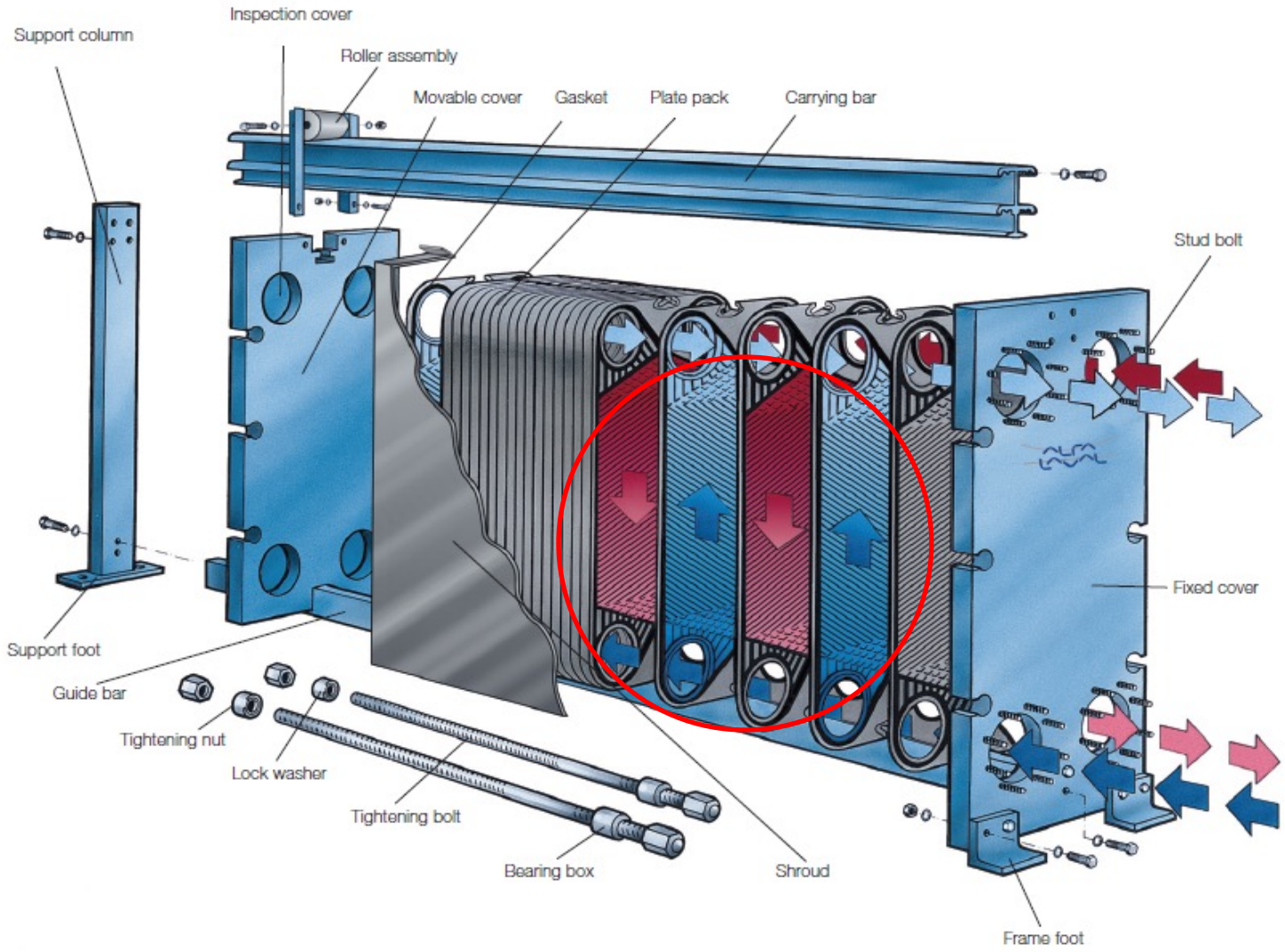
Yumurta İşleme – Sensör Teknolojisi



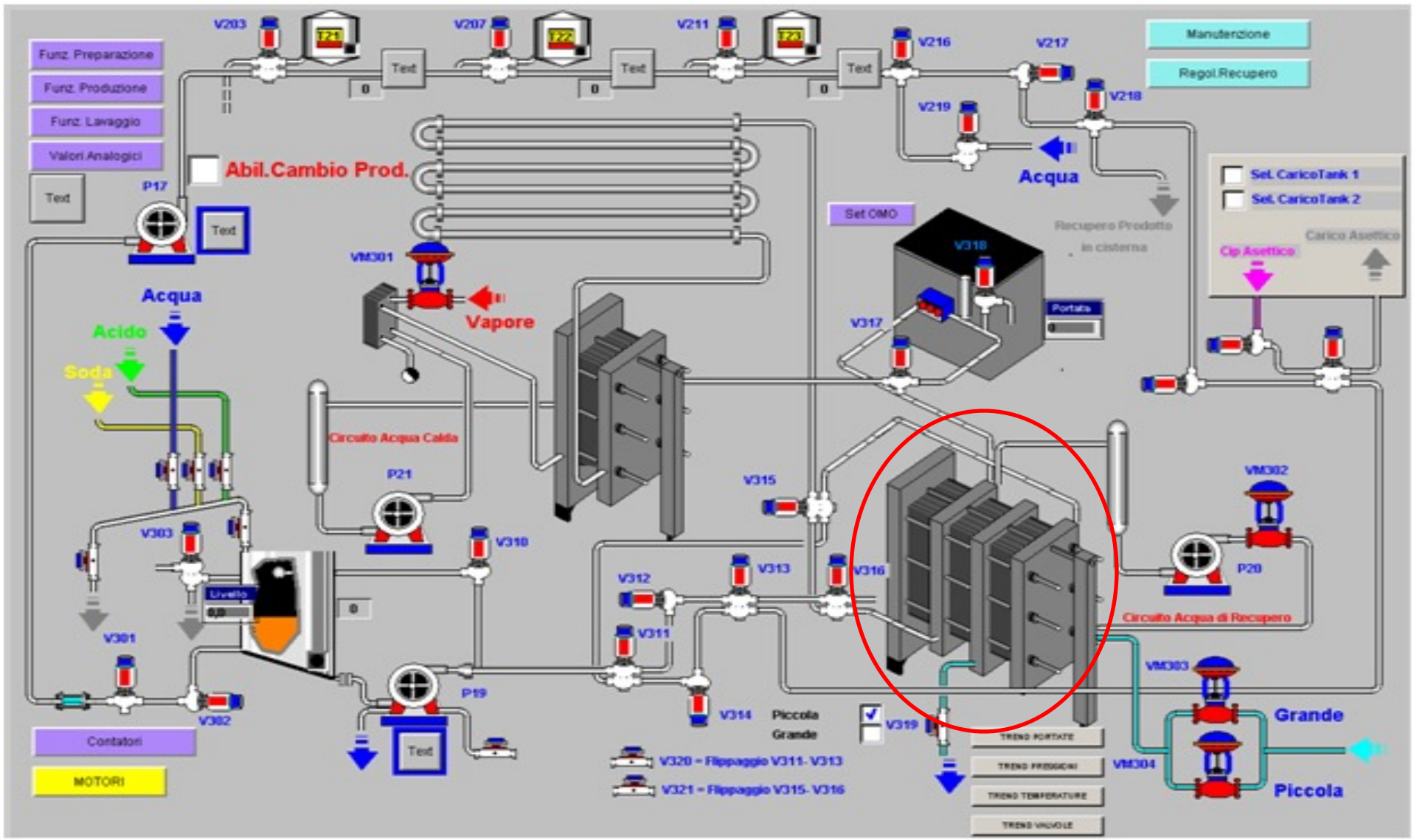




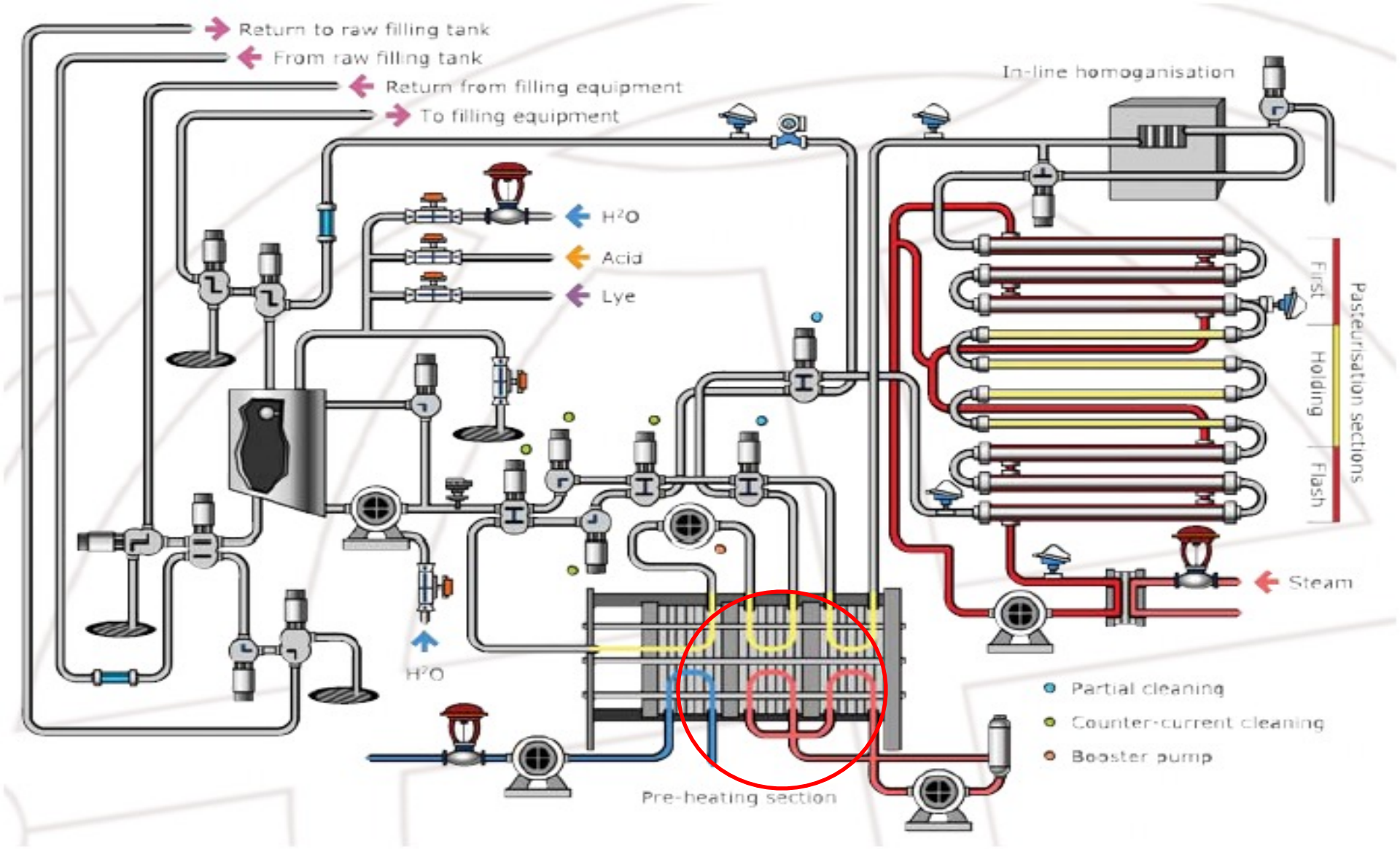
Yumurta İşleme – Plakalı (Pastörizasyon)



Yumurta İşleme - Pastörizasyon



Yumurta İşleme - Pastörizasyon



Yumurta İşleme - Parametreler

	Degrees Celsius	Degrees Fahrenheit	Time
Whole egg	60	140	210 seconds
Whole egg blends	60	140	372 seconds
Whole egg blends	61.1	141.98	210 seconds
Liquid egg white	55.6	132.08	372 seconds
Liquid egg white	56.7	134.06	210 seconds
10% salted yolk	62.2	143.96	372 seconds
10% salted yolk	63.3	145.94	310 seconds
Dried egg white	67	152.6	15 days

Source: OIE Terrestrial Animal Health Standards Commission / September 2005 Appendix 3.8.X

Yumurta İşleme - CIP

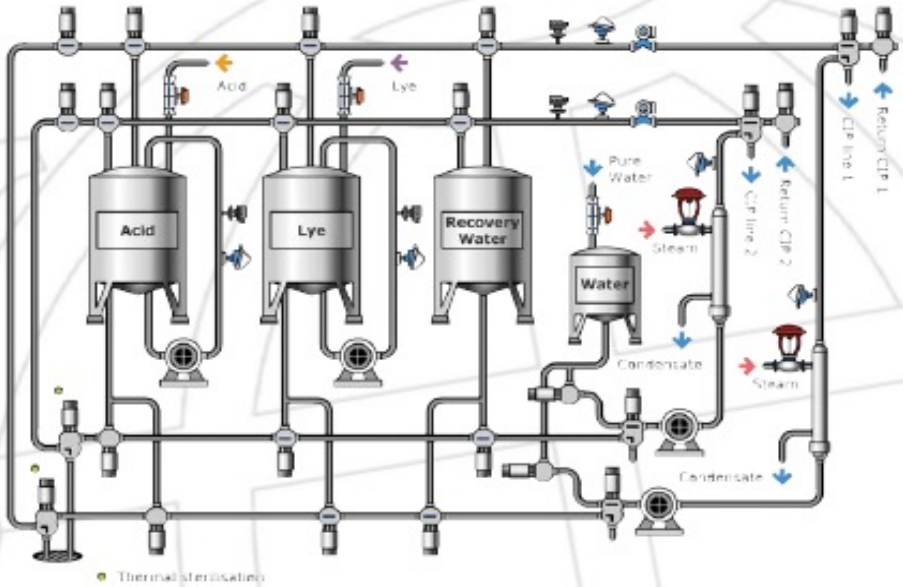
SANOVO CIP Systems

SANOVO egg processing equipment is designed to meet efficient CIP cleaning standards. SANOVO CIP systems meet various requirements and individual customer needs in terms of capacity, choice of chemicals and desired level of automation.

The SANOVO CIP program covers three different models:

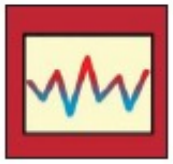
- **SANOMINICIP** is an one-line system and available in two sizes: 10.000 l/h for smaller CIP cleaning applications of short and small pipe installations and 40.000 l/h for cleaning of SANOVO eggshell conveying systems. The temperature regulation is automatically handled and control of valves is manually handled.
- **SANOMIDICIP** is designed for medium-sized pipe length/diameters and smaller tanks. With this design, two or more tanks ensure higher flexibility and the possibility of handling 1-2 CIP lines. The system is available with manual or automatic control of valves. Common for both is automatic temperature regulation.
- **SANOMAXICIP** is designed for large-sized pipe length/diameter and cleaning of big tanks and is available for cleaning of 1-2 CIP lines. The automation of both temperature and all valves is fully controlled and chemical control can be delivered as an option for accurate CIP liquid control.

Perfect cleaning of egg processing equipment



Automation for safe cleaning

Both SANOMIDICIP and SANOMAXICIP are available with automatic control of all parameters to eliminate the risk of mixing CIP chemicals.

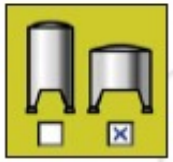


Control and monitoring of all valves ensures no chemical mixing of liquids.

The local operator panel - equipped with unique SANOVO software - helps the operator during cleaning process by displaying operation status, warning and alarms. Data recording and logging is optional if adding SCADA system.

Configuration

SANOVO CIP systems can be configured for various features e.g. number of tanks, tank sizes, 1 or 2 CIP lines, chemical controls and instrumentation.



Intelligent chemical control

The SANOMAXICIP is designed for automatic on-line control of chemical concentrations by use of conductivity probes. Efficient and accurate control reduces the consumption of chemicals.

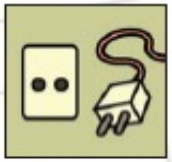
Minimum energy consumption

All tanks for CIP liquids are insulated for minimal heat loss. The concept is indirect steam heating in a tubular heat exchanger with recovery of condensation, reducing energy consumption.

Saving natural resources

SANOMAXICIP can be installed with a water recovery tank. The last cycle of rinsing water will be stored in a water recovery tank for re-use in the first water rinsing cycle. Savings in water and waste water disposal will reach 20 - 50 %.

"Plug&Go" tested prior to delivery



The CIP plant is fully or partly skid-mounted and has been tested thoroughly prior to shipment for easy and fast start-up of the CIP plant.

Only external connections are required before running the CIP plant.

Thermal sterilisation

A thermal sterilisation valve can be added (optional). The thermal sterilisation valve ensures that a closed loop is obtained during the thermal sterilisation cycle designed to kill bacteria resistant up to 85°C-90°C / 185°F - 194°F. Hot water at 90°C / 194°F is added to the water tank for recirculation in the CIP system.

Yumurtanın Teknolojik Özellikleri

- **Köpük oluşturma,**
- **Kabartma ajanı,**
- **Bağlayıcı,**
- **Kalınlaştırıcı,**
- **Kaplama materyali,**
- **Kristalizasyon kontrolü,**
- **Nem verici,**
- **Renklendirici,**
- **Emülgatör,**

Yumurta Kullanım Alanları

- **Yumurta Akı:** **Çikolata ve şekerlemelerde, çikolata ezmesinde, fındık ezmesinde, pekmez, helva, kaplama ürünlerinde, beze ve acıbadem kurabiyesi üretiminde, vücut geliştirme ürünleri ile sağlık ürünlerinde kullanılmaktadır.**
- **Yumurta Sarısı:** **Hamur işleri, ekmek ürünleri, pasta, poaça, çorba, kek, yemek, bisküvi, dondurma, mayonez, gofret, dondurma ve tatlandırıcılar.**

Yumurta Kullanım Alanları

Egg Applications in Baked Goods

Category	Egg Ingredient Function
Breads, Buns, Rolls	Provide richness, flavor, color, nutrients; stabilize structure; brown crusts; glaze (egg wash)
Cakes	Increase volume/height, add lightness to improve matrix with aeration; emulsify fat/liquid; dissolve dry ingredients; moisten; evenly disperse and suspend foam; stabilize structure; provide richness, flavor, color, nutrients
Cookies, Specialty Items	Allow aeration; stabilize structure
Frostings	Retard crystallization; smooth texture; firm
Frozen Products	Improve freeze/thaw/reheat capabilities
Snack Bars/ Energy Bars	Provide protein and other nutrients; bind ingredients; add flavor, color
Muffins, Popovers	Increase volume; improve texture and mouthfeel; create "pastry" effect
Other Sweet Goods	Smooth texture; thicken; add richness, flavor, color, nutrients to custards. Gel; emulsify fat/liquid in other fillings.

Source: American Egg Board, Park Ridge, IL

Egg Functions and Applications

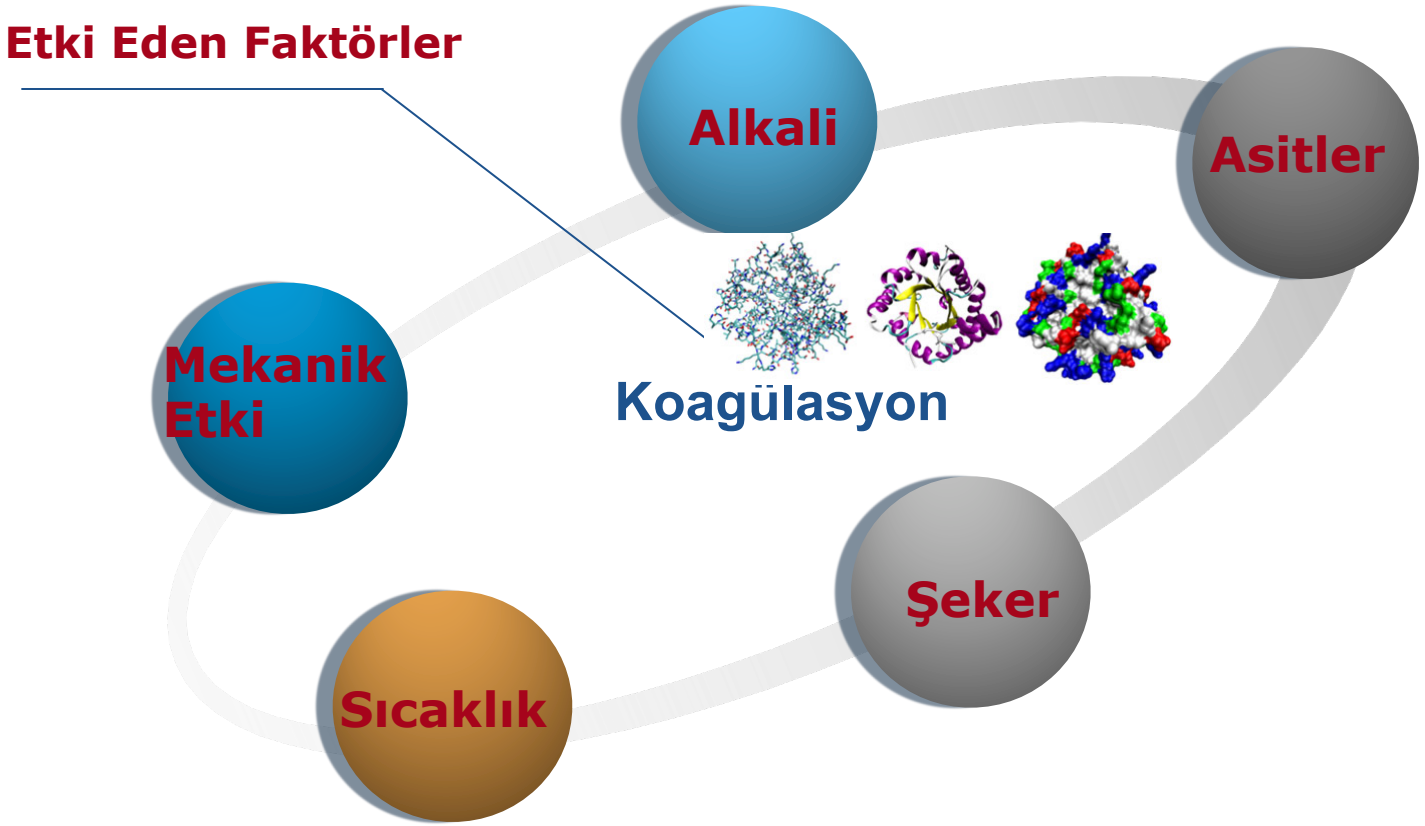
In addition to providing a rich, familiar flavor, eggs have many functional attributes that make them invaluable in food systems. The following table describes these functions and related applications:

Function	Mechanism	Applications
Foaming/leavening	Foaming properties are provided primarily by proteins in the egg albumen. Hydrophobic protein groups with an affinity for air and water-soluble hydrophilic groups lower the egg's surface tension, making air incorporation possible. Globulins lower surface tension and increase foam stability. Ovomucin forms an insoluble film around foam air globules, which stabilizes the foam and increases viscosity. Ovalbumin (the major protein in egg white) and conalbumin provide heat-setting properties. When beaten or whipped, albumen can increase in volume six to eight times.	Angel food cakes Sponge cakes Meringues Soufflés Puffy omelets
Coagulation/gelation	Egg proteins are denatured by heat, giving them thickening, gelling, setting and binding characteristics. Egg white proteins — ovalbumin, conalbumin, ovomucin and globulins — are major contributors to coagulation properties, and yolk lipoproteins also can be of importance.	Custards Puddings Meat products Croquettes Baked goods Cookies Sauces Egg dishes
Emulsification	Eggs' emulsifying properties come from the yolk. Phosphatidyl choline (lecithin) and the protein in the yolk provide excellent emulsification ability in combination with the egg yolk oils.	Mayonnaise Hollandaise sauce Salad dressings Baked goods
Color	Yolk pigments, including the carotenoids lutein and zeaxanthin, provide a rich, yellow color to foods.	Egg noodles Egg bagels Omelets Custards Baked goods Ice cream Sauces
Prevention of sugar crystalization	Eggs control sugar-crystal growth, prevent syneresis and bind water.	Chocolates Boiled candies Frostings Ice cream

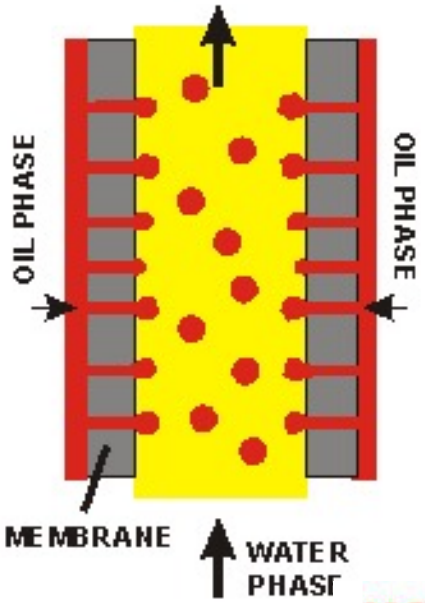
Source: Glenn Froning, Ph.D., professor emeritus, department of food science and technology at the University of Nebraska-Lincoln, and technical advisor to the American Egg Board, Park Ridge, IL.

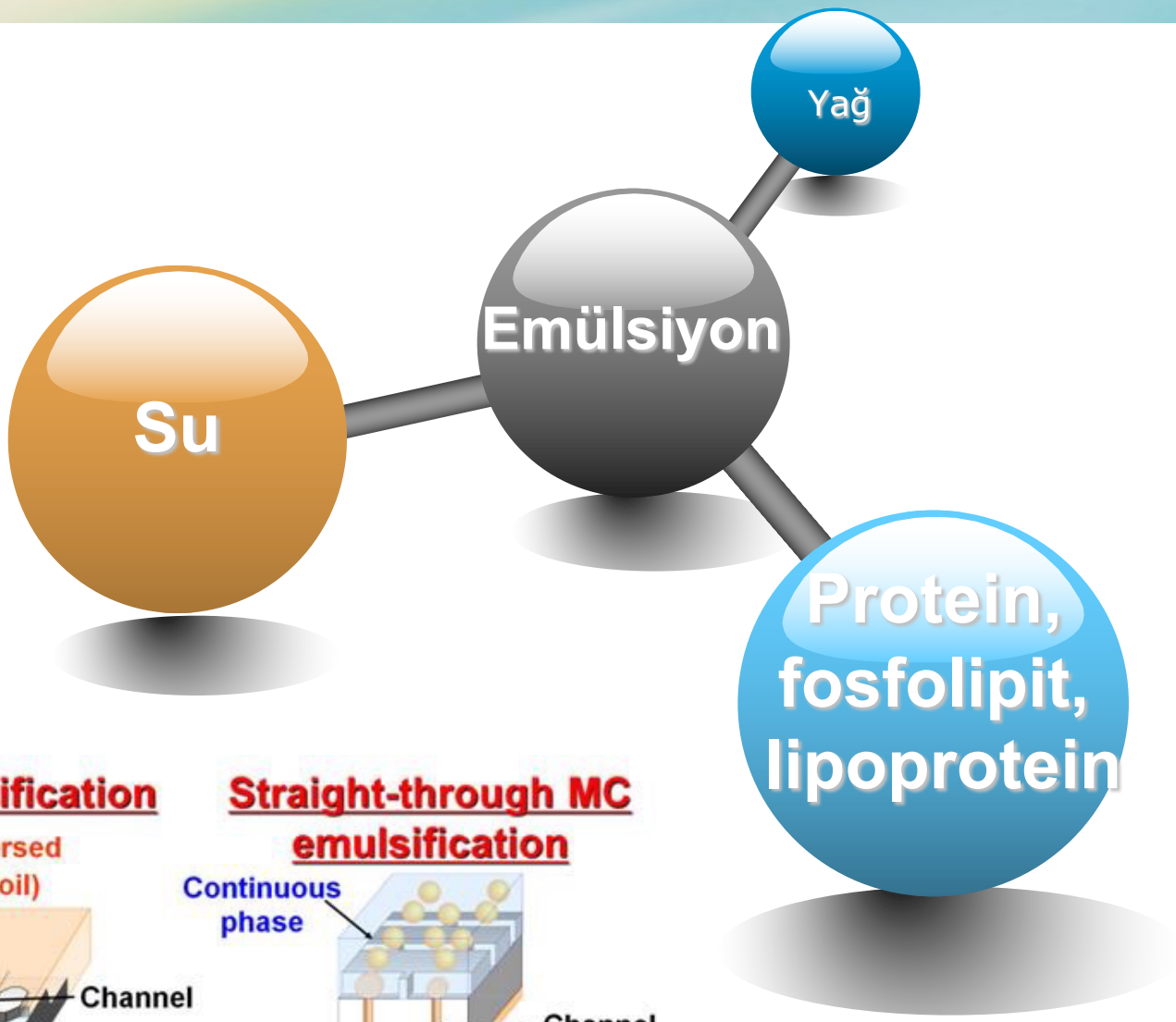
Yumurta Proteinlerinin Gıdalardaki Fonksiyonları

Yumurta Proteinlerinin Koagülasyonu



Emülsiyon


OIL PHASE
OIL PHASE
MEMBRANE
WATER
PHASE


Yağ
Su
Emülsiyon
Protein,
fosfolipit,
lipoprotein

MC emulsification
To-be-dispersed
phase (e.g. oil)
Channel
Continuous
phase (e.g. water)
Straight-through MC
emulsification
Continuous
phase
Channel
To-be-dispersed
phase

Yumurta Proteinlerinde Emülsiyonu Etkileyen Faktörler

Dondurma

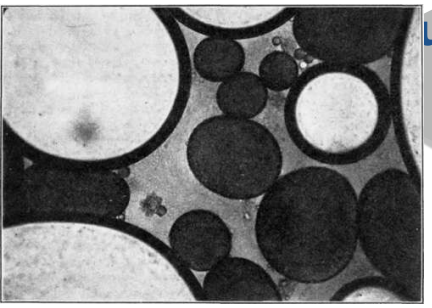
Sıcaklık ve kurutma

Emülsiyon

Asitler

Tuz

umurta sarısında bulunan fosfolipid ve lipoproteinler yüzey aktif maddeler olup emülsiyon oluşturma kapasitesine sahiptiler.



Yağ içerisinde yumurtanın emülsiyon durumu

Yumurta Proteinlerinde Köpük Oluşturma Fonksiyonu

Köpük
Kapasitesi/Stabilitesi

Protein Konsantrasyonu
Ovalbumin,
Ovomucoid

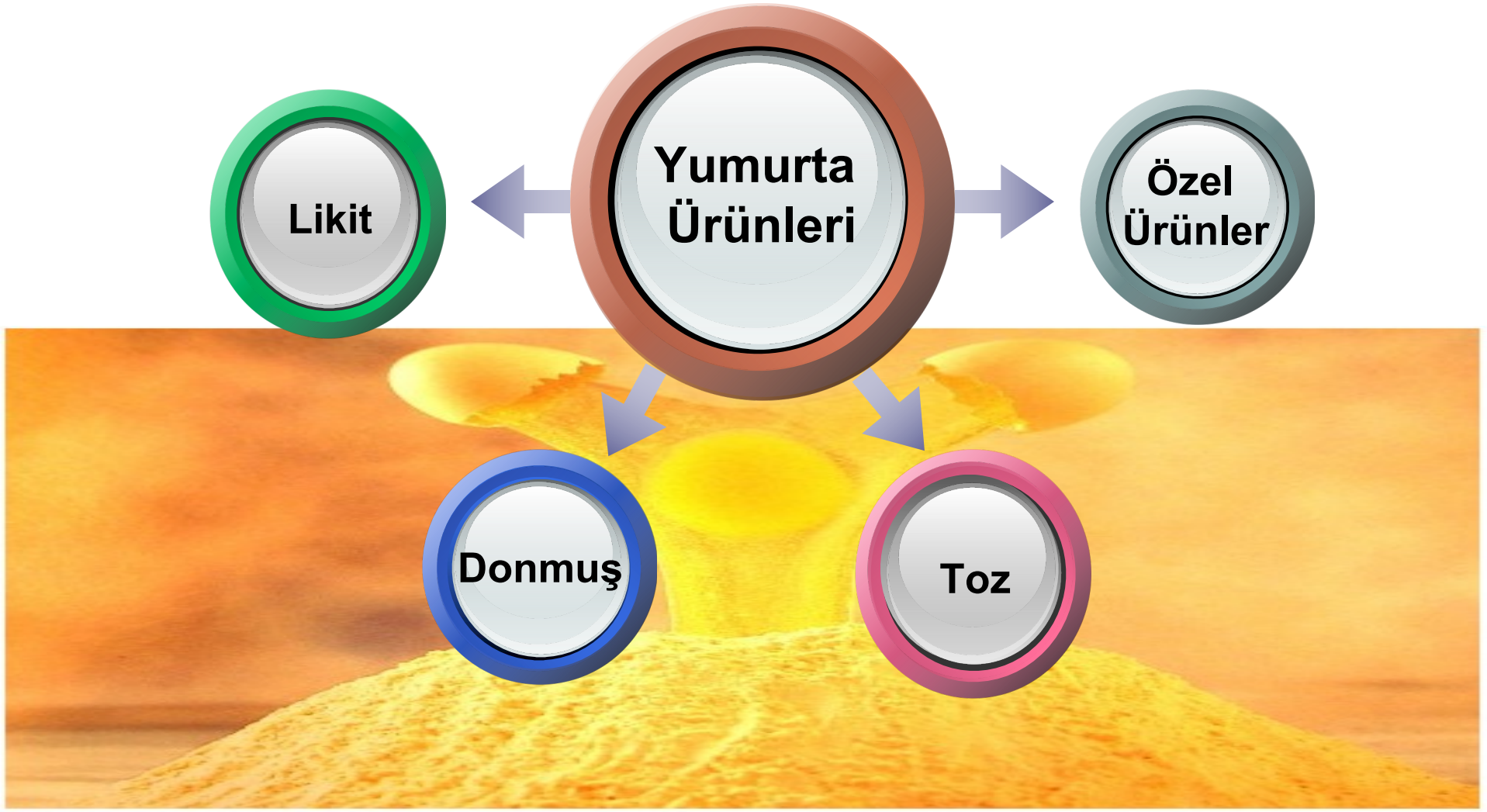
Çevresel Koşullar
Sıcaklık,
Homojenizasyon
Karıştırma,
Tuz,
Şeker,
Asit,
Bakır,
Yağ,
pH .

Yumurtanın mikserde çırpılması (mekanik etki) ile havanın yumurta içerisine dağılımı sonrasında hidrofobik ve lipofilik proteinleri denaturasyona maruz bırakılmaktadır. Proteinler hava kabarcıkları ve su molekülleri arasıbda hidrofilik özellikleri ile bulunurlar. Proteinler çapraz bağ oluşumuna giderek köpük stabilitesinin oluşumunu sağlarlar.

Yumurta Proteinlerinin Köpürme Özelliğini Etkileyen Faktörler

1. Sıcaklık
2. Homojenizasyon
3. pH
4. Karıştırma
5. Tuz, şeker, asit, yağ ve bakır bulunması

İşlenmiş Yumurta Ürünleri



Yumurta Ürünleri

Likit

1. Pastörize Bütün yumurta, sarı ve beyazı,
2. Scrambl yumurta karışımı,
3. Stabilize edilmiş yumurta sarısı,
4. Tuzlu bütün veya tuzlu yumurta sarısı,
5. Şekerli yumurta sarısı,
6. Uzun raf ömürlü ürünler

Donmuş

1. Pastörize Bütün yumurta, sarı ve beyazı,
2. Scrambl yumurta karışımı,
3. Tuzlu bütün veya tuzlu yumurta sarısı,
4. Şekerli yumurta sarısı,
5. Mısır şurubu ilave edilmiş tuzlu yumurta,
6. Sitrik asit ilave edilmiş bütün yumurta.

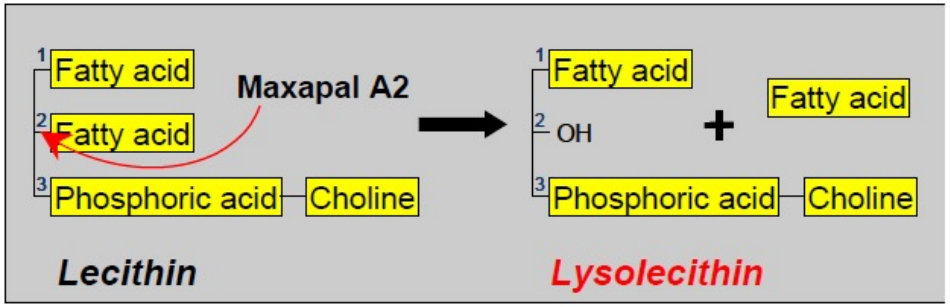
Toz

1. Bütün yumurta, sarı ve beyazı tozu,
2. Akışkan (topaklaşmayan) Bütün yumurta, sarı ve beyazı tozu,
3. Stabilize edilmiş bütün yumurta ve yumurta akı,
4. Scrambl yumurta karışımı tozu.

Özel Ürün

1. Haşlanmış kabukları soyulmuş yumurta,
2. Ultra-Pastörize edilmiş yumurta ürünleri,
3. Özel karışımlar,
4. Diğerleri

Fonksiyonel Yumurta Ürünlerinin Üretiminde Enzimlerin Kullanımı



Glikoz Oksidaz
- Y.Akı Tozu
- Glukozun indirgenmesi

Katalaz
- Y. Akı Tozu
- Hidrojen peroksitin parçalanması

Lipaz
- Likit Y. Akı
- Y.Sarısı Kontaminasyonunun elemine edilmesi

Fosfolipaz
- Yumurta Sarısı
- Lesitin lysolesitin'e dönüştürülür

İşlenmiş Yumurta Ürünlerinin Kullanım Avantajları

Güvenli

1. Düşük kontaminasyon riski,

2. Salmonella riski bulunmuyor,

3. Pastörize edilmiştir.

Raf Ömrü

1.Likit Ürünlerde 0 ile 4ºC'de 1-12 hafta,

2. Dondurulmuş ürünlerde 1 yıl,

3. Kurutulmuş ürünlerde 1-2 yıl ve üzeridir.

Kolaylık

1. Kolay depolama,

2. Kırma için ek işçilik yok,

3. Kullanıma hazır.

Performan

1. Standart ürün kalitesi,

2. Kolay fomüle edilebilme,

3. Standart Ürün stabilitesi.

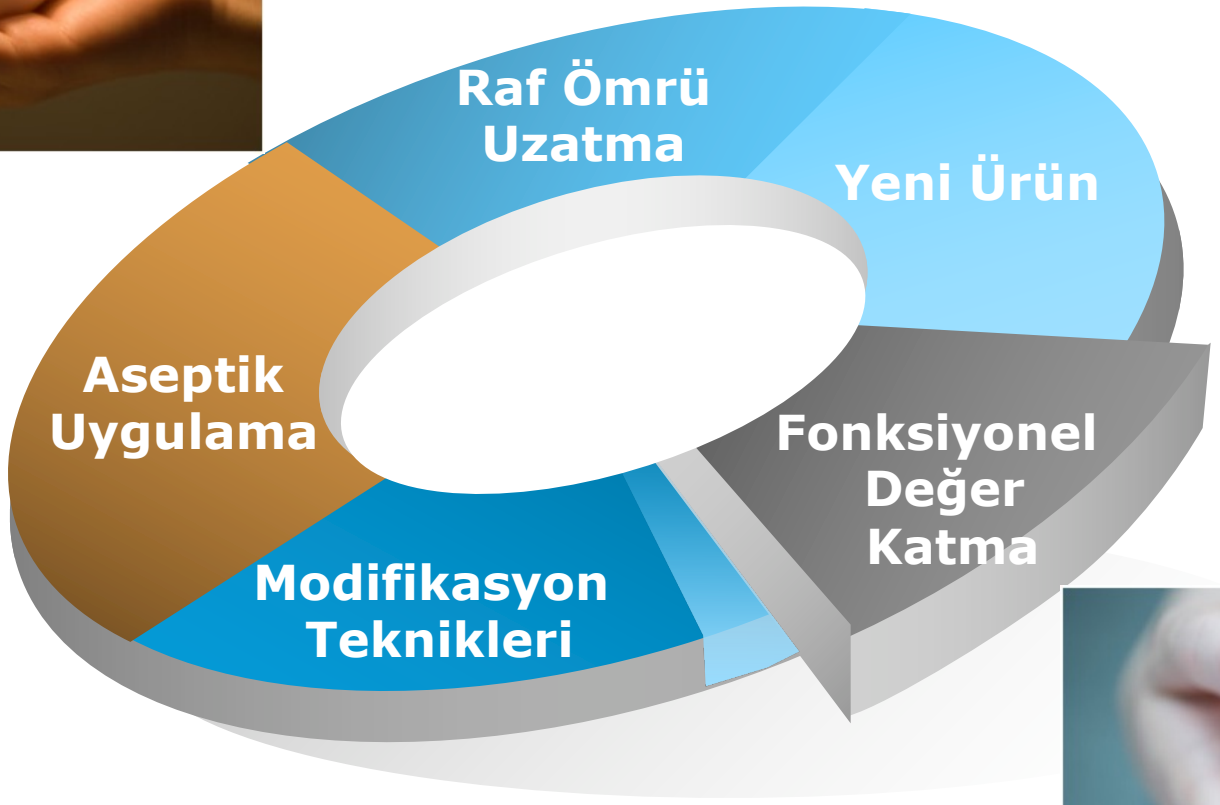
Frozen Liquid Egg Products

Yumurta Tozu Besin Değeri

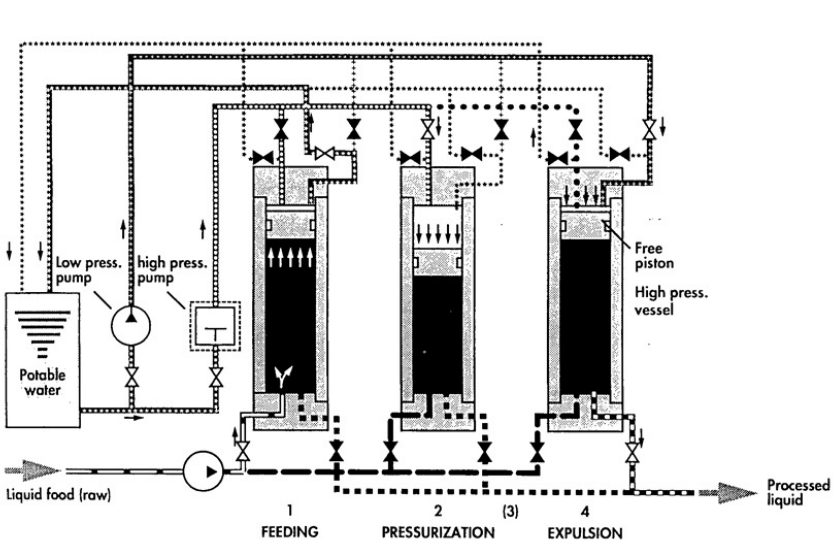
Toz (100 g)	Bütün	Sarı	Beyaz
Protein – g	47,35	34,25	81.1
Nem – g	≤ 4,0	≤ 4,0	≤ 8,0
Yağ – g	40,95	55,8	0
Kolesterol – mg	1715	2335	0
Karbonhidrat – g	4,95	3,6	0,8
Kalori - cal	594	666	382

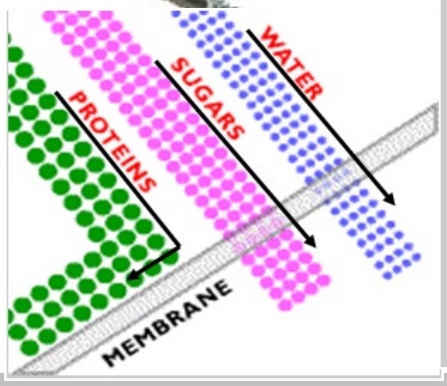
Kaynak: Agricultural Research Service, USDA

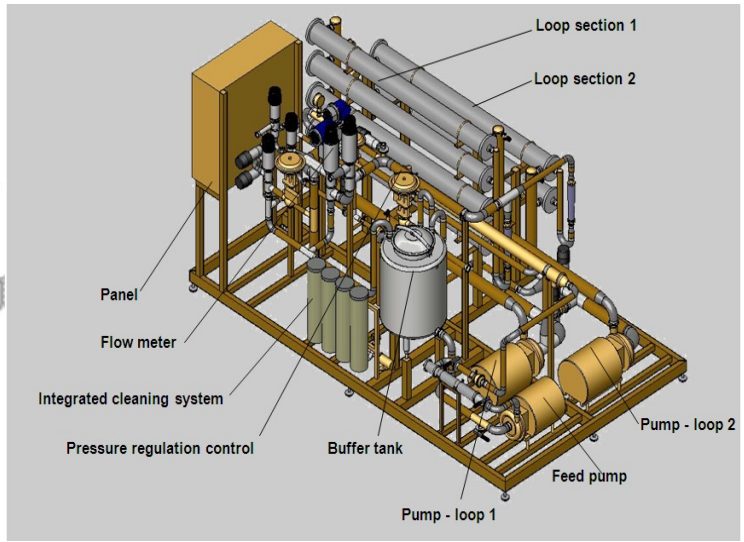
Proseste Fonksiyonel Yumurta



Yeni Teknikler







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Teşekkürler !

Muhammed YÜCEER