MOBA

GRADING - PACKING - PROCESSING

OvoPro

HANDLING OF RAW PRODUCT

THE PARTNER FOR PROFIT

www.moba.nl

Handling of raw product

'Up to 70% of the added value is created in this process step.'

The part of the process that takes place between breaking and pasteurizing is called the raw-product handling. Before the egg product is pasteurized, there are a number of required actions. This ranges from cooling and storing the product prior to pasteurization to creating added value for the end product by applying a certain recipe required by the end user.

Designing this part of the process correctly will determine the overall efficiency of the entire processing plant.

Specific focus needs to be on minimizing the contamination of the raw product because that will eventually determine the quality of the end product. This part of the process ensures consistent and customized products. To achieve the right product in the most efficient way, you need the correct tools. Designing this part of the process correctly will ensure that the overall performance of the processing plant is as consistent as possible.

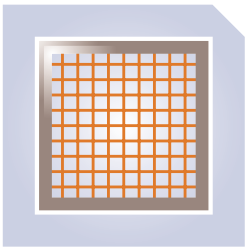
Choice of the correct components and procedures will determine the ability to achieve a consistent end product over and over again.

Moba OvoPro focuses on perfect solutions for filtration, cooling, storing, blending and homogenizing of the raw product. By studying the required specifications for your end products, we can create an environment for optimal profits combined with consistent quality.

Pot style filters

Self cleaning filters

Filtration



OUR FOCUS

- Choosing the right filter to fit your capacity and to ensure the longest possible production runs
- Dual filter solutions for small operations (ffi75 cph)
- Pot filter: Large capacity system for medium-sized operations (ffi200cph)
- Fully automatic self-cleaning filter for the large operations; also for high pressure applications (ffi800cph)

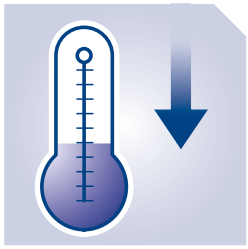
After the eggs have been broken and inspected, any shell fragments should be removed immediately from the product stream. Even though the shells were washed and sanitized, the porous egg-shell structure will always carry a certain bacterial load.
To limit the risk of further contamination, the egg products should first be filtered after breaking. This reduces the period in which the shell fragments remain in the liquid.
Another reason to filter directly after breaking is that at this point the egg temperature is more suitable for filtration. The lower viscosity of the egg before cooling allows you to use relatively narrow filters. This effectively results in better product filtration.

WE OFFER

- Different kinds of filtration options, depending on application and capacity:
- Dual filtration assemblies for small-capacity breaking operations or for additional product filtration before pasteurization or spray drying
- High-capacity pot-style filters for medium-size breaking operations that can handle the separated products up to 200 cases per hour
- Self-cleaning filters that can handle up to 800 cases per hour for every section and are available with 1- 3 individual filtration elements
- Each independently operated filter element can be supplied with 0.05, 0.08 and 1.0 mm perforations
- Compact, integrated filtering and cooling assembly, and all-in-one application that can be installed easy and quickly

Cooling heat exchanger

Cooling



OUR FOCUS

- Short cooling trajectory
- Multi-section capacity: small footprint
- Plate heat exchanger for optimal performance and lowest energy consumption
- Easy cleaning and low water usage when cleaning

The next step after filtration is to immediately cool down the product. Egg products, especially egg yolks, have exceptional nutritional value, which is also a perfect breeding ground for micro organisms. At temperatures between 30°C and 40°C certain micro organisms can double every 20 minutes in egg yolk.

Lowering the temperature will slow down the multiplication of micro organisms and decrease the contamination rate of the raw product. This is why it is critical to cool down the egg products quickly to temperatures below 39°F (4°C) immediately after breaking and filtering.

Less contamination at an early stage means less severe pasteurization. The result is better functional properties in the end product.

'Moba OvoPro's unique process know-how allows you to get the best possible cooling solution for your specific needs.'

Plate-cooling heat exchangers are specifically designed to cool down viscose liquids such as egg products in the most efficient way possible. The plates create a large cooling surface, but keep the footprint of the cooling heat exchanger small. Single-plate heat exchangers can be used for cooling. Keeping the pressure of the product higher than the cooling water prevents contamination even in the unlikely event of a minor leak.
The heat exchangers can be divided into sections, allowing you to cool different products quickly at the same time. There are different options for the frame. A straightforward tie-bar frame is simple and cost-effective while a versatile automatic frame enables quick opening of the plate exchanger for efficient cleaning and maintenance.

WE OFFER

- Designs to cool down high viscosity products like liquid egg in the shortest and most efficient way possible
- Small footprint, high capacity and excellent cooling abilities
- Multiple- plate patterns designed for specific egg-product handling
- Single-wall plates with simple and foolproof gasket exchange

- Robust, over-the-plate clip gaskets, available in different materials
- A product range from 500 to 20,000+ liters per hour
- Computerized or semi-automatic liquid distribution systems
- Tie-bar frame: Low-cost alternative with 6 to 8 tie bars to keep the plate pack closed Ideal for applications that do not require daily or weekly access for quality control or government inspections
- Spindle frame: Single and double spindle options for quick access for maintenance and inspection
- Fully automated frame: system with a hydraulic closer. The unit has independent hydraulic rams with an exclusive locking mechanism that allows for the hydraulic pressure to be released during operation.
- Compact integrated filtering and cooling assembly. All-in-one application, which can be installed easily and quickly

Blending

OUR FOCUS

- Handling only products that need blending
- Better and quicker mixing of ingredients with the highest efficiency
- Our vision for high-volume plants it to use smaller and specifically designed high-capacity blending units:
  - reduced investments
  - low operating costs
- 50-200cph tank mixer
- >200cph high-speed mixer

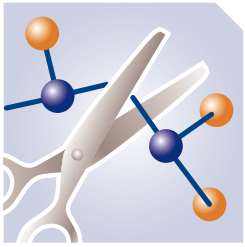
After breaking and separating the eggs, the egg components have to be 'configured' for the specific applications required by end users. These components always need to be consistent with regard to their properties. When creating egg-mixes or adding ingredients to the raw product, the processor needs to have the ability to blend all the different components properly into a uniform product.
This could be done in the common storage tanks since they always have an agitator to be able to maintain a consistent temperature throughout the tank. This method might be acceptable for smaller operations, but in the larger plants it might lead to an overcapacity in storing, just

for blending purposes. Having the ability to quickly and thoroughly blend specific batches in dedicated specialized (smaller) blending tanks for larger plants would be more effective. High-speed mixers allow you to prepare customized quantities instead of deciding on volumes in advance. Blending should always be performed BEFORE pasteurizing. Blending afterwards is risky because of recontamination to the product.

WE OFFER

Independent, standard or high-speed blending systems. When configured properly, they increase the plant's flexibility while reducing processing costs and unnecessary product- handling.
Blending systems in 500 or 1000 liter capacities and in one or two tank configurations.
All our blending solutions are fully CIP cleanable.

Stabilization



OUR FOCUS

- Ability to add enzymes used for stabilization of egg products, independent of the supplier.

When creating an egg product for a specific purpose, it is all about making the product as stable as possible for the intended application. For example, stabilized egg yolk has improved emulsifying properties that give mayonnaise a higher heat stability and improved creaminess. If however, you would want to use this specific product for making custard, you might find that the improved emulsifying properties have also reduced the gelation properties of the egg yolk. Enzymes are used for stabilization. They stabilized the yolk or whole egg in order to break down certain (fatty) molecules in the egg. This enables higher pasteurization temperatures and a better specific end product: **The egg product is converted into a specific ingredient.**

WE OFFER

- Equipment designed to handle all kinds of specific enzymes. You can produce the widest range of ingredients in this way.
- Designs that can handle enzymes from various producers.

Fermentation installation

De-sugaring

OUR FOCUS

- Ability to add enzymes or yeast for de-sugaring of albumen
- Perfect performance with enzymes that come from various suppliers

Albumen is usually pasteurized in a hot room after being spray dried. The reason for this is that egg whites are very heat sensitive and lose their functional properties at relatively low pasteurizing temperatures. Although the hot room preserves the albumen's functional properties, spray-drying the albumen causes the glucose in the egg whites to 'brown' the dried product. To avoid this side effect, the glucose needs to be removed from the albumen before drying. Removing glucose is known as de-sugarization and it is a fermentation process based on enzyme or yeast treatment. De-sugared albumen is subsequently spray-dried and kept into a hot room for a certain amount of time for pasteurization. This method preserves the whipping abilities of the dried end product.

WE OFFER

- Products which can be adapted to handle a various range of yeast or enzyme suppliers to carry out the de-sugarization process.

Storage

OUR FOCUS

- Avoiding over dimensioning; too much tank volume in between process steps destroys flexibility.
- Perfect balanced storage will result in most cost-effective production runs.
- Special tanks for egg liquids are needed with special polished welding and without any horizontal surfaces.

The quality of the tanks should first of all be suited for egg products. As all egg products in every process step carry a certain bacterial load, even the smallest remaining quantity will

Shear homogenizing

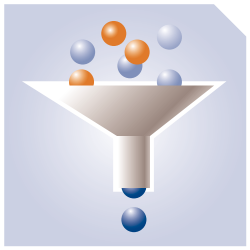
Shock

destroy the quality of next production run. Any defects in the design or construction could result in a tank where micro organisms can 'hide' from the cleaning and sanitizing process and destroy your valuable products. Many cheap tanks that will do for many types of liquids are not suitable for egg processing. Polished metal, no horizontal surfaces and perfect polished welds are an absolute must.
Product storage and blending tanks play a key role in the flexibility and capacity of the logistics of a processing plant. The most important aspect is to choose the right balance between efficiency and economics in a precise manner. Since the purpose of a tank is storing, it is important to always have sufficient capacity. At the same time, it is vital to avoid unutilized storage capacity.
Another important feature of every storing tank is cleanability. In order to be able to switch quickly from one product to another, cleaning and sanitizing of a tank needs to be as fast and thoroughly as possible.

WE OFFER

- Stainless steel storage tanks that meet 3-A™ sanitary standards
- Gentle agitation for producing a homogeneous product
- All our storage equipment can be CIP cleaned.
- Single-wall tanks for installation inside refrigerated rooms
- Insulated and refrigerated or insulated/jacketed for maximum production schedule flexibility
- Silo-style storage tanks for external installation

Homogenizing



OUR FOCUS

- Shear homogenizer systems produce a homogenized product at lower cost per kg product than conventional high-pressure units. Furthermore, they offer the lowest possible maintenance costs.
- Using the Shock system results in a superior homogenized product with the best functional properties. It allows pasteurization at higher temperatures for extended periods of time without cleaning yet with saving water, chemicals and labor.

Shock rotor

Homogenizing breaks down the fat particles in the liquid and alters the proteins that are responsible for coagulation during pasteurization. Proper homogenizing allows you to pasteurize longer at higher temperatures. However, pasteurizing at higher temperatures will affect functional properties. Homogenizing is actually mixing egg products on a microscopic level. This will slow down the natural separating process of two individual liquids, resulting in a nice cosmetic appearance of the product. This is of special importance for scrambled egg mixtures, where vegetable oil is added to the egg product.

There are three principles of homogenizing:

- The first is homogenizing by pressure: The product exits the high-pressure chamber through a very narrow gap at a very high speed, which breaks up the fat particles.

It is important to realize that all homogenizing methods will damage the proteins in the egg products to a certain extent. Therefore, homogenizing has a certain negative effect on the functional properties. To limit the impact of homogenizing to the absolute minimum, the next two principles are recommended:

- Shear homogenizing: The product travels through a very fast rotating screen inside a stationary screen. This procedure creates a motion that breaks the fat particles in the yolk into smaller particles. The impact on properties is limited while the principle is the most cost-effective system.
- A third homogenizing method is known as the Shock. This method is basically a non-contact homogenizing action, based on cavitation. This is induced into the liquid by a very fast-spinning special rotor. The special shape of the rotor, in combination with the high speed, creates vacuum bubbles. These bubbles implode immediately, releasing energy from the implosions, which is transferred into the liquid by means a shock wave. This results in an optimal homogenization of the liquid without any damage to its functional properties. This process also generates heat that can be used for very precise final heating. More information about the Shock method is found in the brochure about Pasteurizing.

WE OFFER

- Shear homogenizing:
  - Economic and effective
  - Low maintenance and low production costs
  - CIP cleanable
- Shock:
  - Superb non-contact homogenizing
  - Superior homogenized product without loss of functional properties
  - Longer pasteurization runs without cleaning
  - Reduction of productions costs when combined with final heating purposes

Reverse Osmosis

OUR FOCUS

- Preparing for the most efficient spray-drying process
- Saving energy
- Not reducing the functional properties
- Longer running times between cleaning procedures

Egg products can be converted into powder by spray drying. The less water contained by the egg liquids before spray drying, the more efficient the process. There are processes to 'pre-remove' water that will result in a lower energy consumption during the spray drying process. It also enables longer running periods before you need to clean the entire spraying line.

The two most commonly used processes are 'Ultra filtration' and 'Reverse Osmosis'.
In both cases, the liquids are filtered through a membrane. Ultra Filtration is based on size exclusion, in other words, egg-liquid particles cannot pass the membrane while water can. The downside of this technology is that some minerals and proteins are also able to pass through the filter and have a negative effect on the properties of the liquid end-product. For this reason, some legislations do not allow this method (e.g. USDA).
Osmosis is the natural movement of solvent from an area of low solute concentration, through a microscopic membrane, to an area of high solute concentration with no external pressure. By applying pressure the process is reversed ('Reverse Osmosis') so that concentration rates and pressure differences create water on one side of the membrane and egg liquid, with - in case of albumen - up to 23% dry matter, at the other side. This is the most efficient pre-treatment possible.
Moba OvoPro can implement both technologies but advises Reverse Osmosis in most cases Reverse Osmosis requires higher pressures than in Ultra filtration and that entails using special piston pumps and ceramic membranes. Although the initial investment for Reverse Osmosis is somewhat higher, the return on investments is much better.
Reverse Osmosis will make the spray drying process more efficient and functional properties will be preserved better.

WE OFFER

- Removal of approximately 50% of the water content of albumen
- Up to 23% dry matter

Spray nozzle section

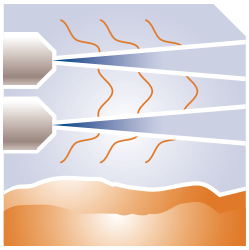
Bag house of the spray drying Chamber

- Ceramic membranes that preserve all functional properties of egg liquids
- Piston pumps for high pressure, high efficiency and CIP, (Cleaning in Place).

Spray drying albumen

OUR FOCUS

- Vbox spray dryer: the most efficient system up to 750kg water evaporated / hour
- Minimized product retention
- Highest energy efficiency (heat recovery can save up to 30% on fuel costs)
- Easy cleaning and servicing
- Super-long life cycle (in and outside fully-welded stainless steel)



After completing a liquid-egg product, two methods are available for long-term preservation: freezing or spray drying. Both methods result in shelf life of approximately one year, but spray drying reduces transport costs to the minimum because of the low weight and volume (9 kg of liquid albumen is reduced to approximately 1 kg powder). In addition, the powder does not require cooled storage. Powder products also have less risk of contamination as a result of mishandling; in other words, it is a relative safe product to handle and transport.

The principle of spray drying is spraying the egg liquids with high pressure (130-200 bar/ 2000-3000 psi) into hot air. Heating systems can operate by direct use of gas, steam coils or by heated air (indirect air system). Temperatures vary from 160°C / 320°F (steam coils) to 194°C / 381°F (direct use of gas). Within 12 seconds after spraying, the egg product turns into powder, ready to be packed. Humid air is filtered to retain as much powder as possible and the powder is automatically collected from the drying chamber by using augers or pusher bars.

In order to maximize performance and avoid loosing powder particles, the out-flowing air is filtered through cyclones or bag-shaped filters. The airflow in cyclone filters is arranged as such that even very fine particles are separated by centrifugal force. For better performance (3.7% more powder collected) fabric filters are preferred, also because they are easier to maintain and clean. Regular cleaning is fully automatic by applying reversed pulses of air.

Whole egg and yolk are pasteurized before spray drying while albumen is sprayed in an unpasteurized form and later pasteurized as powder in a hot room. This is the best method for preserving the functional properties of albumen. Since albumen contains glucose, it must be removed before spraying to avoid browning (caramelization).

Spray drier control panel

After spraying, the average moisture in the resulting powders is 6-7% for albumen and 3-4% for whole egg and yolk. Typical albumen powder products are for whipping, non-whipping or instant dissolving. The instant dissolving type requires a special, multi-stage agglomerating dryer in order to let the particles agglomerate to bigger particles. The typical applications for whole egg and yolk powders are standard quality, glucose-free and free-flowing products.
In addition to adjusting the spray-dry conditions to any of the above products, agents can also be added before spray drying, such as a whipping agent in albumen or an agent that increases the flow ability in various products. Stopping and re-starting a spray dryer consumes time and energy. To achieve the best return on investment, the capacity of a spray dryer must be adjusted appropriately for the entire plant. An accurate calculation based on plant-related requirements is needed to choose the most effective type of spray dryer.

WE OFFER

- V-box, flat bottom and tower spray dryers depending on capacity and final product requirements
- Multi-stage agglomerating dryers
- High pressure pumps and specific nozzle systems to atomize the liquid into the drying chamber in combination with hot air
- Forced air cooling of the spray nozzles to eliminate 'burn-on' of the product
- Air filtering via bag houses or cyclones
- Removal of the dried product from the drying chamber by means of augers or pusher bars
- Sifting and filling of the dried product
- V-Box spray driers increase from 100kg/h up to 750kg/h H_2O evaporation per hour
- For higher capacities 'Flat floor' or 'tower' spray driers are used. They can handle from 800kg up to 3,000kg H_2O evaporation per hour