Vegetable milks

The consumption of vegetable milks is constantly and significantly growing all over the world. The vegetable milk products are gradually changing the eating habits of many people both for their nutritional values and for their greater environmental and energy sustainability. During the growing and processing phases, the vegetable products, compared to the animal milk and dairy ones, demand less natural resources by generating at the time less CO₂ emissions.

Pieralisi Group, always sensitive to the environmental issues and to the sustainability of the planet, has applied its technology to the production processes of different kinds of vegetable milks, contributing to their constant qualitative and nutritional development. Pieralisi centrifugal decanters and separators, developed on the basis of the experience gained in the food industry, are today widely used in the various phases of separation requested during the production of vegetable milks, in particular:

1. Soya milk
2. Almond milk
3. Rice milk
4. Oat milk
1 Soya Milk  
2 Almond Milk  
3 Rice Milk  
4 Oat Milk

Process section involving Pieralisi technologies
A complete line for a vegetable milk clarification plant consists of the following components:

1. Dosing system
2. Mixer
3. Mill
4. Pump
5. Homogenizer
6. Flow meter
7. Heat exchanger
8. Decanter centrifuge
9. Decanter centrifuge control panel
10. Counter pressure valve
11. Tank
12. Centrifugal separator
13. Centrifugal separator control panel
14. Solid conveying system

**CIP washing system**

1. Decanter centrifuge
2. Centrifugal separator
3. Inner bowl washing circuit
4. External bowl washing circuit

**TYPICAL VALUES**

- **Milk 1st separation**
  - Up to 40 % DS
  - 1 ÷ 4 % DS

- **Milk 2nd separation**
  - 0,1 ÷ 1,0 % DS

- **Okara**
  - 18 – 22 % DS
Decanter centrifuge (CPA series)

Pieralisi decanter centrifuges are based on a modern technology that combines the ability of treating high solids content products with an excellent clarification efficiency. Separation performances are related not only to mechanical details but also to operating parameters (centrifugal force, flow rate, differential speed, liquid levels) and to the specific characteristics of the product (density, viscosity, quantity and dimension of solid particles). A main motor connected to the decanter shaft drives the bowl rotation. The extremely high centrifugal force generated inside the bowl is proportional to the rotational speed and to the bowl diameter. The product to be clarified enters through the feeding pipe, it passes in the diffuser to be distributed at the centre of the bowl and then it is accelerated.

The centrifugal force acting on the solid particles is responsible for the solid-liquid separation. Every decanter centrifuge can be tailored to any specific application, selecting between the different available configurations, components and devices. The centripetal pump (a) and the solid scraper (b) are the most common systems used in food applications.

Adjustable Centripetal Pump

In order to satisfy the specific needs of some applications and provide better performances and greater operating flexibility, Pieralisi Group has developed a special device called Adjustable Centripetal Pump (CPA), that allows to discharge the clarified liquid from the bowl. The use of the centripetal pump, integrated in the decanter liquid side terminal, permits to have the clarified liquid outlet under pressure, minimizing the contact with the air and the consequent oxidation phenomena or foam formation. Another specific advantage of the centripetal pump is to allow the continuous regulation of liquid exit level during operation; this option bestows to the decanter a great versatility, which results essential for an optimal management of the performances mainly in presence of products with variable concentrations and characteristics. The centrifugal pump uniqueness and peculiarities make Pieralisi’s CPA decanters particularly fit for the food industry, above all in the beverage sector. Pieralisi’s CPA centrifuges are available in both 2 or 3 phases version.

Solid scraper device

The dehydrated solid that is stockpiled on the bowl internal walls, is transported by a scroll and continuously emptied towards the side opposite to the liquid exit. In order to avoid the dehydrated solid accumulation and to guarantee a regular discharge, a specific pneumatic device (solid scraper) can be installed in the solid chamber. This device is automatically activated on the base of the parameters set by the operator on the control panel.

Centrifugal separator

Pieralisi vertical centrifuges represent the perfect technological solution to complete the separation process done with horizontal decanters. Vertical separators, taking advantage of their extremely high rotational speed, can reach centrifugal force values up to 10.000 g, far higher than decanters can reach. This very high centrifugal force is the key element that allows the separators to remove the solid particles that have not been grabbed in the previous separation steps, generating a highly pure clarified liquid. In addition in this case the reachable performances are linked to many factors, both constructive (disc type and design, inside volumes, liquid discharge levels and devices) and operative (flow rate, characteristic of the product, solid quantity and type, temperature). Pieralisi centrifugal separators for dairy products are specifically developed to reach the clarified milk maximum quality, by using internal components designed to remove also the smallest solid particles.

The product to be clarified enters into the top of the separator through the feeding tube, it is successively undergone to centrifugal force and then it is forced to pass through the hundreds of internal discs. The combined action of the centrifugal force together with the presence of the internal discs leads to the separation of the solid particles that are deposited on the bowl wall, where these are discharged in an automatic and intermittent way. The clarified liquid centrally climbs back towards the top of the bowl and it continuously exits through the centripetal pump. The discharge by means of the centripetal pump permits, as for decanters, to have a stream on pressure, to avoid the air contact and the consequent possible oxidation and to minimize the foam formation.

CIP washing system

In the food industry, the requirements of hygiene and cleanliness of the machineries are very restrictive and therefore they are absolutely unavoidable. Pieralisi centrifuges (both decanters and separators) are provided with a reliable and efficient CIP washing system (Clean in Place), that is automatically run from the control panel and can be set depending on every single process need. Two specific washing sequences are automatically started and handled by the control panel at the end of every operation cycle or in case of necessity. A number of dedicated solenoid valves, conveniently installed in the washing circuit, allows to feed the washing liquid in various points, both inside the rotating assembly and in its external part, between bowl and case. The CIP washing procedure, besides being a fundamental requisite to fulfill the food industry regulation, it represents a primary element in order to preserve the functionality of each single component of the separation unit and to maintain the highest level of reliability and performances in the course of time.

Electrical and control panel

“Pieralisi Control System” is divided in two main sections: power and control. The main switches and the variable frequency drives (VFD) for both decanter, separator and auxiliaries are placed in the power side. The control module is based on the latest generation PLC and MMI with a touch screen panel. A dedicated software, designed by Pieralisi automation department, is embedded in the PLC to automatically control the whole separation plant during each operating phase: start-up, duty, flushing, shutdown and emergency. The MMI allows navigating through several areas:

• separation process monitoring
• operating parameters control
• alarms detection and interlocks
• main parameters trend display

The last control release optimizes the separation performances and stabilizes the operation conditions by controlling the decanter centrifuge in “torque mode”. The logic is continuously calculating the torque on the decanter scroll, keeping it stable at its set point value, by smoothly acting on the scroll differential speed. The PLC automatically handles and controls the centrifugal separator in each operating step (start-up, duty, discharge, flushing and shutdown), monitors the main parameters and effectively manages any anomaly or emergency. All Pieralisi control panels can be equipped with a dedicated module suitable for remote connection, supervision, diagnostics and support.

Upon request, only the control unit (TCP) can be supplied: this solution does not consider the possibility to control the auxiliaries and does not have the electrical section with VFD and breakers.

Back pressure valve

In presence of liquid discharged by means of the centripetal pump, it is possible to control the clarified liquid pressure through a dedicated control valve (manual or automatic). The aforementioned regulation, besides sending the product to a certain distance from the discharge point without using any external pump, it significantly contributes to a more precise control of the clarified liquid quality that is obtained from the separation process.

Solid conveying system

The solid exiting from the decanter can be discharged by gravity in an underlying container or it can be moved in a lateral one, using an adequate horizontal or inclined scroll conveying system. The main control panel can handle every single component of the system, it automatically activates the start and stop sequences, in relation to the centrifuge effective working conditions. The Pieralisi’s decanter unique design allows installing the conveyor directly under the solid exit without any further civil work.

Solid conveying system

The Pieralisi’s decanter unique design allows installing the conveyor directly under the solid exit without any further civil work.

Adjustable Centripetal Pump

In order to satisfy the specific needs of some applications and provide better performances and greater operating flexibility, Pieralisi Group has developed a special device called Adjustable Centripetal Pump (CPA), that allows to discharge the clarified liquid from the bowl. The use of the centripetal pump, integrated in the decanter liquid side terminal, permits to have the clarified liquid outlet under pressure, minimizing the contact with the air and the consequent oxidation phenomena or foam formation. Another specific advantage of the centripetal pump is to allow the continuous regulation of liquid exit level during operation; this option bestows to the decanter a great versatility, which results essential for an optimal management of the performances mainly in presence of products with variable concentrations and characteristics. The centrifugal pump uniqueness and peculiarities make Pieralisi’s CPA decanters particularly fit for the food industry, above all in the beverage sector. Pieralisi’s CPA centrifuges are available in both 2 or 3 phases version.

Solid scraper device

The dehydrated solid that is stockpiled on the bowl internal walls, is transported by a scroll and continuously emptied towards the side opposite to the liquid exit. In order to avoid the dehydrated solid accumulation and to guarantee a regular discharge, a specific pneumatic device (solid scraper) can be installed in the solid chamber. This device is automatically activated on the base of the parameters set by the operator on the control panel.

Centrifugal separator

Pieralisi vertical centrifuges represent the perfect technological solution to complete the separation process done with horizontal decanters. Vertical separators, taking advantage of their extremely high rotational speed, can reach centrifugal force values up to 10.000 g, far higher than decanters can reach. This very high centrifugal force is the key element that allows the separators to remove the solid particles that have not been grabbed in the previous separation steps, generating a highly pure clarified liquid. In addition in this case the reachable performances are linked to many factors, both constructive (disc type and design, inside volumes, liquid discharge levels and devices) and operative (flow rate, characteristic of the product, solid quantity and type, temperature). Pieralisi centrifugal separators for dairy products are specifically developed to reach the clarified milk maximum quality, by using internal components designed to remove also the smallest solid particles.

The product to be clarified enters into the top of the separator through the feeding tube, it is successively undergone to centrifugal force and then it is forced to pass through the hundreds of internal discs. The combined action of the centrifugal force together with the presence of the internal discs leads to the separation of the solid particles that are deposited on the bowl wall, where these are discharged in an automatic and intermittent way. The clarified liquid centrally climbs back towards the top of the bowl and it continuously exits through the centripetal pump. The discharge by means of the centripetal pump permits, as for decanters, to have a stream on pressure, to avoid the air contact and the consequent possible oxidation and to minimize the foam formation.

CIP washing system

In the food industry, the requirements of hygiene and cleanliness of the machineries are very restrictive and therefore they are absolutely unavoidable. Pieralisi centrifuges (both decanters and separators) are provided with a reliable and efficient CIP washing system (Clean in Place), that is automatically run from the control panel and can be set depending on every single process need. Two specific washing sequences are automatically started and handled by the control panel at the end of every operation cycle or in case of necessity. A number of dedicated solenoid valves, conveniently installed in the washing circuit, allows to feed the washing liquid in various points, both inside the rotating assembly and in its external part, between bowl and case. The CIP washing procedure, besides being a fundamental requisite to fulfill the food industry regulation, it represents a primary element in order to preserve the functionality of each single component of the separation unit and to maintain the highest level of reliability and performances in the course of time.

Electrical and control panel

“Pieralisi Control System” is divided in two main sections: power and control. The main switches and the variable frequency drives (VFD) for both decanter, separator and auxiliaries are placed in the power side. The control module is based on the latest generation PLC and MMI with a touch screen panel. A dedicated software, designed by Pieralisi automation department, is embedded in the PLC to automatically control the whole separation plant during each operating phase: start-up, duty, flushing, shutdown and emergency. The MMI allows navigating through several areas:

• separation process monitoring
• operating parameters control
• alarms detection and interlocks
• main parameters trend display

The last control release optimizes the separation performances and stabilizes the operation conditions by controlling the decanter centrifuge in “torque mode”. The logic is continuously calculating the torque on the decanter scroll, keeping it stable at its set point value, by smoothly acting on the scroll differential speed. The PLC automatically handles and controls the centrifugal separator in each operating step (start-up, duty, discharge, flushing and shutdown), monitors the main parameters and effectively manages any anomaly or emergency. All Pieralisi control panels can be equipped with a dedicated module suitable for remote connection, supervision, diagnostics and support.

Upon request, only the control unit (TCP) can be supplied: this solution does not consider the possibility to control the auxiliaries and does not have the electrical section with VFD and breakers.
## Decanter Centrifuge (serie CPA)

### ROTATING ASSEMBLY
- **Bowl**
  - Shallow cone
  - Inner surface with liners
  - Inner surface with grooves
  - Wear protection solid discharge bushings (replaceable)
  - Single flight
  - Variable pitch flight
  - Flight with windows
  - Flight wear protections: sprayed tungsten carbide

### MATERIALS
- **Bowl and Scroll**
  - SAF 2205 Duplex
- **Case**
  - AISI 316 stainless steel
  - Stainless steel cylindrical body
- **Scroll**
  - Stainless steel solid-liquid chambers
  - Stainless steel subframe
  - Painted carbon steel subframe
- **Parts in contact with the product**
  - Stainless steel

### EXECUTION
- **Installation area**
  - Tailored on the application and international standard

### LUBRICATION
- **Gearbox**
  - Oil bath (tailored on the FDA specifications)
- **Bearings**
  - Automatic greasing (grease tailored on the FDA specifications)

### PROCESS CONFIGURATION
- **Liquid outlet**
  - Interchangeable liquid outlet levels
  - Liquid discharge level adjustable during operation (CPA)

### DRIVES
- **Bowl drive**
  - Electric motor
- **Scroll drive**
  - Fixed differential speed
  - Electric motor (back drive)
  - Hydraulic motor
- **Control panel**
  - Counter pressure valve
  - Cooling fan
- **Solids scraper device**
  - Cip washing system

### DECANTER OPTIONS
- **Kits and Systems**
  - Control panel
  - Manual activation of the solid discharge
  - Automatic activation of the solid discharge
  - Cip washing system

### PLANT OPTIONS
- **Kits and Systems**
  - Filtering unit
  - Constant level feeding system
  - Feeding pump
  - Flow rate measurement kit
  - Heating system

## Centrifugal Separator

### PROCESS CONFIGURATION
- **Liquid discharge**
  - Single outlet under pressure
- **Solid discharge**
  - Manual
- **Type of separation discs**
  - Clarifier

### MATERIALS
- **Bowl**
  - SAF 2205 Duplex
- **Cover**
  - Stainless steel
- **Frame**
  - Cast iron with stainless steel inner protection
- **Wet parts**
  - Stainless steel

### PROTECTION
- **Gaskets**
  - High wear and corrosion resistant
- **Seal**
  - With wear and corrosion special protection system

### TRANSMISSION
- **Type**
  - Gears
  - Belts
- **Lubrication**
  - Oil bath (tailored on the FDA specifications)
  - Oil with forced circulation cooling system

### EXECUTION
- **Installation area**
  - Safe area

### INSTALLATION
- **Type**
  - Stand alone separator with vibration absorber and anchor device
  - Separator on stainless steel base
  - Stainless steel skid equipped with control panel and auxiliary units

### SEPARATOR OPTIONS
- **Kits and Systems**
  - Control panel
  - Manual activation of the solid discharge
  - Automatic activation of the solid discharge
  - Cip washing system

### PLANT OPTIONS
- **Kits and Systems**
  - Filtering unit
  - Constant level feeding system
  - Feeding pump
  - Flow rate measurement kit