



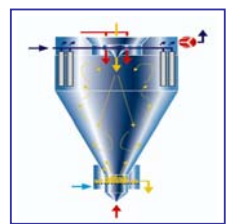
Process Engineering
Division

Niro

First Industrial Spray Dryer With Integrated Filters and Fluid Beds (IFD™)

Installed at COLUN Chile

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Introduction

In the heart of the dairy production region of Chile, 900 km south of the capital Santiago, a group of 70 farmers of the town of La Unión, in 1949 founded the company Colun (Cooperativa Agrícola y Lechera de La Unión Ltda.), today grown to the biggest dairy cooperative in Chile with a daily reception of up to 1.3 million litres of milk, and thereby the biggest dairy plant in Chile.

At present Colun is the leading producer of cheese, butter, whey and milk powder and "Dulce de leche", and the second or third producer of fresh cheese, UHT milk and yoghurt, with a total of 200 distinctly referenced products distributed under their strong brand name to Chilean consumers. An important part of their products are also exported.

The plant is very well equipped with modern technology and highly automated processing equipment. For every project the technical team evaluates the different technological alternatives in order to make the best quality products at the lowest possible cost.

Colun has today three Niro evaporators and dryers. The first one was installed in 1981 and the second in 1998. Recently a new powder plant has been installed by Niro as part of an important investment plan, which the cooperative is developing to cope with the increasing amount of milk from the associates - with growth up to 10% annually. The new plant is to be used to produce top quality products for the Chilean and for international markets, which are accessible due to Chile's many commercial agreements with other countries.

Due to the convenience of the energy cost in Chile, Colun has focused on MVR evaporators and has gained strong experience with this technology delivered by Niro's Evaporator Division in France.

Colun has a small and very professional team, where experience is respected and through the years it has developed what can be called a "Colun culture", meaning the way business is handled.

The General Manager, Mr. Eduardo Carrasco, is Colun's third General Manager in 56 years. Likewise, Operations Manager Mr. Jaime Recordon, who has a degree in Dairy Engineering from France, is the company's third chief at the plant.

New professionals have been hired in recent years in different areas such as sales, marketing, strategic planning, production, product development and engineering to assure the continuity and the future development of the cooperative.

COLUN factory with the new Integrated Filter Dryer, IFD™



COLUN investing for the Future

When the visionary management of Colun in 2005 decided to invest in their third Niro milk powder processing plant, their focus was on new technology, which would provide a first-class final product produced under conditions that would give them:

- Production flexibility
- Low energy consumption per kg powder
- Protection of the environment by low powder loss
- Low noise level
- Low amount of effluent from CIP

The project was defined for Niro to be from inlet of the product to the evaporator until the powder was in 25 kg bags on a pallet.



Powder Silos and IFD™ Dryer under construction

Evaporation

The evaporator is with Mechanical Vapour Recompression (MVR), a well-known and proven technology, but for this project with special features.

Low Thermophile Design

To avoid thermophile bacteria and their spores to develop, the preheating is done in a direct contact heater with no heat surface. The pasteurization and heat treatment of the milk is done by direct steam injection from 72°C up to 120°C, and with a holding time from 21 sec. to 240 sec. enabling production of Low - Medium and High Heat powders. To save energy the hot product is used to preheat the colder product in a direct contact flash

regenerative vessel at low Δ -t. Due to the special design the plant can run for 20 hours without intermediate cleaning. Cleaning agents are saved and effluent discharge reduced.

Wrap-Around Separator

The vapours from the evaporation are discharged through specially designed wrap-around separators before entering the MVR fan for recompression. This type of separator has a very good separation efficiency

at a very low pressure drop, resulting in a good energy utilization. A further big advantage is a reduced space requirement and smaller total surface, from where heat can be lost due to radiation.

Condensate Utilization

During the evaporation, a big amount of warm condensate is produced. This condensate is used to preheat the drying air for the spray dryer, and this saves a lot of energy.

Spray Drying

The spray drying plant, designed and supplied by Niro, has integrated filters and fluid beds, and is a "first of its kind" in industrial scale.

The IFD™ (Integrated Filter Dryer) design is based on well proved technology, however, the way this is combined makes it unique, and as such lives up to Colun's requirements and visions for the future.

When the concentrate is discharged from the evaporator, it is passed through a spiral tube heat exchanger with corrugated tubes, where the product is heated by means of water passing counter-currently to minimize the D-t for lenient heating and continuous operation.

The IFD™ plant is equipped with nozzle atomization. The short operator-friendly nozzle lances are easy to adjust during operation for optimal agglomeration.

After the primary drying in the chamber the powder is discharged into a static back-mix fluid bed similar to the one in a Multi-Stage Dryer. The powder is finally dried and cooled in a static plug-flow fluid bed surrounding the back-mix fluid bed. When instant whole milk powder is produced lecithin is added to the powder in the fluid bed.

All the process air is discharged through bag filters integrated inside the drying chamber at the periphery, where they hang down from the ceiling. The separation efficiency (≤ 10 mg/Nm³ air) is the same as that known from the Niro SANICIP™ CIP-able bag filter.

During operation the product, which is collected on the outside of the filter material,

is removed by a compressed air stream blown into the inside of each bag by means of a specially designed reverse jet air nozzle (patented) positioned above each bag.



Reverse Jet Air Nozzle

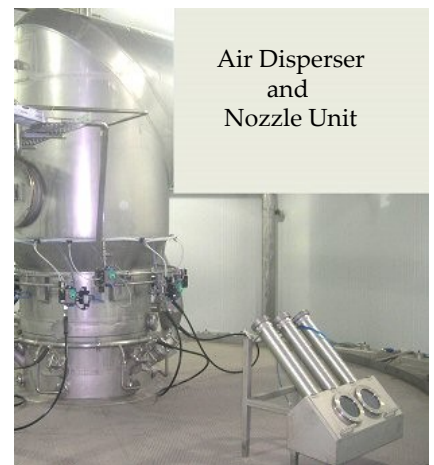
This results in a low pressure drop across the filter, i.e. reduced energy consumption and noise emission.

Another special feature (patented) in the IFD™ plant - inherited from the Niro SANICIP™ bag filter - is the wet cleaning of the bags from inside towards the dirty outside by means of CIP solution, which reduces the overall CIP liquid amount and thereby the effluent from the plant.

The final powder is passed through a sifter, from where the fines fraction can be returned to the nozzles for optimal agglomeration.

Advantages of the IFD™ Dryer at a glance:

- Low powder emission at low pressure drop resulting in more powder to sell and low energy consumption and low noise level.
- Very few moving parts in the dryer meaning less flexible connections and reduced spare part requirements.
- Compact layout resulting in smaller building volume
- No ducts or cyclones with powder to be cleaned resulting in easier CIP and reduced effluent discharge.
- Flexible production, as both agglomerated and non-agglomerated powders can be produced.



Air Disperser and Nozzle Unit

Powder Handling, Conveying and Bagging-Off

Powder Handling and Conveying

The new powder handling system for the Colun factory has been installed by Colby Powder Systems (member of the Niro Group). The system is designed to convey powders from an existing Niro Compact Dryer and the new IFD Dryer.

Proven "Colbytrans" vacuum dense-phase technology is used to gently transfer agglomerated instant whole milk powders to four silos for intermediate storage. The conveying of powder from storage silos to the packing in 25 kg bags is also achieved by a vacuum dense-phase, however here Colby's unique MAP (Modified Atmosphere Processing) system is installed to remove oxygen from the powder - at less than 0.5% O₂ - prior to feeding it into the packing system.

The COLBY conveying system gives Colun the following advantages:

- Easy cleaning and high level of sanitation
- Reliable operation with low powder damage
- Low residual oxygen levels
- Advanced control system and a complete scope of supply

Bagging-off

The bagging-off equipment is delivered by AVALON New Zealand, also a member of the GEA Process Engineering Division.

They will supply a completely new developed powder packer, the IBF-800.

It is based on the well known "Inline 800" with all its advantages, such as accuracy, sanitation standard, cleanability, and reliability. But the new design has a smaller foot-print, as only one single weighing station is needed to reach the same filling accuracy (± 25 g/25 kg bag).

The powder will be discharged from the prepassing hopper into the bag filler, which is equipped with an inert gas flushing system to ensure a maximum of 2% of O₂ in the bags.

To reduce manpower during bagging off, an automatic bag presenter is used. From the bag filler the bags are automatically conveyed via a neck stretcher onto the heat sealer, metal detector and check weigher before the bags are coded and placed on pallets.



AVALON Automatic Bag Presenter and Inline IBF-800 25kg bagging-off machine installed at the COLUN factory.

COLUN is ready for the Future

To demonstrate Colun's technical skills, they have - under supervision by Niro's specialists - been in charge of the whole installation including all the processing equipment, utility supply and electrical installations.

With this new "State of the Art" plant Colun will be able to produce powders of the best quality using minimum energy per kg powder.

The environment will be protected, their farmers will receive premium payment for their milk supply,

and together with Niro, Colun has lived up to their visions.



Model scale 1::25 of the new powder plant installed at COLUN in Chile

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