PROCESSING OF PLANT BASED FOOD

Solutions for future food

HOSOKAWA MICRON

HOSOKAWA MICRON GROUP

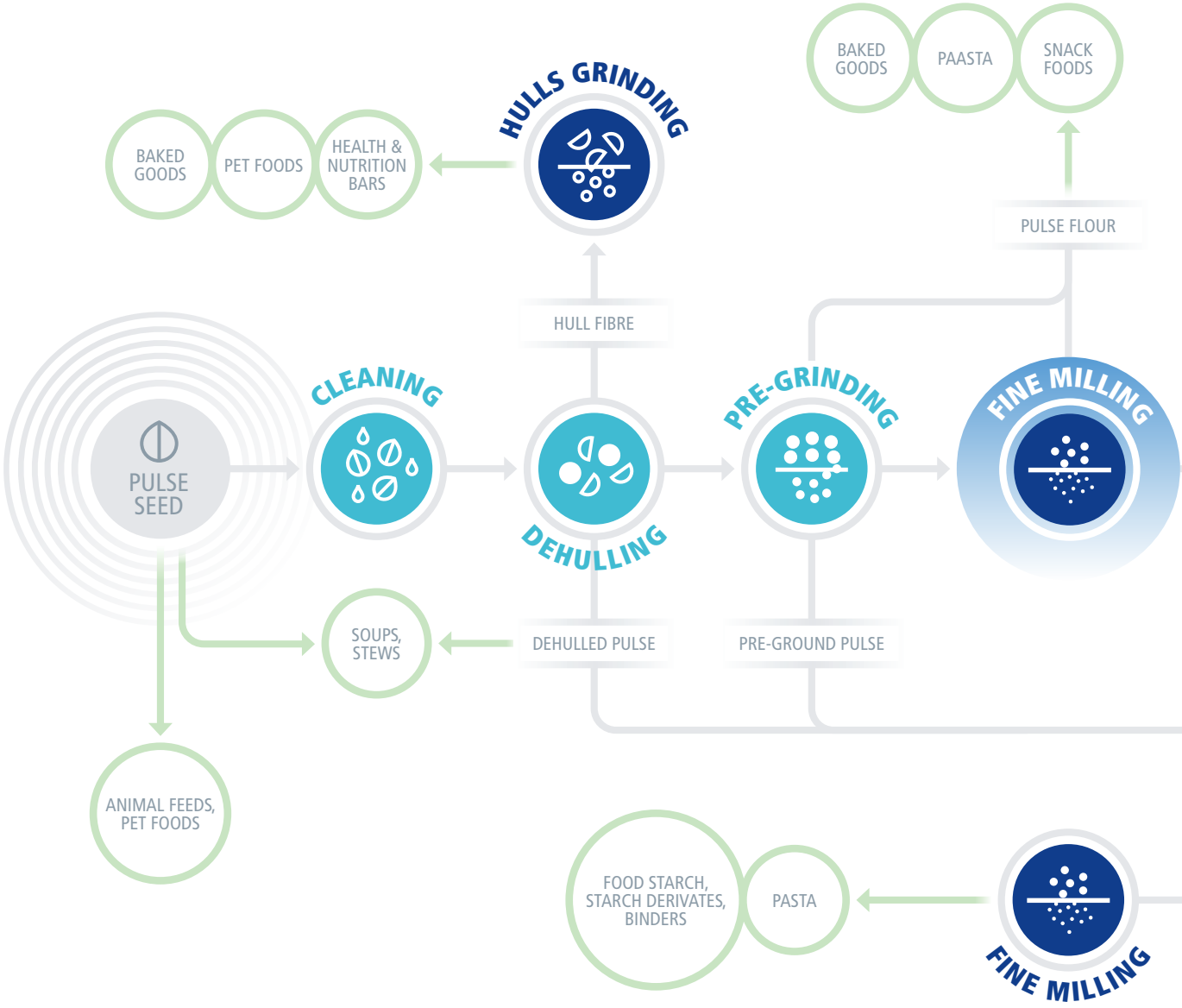
Müller´s Mühle, Germany

The Hosokawa Micron Group offers you innovative technology for customised solutions from one single source. Due to 120 years of experience in your process, we deliver the highest quality machines for your plant and product safety. Customers all over the world trust in our technologies and in the know-how of our experts.

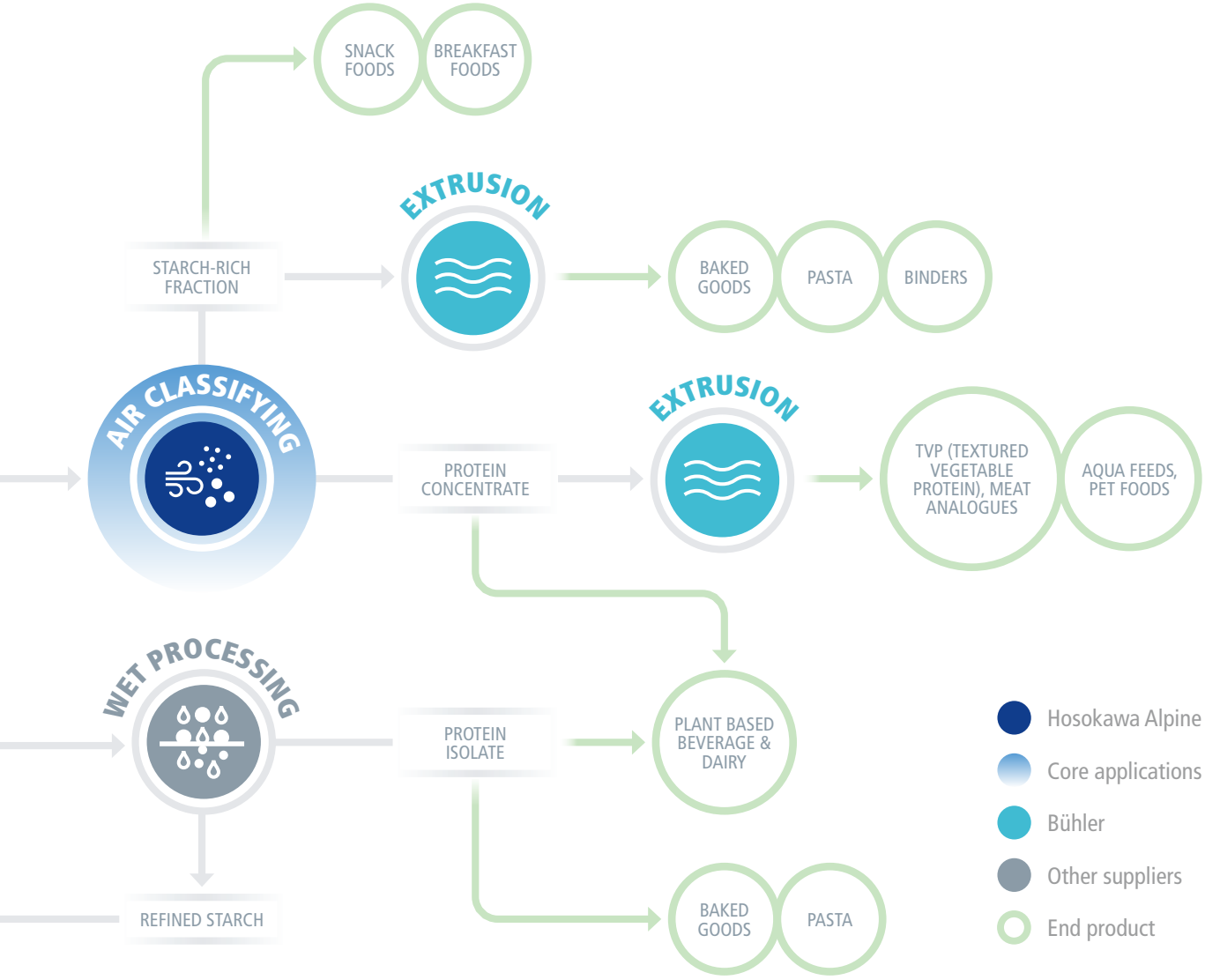
- **INNOVATIVE TECHNOLOGY FROM ONE SINGLE SOURCE**
- **HIGHLY ENRICHED PROTEIN CONCENTRATES**
- **CUSTOMISED PLANT SOLUTIONS FOR EVERY REQUIREMENT**
- **INTERNATIONAL FOOD SAFETY STANDARDS**
- **PROCESS DEVELOPMENT WITH MORE THAN 65 MILLS AND CLASSIFIERS AT 3,000 M²**

PULSE PROCESSING VALUE CHAIN

with our partners we can cover the complete process



The production of protein concentrates - for example with peas - is a high-tech process that involves various steps for which high performance machines and systems are required. **Hosokawa Alpine's** competences lie in the dry fractionation process. Dry fractionation means efficient separation of protein and starch in a dry, sustainable and efficient grinding and classification process. **Hosokawa Micron BV** offers machines and systems for mixing, agglomeration and sterilization (pages 13 – 15), that are needed in the downstream processes for the final applications. **Hosokawa Solids** supports customers throughout the process with solutions for storage, conveying, weighing and dosing (pages 16 – 17). If you are interested in a complete dry fractionation process, we can offer this together with our partner **Bühler**.



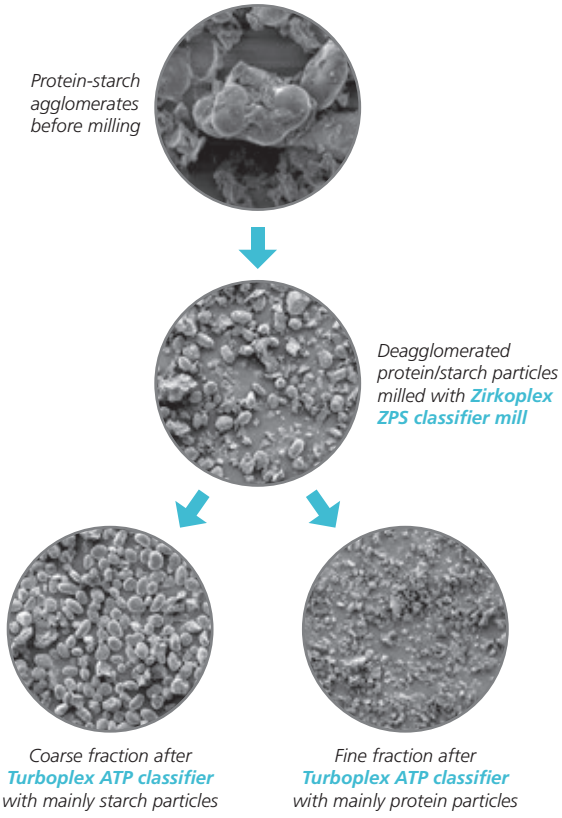
PROTEIN FROM PULSES

with ZPS air classifier mill and ATP air classifier (precision process)

Let's take a look at the microscopic image (SEM) of a yellow pea: The feed material (before grinding) shows protein and starch agglomerates. Hosokawa Alpine's special know-how is to grind in the "right" way to deagglomerate the smaller protein (~3µm) and the larger starch particles (15 – 40 µm) and then to fractionate the fine fraction and the coarse fraction. Hosokawa Alpine's dry fractionation of proteins (precision process) consists of an efficient fine grinding with the Zirkoplex ZPS classifier mill and a high-performance classification of this finely ground product with the Turboplex ATP classifier. As a result, there are two products: a fine product (protein concentrate) and a coarse product (starch concentrate).

ADVANTAGES OF DRY FRACTIONATION

- Efficient separation of protein and starch
- Energy efficient operation
- No water consumption
- Economical by-products
- No e-numbers required
- Chemical-free processing



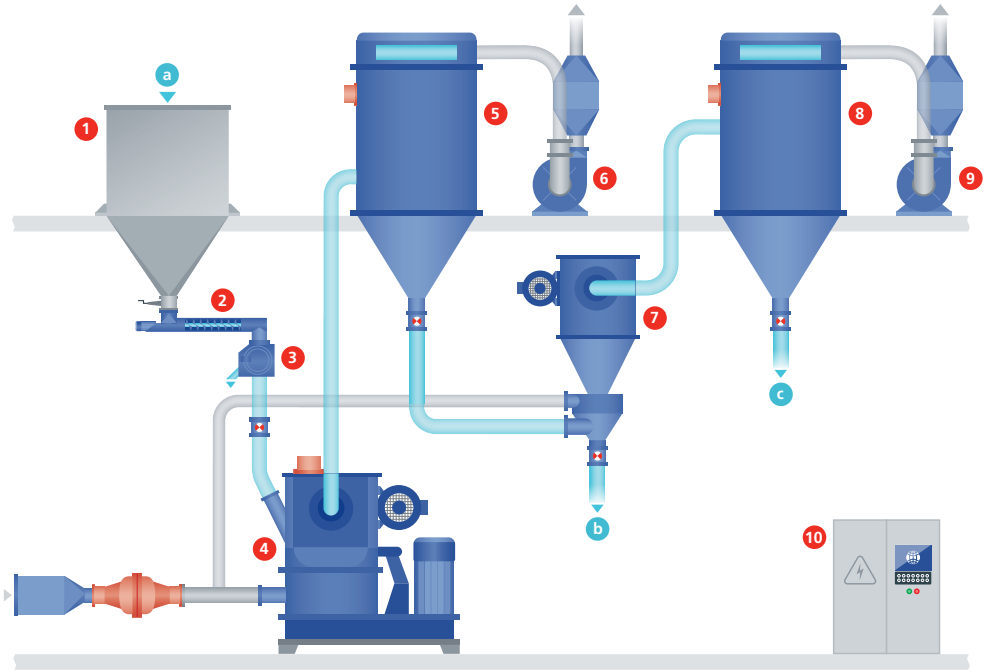
REFERENCE PRODUCTS

PRODUCT	*PRODUCT START PROTEIN CONTENT [% DM]*	*FINAL PROTEIN CONTENT [% DM]*	*YIELD OF FINES [% PROTEIN CONCENTRATE]*
Dry chickpeas	21	31–37	37–47
Dry dehulled faba beans	34	62–70	17–27
Dry dehulled green peas	23	51–57	19–23
Dry dehulled yellow peas	23 (27)	55–60 (70)	17–27
Dry red lentils	28	54–58	22–26

Please note: Pulses are subject to natural variations. To obtain exact results, the systems must be tested with your own products.

PROTEIN DRY FRACTIONATION PLANT

with ZPS air classifier mill and ATP air classifier



1	Feeding bin
2	Feeding screw
3	Metal separator
4	ZPS classifier mill
5	ZPS automatic filter
6	ZPS blower
7	ATP classifier
8	ATP automatic filter
9	ATP blower
10	Control cabinet

a	Feeding product
b	Low-protein fraction
c	High-protein fraction

PROTEIN FROM PULSES

with CW II pin mill and ATP air classifier (standard process)

Hosokawa Alpine's standard process for the dry fractionation of proteins consists of efficient fine grinding with the Contraplex CW II pin mill and high-performance classification of this finely ground product with the Turboplex ATP classifier.

For some products with a high fibre and/or oil content, the Contraplex CW II is the mill of choice for efficient deagglomeration (see page 11). For pulses, the standard process with the Contraplex CW II pin mill impresses with its compact installation (compared to the precision process with the ZPS classifier mill) as well as low energy consumption and low investment costs.
On the other hand, there are limits: The fineness and protein values are in the medium range, the product temperature is higher and pin mills are more susceptible to wear than classifier mills.

› *Innovaprot, Italy*

Standard process with CW II pin mill	***Precision process with ZPS classifier mill***
Compact installation	Flexible installation, but needs more space
Low investment	Bigger investment
Medium fineness and protein values	High fineness and protein values
Higher product temperature	Cooling for temperature-sensitive products
Sensitive to wear	Wear protection possible

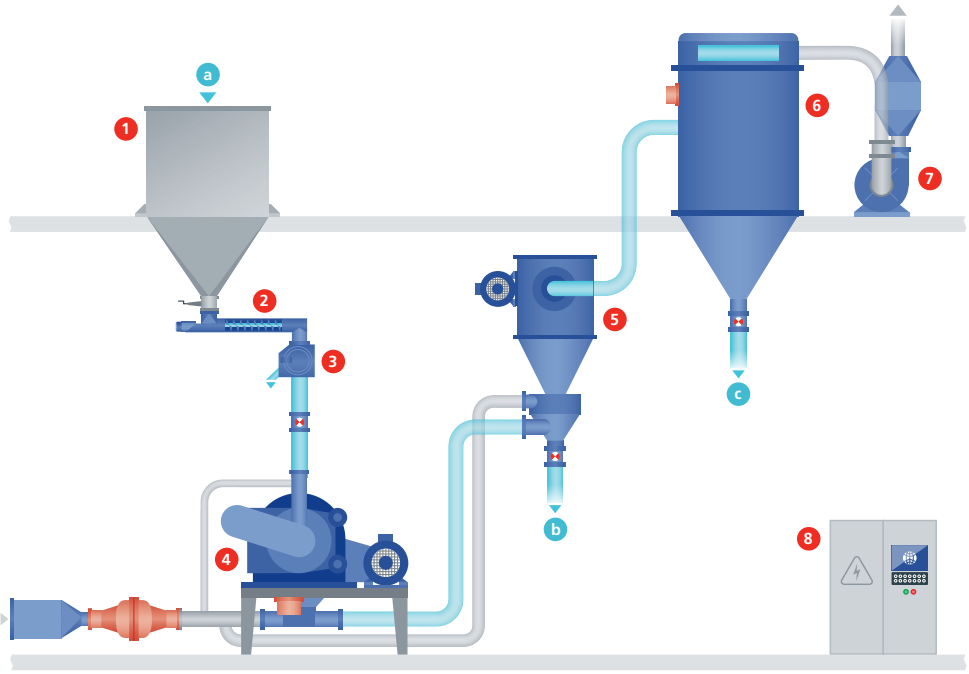
ZPS	200	315	400	200/4	500	630	750	1000
Scale-up factor	1	2	3	4	4.2	6	9	14
Mill drive [kW]	15	37	55	90	90	132	200	355
Classifier drive [kW]	5.5	7.5	11	4x5.5	15	22	30	45
Total air flow rate [m³/h]	1,200	3,000	4,800	4,800	7,500	12,000	18,000	30,000

ATP NG	200	315	400	200/4	500	315/3	630	315/6
Scale-up factor	1	2.5	4	4	6.25	7.5	10	15
Drive [kW]	7.5	10	22	4x7.5	30	3x18.5	45	6x18.5
Total air flow rate [m³/h]	1,400	3,500	5,600	5,600	8,800	10,500	14,000	20,000

CW II	250	400	630	800
Scale-up factor	1	2	5	9
Mill drive (housing/ door) [kW]	2x15	2x30	2x75	2x132
Total air flow rate [m³/h]	870	1,050	3,700	7,000

PROTEIN DRY FRACTIONATION PLANT

with CW II pin mill and ATP air classifier



1	Feeding bin
2	Feeding screw
3	Metal separator
4	CW II pin mill
5	ATP classifier
6	Automatic filter
7	Blower
8	Control cabinet

a	Feeding product
b	Low-protein fraction
c	High-protein fraction

PROTEIN FROM FUTURE SOURCES

with customized processes

There are several other sources of protein that were previously only used for the feed industry. The challenge of today is to bring this valuable protein back for human consumption. Especially under the aspect of sustainability, upcycling of food side streams is desirable.

EXAMPLES ARE

- Sunflower meal
- Pseudo cereals (e. g. Quinoa)
- Guar split
- Locust bean gum split
- Food side streams from brewery processes
- Food side streams from oil extraction processes
- and more ...

But as mentioned, not only protein is interesting for dry fractionation. Some other valuable ingredients can also be fractionated (e. g. fiber fractions, see beta-glucan on page 12). Moreover, the (fibreous) hulls of pulses (see pages 6 – 9) can be finely ground with the ZPS classifier mill for their final application (e.g. pet food, cookies and brownies). Future projects may revolve around the field of wet/dry factionation.

IF YOU HAVE ANY OTHER PRODUCTS THAT COULD BE CONSIDERED FOR DRY FRACTIONATION, **WE ARE HAPPY TO DO TRIALS WITH OUR TEST EQUIPMENT!**

DEVELOP YOUR PROCESS

with a multiprocessing system

Are you still in the development stage and looking for the right process for your product? Then a multiprocessing system could be the solution! The multiprocessing system is a mobile and very flexible concept: different mill / classifier types can be integrated into one system. Therefore, it is possible to quickly switch between the required units. This is very useful for developing various products or applications.

ADVANTAGES

- High flexibility
- Well-known and proven Alpine mills, only in lab size
- Perfect for development projects or smaller batches
- Short changeover and assembly times

» *Would you like to know more?*

In our test center are multiprocessing plants for doing feasibility tests installed. Beside that various research institutes work with our multiprocessing plant in the field of dry fractionation. Our customer IMPROVE was looking for a sustainable production for protein dry fractionated plant flours. In this, they identified dry fractionation to have a huge development potential to produce protein-rich food ingredients. To find the best solution, IMPROVE used a multi-processing system from Hosokawa Alpine.

More info

PROTEIN FROM GRAINS AND CEREALS

with customized processes

WHEAT AND RYE | For wheat and rye you can choose the standard process (see page 8/9) with the Contraplex CW II pin mill and the Turboplex ATP classifier or, if you are aiming for higher protein contents, the precision process (see page 6/7). Depending on the amount of protein before processing, different amounts / yield of protein are obtained.

OATS AND BARLEY | Oats and barley contain beta-glucan as a valuable ingredient. Due to the high fat content of oats, it is mandatory to use the Contraplex CW II pin mill for fine grinding (standard process with CW II and ATP, see page 8/9). A further de-fatting step of oats can additionally improve the process properties for an efficient fractionation. As opposed to the protein dry fractionation the beta-glucan is here collected in the coarse fraction. To obtain higher beta-glucan values, the grinding-classification process can be repeated several times.

SOY I Hosokawa Alpine can offer various solutions for soy processing:
Pre-treatment: Pre-Crushing of the soy beans and dehulling of soy beans
Fine grinding of: full-fat soya beans, roasted soy beans, extracted soya flakes, extruded soya flakes (Wenger Process) and soy protein concentrates (SPC)

RICE I Process technology for tomorrow includes fine grinding of rice in its various forms: may it be rice hulls, rice flakes, rice protein or rice starch.

BLENDING

Gentle mixing without product distortion

Besides mixing accuracy, important points of attention for mixing are aspects such as heat generation, product distortion and yield. All mixers are flexible in operation and can be used for various batch sizes from 10 to 100 % filling without compromising to quality.

The Nauta® conical screw mixer is especially suited to processing delicate products, offering gentle mixing without product distortion and constant product quality.

FEATURES AND BENEFITS

- Gentle mixing without product distortion
- Batch sizes from 5 to 80,000 litres
- Perfect mixing quality and accuracy
- Fast and complete discharge from a bottom discharge

Nauta® conical screw mixer

The CPM conical paddle mixer is a multi-purpose mixer for processes where high accuracy and fast mixing with limited product distortion are important.

FEATURES AND BENEFITS

- Gentle and fast mixing
- Batch sizes from 20 to 20,000 litres
- Compact and simple design
- Suitable for mixing, drying and reaction processes

CPM conical paddle mixer

STEAM STERILISATION

of plant-based proteins

The Conical Paddle Dryer offers a flexible, economical and environmentally safe batch process for sterilizing plant-based proteins.
It ensures optimal removal of all pathogenic organisms and germs, with minimum risk of product distortion.
After sterilisation, the product moisture content can be brought to the desired level by vacuum drying. The unique design allows for quick product changes.

FEATURES AND BENEFITS

- Batch volumes from 200 up to 10.000 litres
- Sterilisation, drying and mixing in one operation
- Gentle and fast processing, while preserving product characteristics
- Fully automated, recipe-driven system

Conical Paddle Dryer

AGGLOMERATION

Flexomix mixer / agglomerator

The agglomeration process takes place in the Flexomix agglomeration system, a unique compact vertical high-speed mixer with typical residence times of just a few seconds. The innovative design comprises a flexible mixing chamber which includes an external roller massage system for self-cleaning. The addition of minimal liquid during agglomeration optimally shortens the final drying step afterwards (in the fluid bed). As a result, the Flexomix reduces energy consumption and saves investment costs.

› *Flexomix*

FEATURES AND BENEFITS

- Excellent mixing effect
- Self-cleaning
- Low manpower requirements
- Maintenance friendly construction

FLASH DRYING

DMR Flash Dryer

Selecting the right drying process is essential to extend the shelf life and safeguard characteristics such as digestibility and mouthfeel as well as the nutritional value and quality of the protein powder. The drying phase is particularly vital when it comes to obtaining the maximum amount of high-quality protein powder from your processing line. “Under-drying” of the wet press cake can result in the growth of fungi or bacteria, while “over-drying” can cause scorching which will damage the delicate nutrients/ components.

› *DMR Flash Dryer*

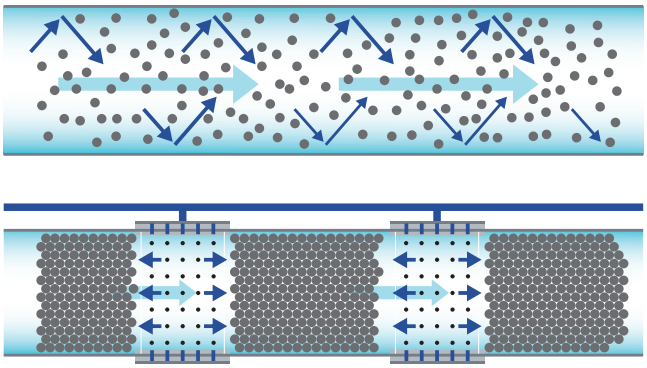
FEATURES AND BENEFITS

- Maximize drying efficiency to reduce footprint
- Very short residence time (“flashing”) to optimize the quality
- Hygienic design to prevent undesirable growth of bacteria
- Ergonomic cleanability
- Maintenance friendly construction

PNEUMATIC CONVEYING

of proteins and starch

To guarantee optimum product quality, different conveying methods must be used at various process steps. Adapted to the product characteristics (grain size & shape, density, hardness, fat & water content, ...) as well as to the individual process requirements (capacity, conveying distance, environmental conditions, truck unloading, ...), the most advantageous system for pneumatic conveying is applied.



YOUR ADVANTAGES AT A GLANCE

- Dilute phase conveying: simple and cheap implementation
- Plug conveying: gentle to the product, almost no grain destruction
- Preservation of aroma substances and essential oils through gentle conveying
- Individually adapted processes as pressure or suction conveying system
- Reliable, proven conveying systems

STORAGE, CHARGE & DISCHARGE

Product-appropriate storage of proteins and starch

Proteins and starch can be stored in a mass flow silo with a suitable discharge aid, in big bags or sacks.

YOUR ADVANTAGES AT A GLANCE

- First in, first out
- Reliable, residue-free discharge
- Complete systems with full equipment
- Dust-tight
- Gentle handling of the material to be discharged

Emptying silos, hoppers

DOSING & WEIGHING

Dosing and filling of proteins and starch

Via dosing and weighing technology, your product arrives where it is needed in the right quantity: in the mixer or for filling of silo vehicle, big bag or bag. The weighing process is optimized by matching the dosing unit, scale and control system to the special requirements of the products.

YOUR ADVANTAGES AT A GLANCE

- Integrated control system for high operational reliability
- User-friendly system
- Functionally reliable system technology
- Precise weighing and dosing technology
- Filling under hygienic conditions

APPLICATION CENTER FOOD

Food design systems for food customers

In 2021, Hosokawa Alpine opened the Application Center Food in Augsburg with the following machines in stainless steel and ATEX-design: air classifier mill ACM 10, classifier ATP 200 and fine impact mill UPZ 315.
The Application Center Food is a separate room within the well-known test center in Augsburg. The fine impact mill Sugarplex SX Flow with crystallisation for shelf stable sugar is installed nearby.

THERE ARE SEVERAL REASONS FOR TESTING

- Our customers would like to see the mills running and discover the Alpine experience with all their senses: Feel, touch and hear the mills and their products!
- At the same time, we discuss the technical special features of the projects with our customers, e. g. plant layout, ATEX issues etc.
- Last but not least, a performance-warranty for throughput / fineness is given on the basis of the tests.

INNOVATIVE TEST CENTERS

Our research and testing facilities can provide you with a wealth of machines and complete systems for the most varied plant configurations, all available on a global level. Precision, quality and innovative technologies: Do your testing with us.

YEARS OF EXPERIENCE

Profit from our many years of experience in the provision of solutions and our mastery of sophisticated processes. Well-known customers all over the world place their trust in the technology and know-how of the Hosokawa Micron Group.

GLOBAL SERVICE

Our service teams take care of repairs and maintenance, both on site and in our modern workshops equipped with the latest technology – smoothly, speedily and all around the world! The Hosokawa Micron Group – a partner you can rely on. Find out for yourself, you are sure to be impressed.

CONTRACT MANUFACTURING

The Hosokawa Micron Group is your professional and reliable partner for toll processing. We allow you to concentrate fully on your core business and to offset capacity bottlenecks without investment risks or long-term personnel commitment. Whether for a one-time project or a recurring job – our crew as well as our equipment are very flexible in adapting to your specifications!

ADVANTAGEOUS SYNERGIES

The know-how and experience of numerous specialists are bundled in the Hosokawa Micron Group to produce perfect solutions. Experience from a variety of customer segments in mechanical process engineering ensures that you, as the user, enjoy optimum solutions for practically every product – from an individual component to an entire plant.

HOSOKAWA MICRON GROUP

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Milling | Classifying | Compaction

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