

SEPARATION TECHNOLOGY EXTRACTION OF PLANT PROTEINS

Maximum yield and quality
by efficient wet fractionation



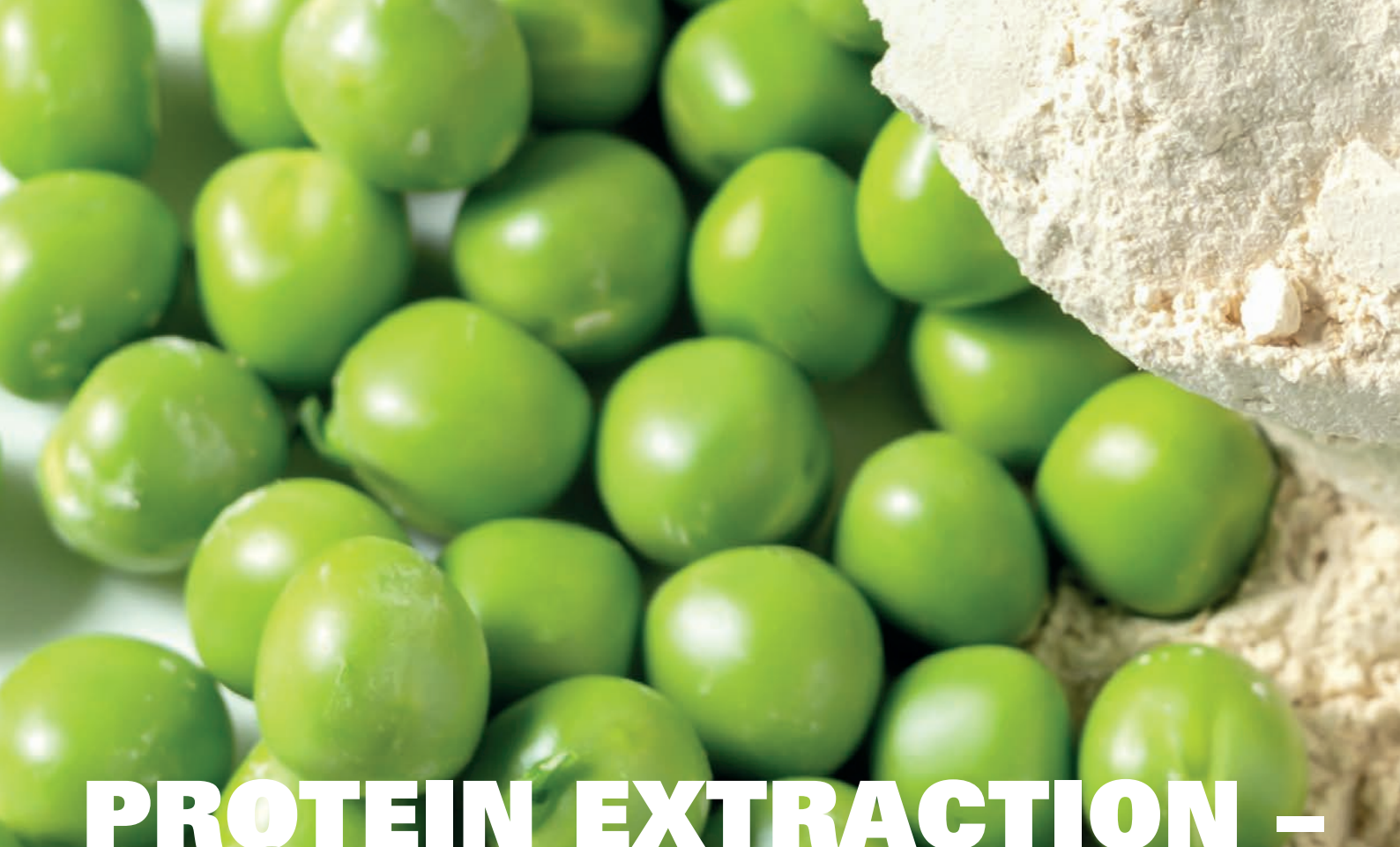
Engineered For Your Success



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PROTEIN EXTRACTION – GROWTH MARKET AND CHALLENGES

Plant-based proteins play an essential role in providing sustainable food for a growing world population. Vegan food has long since outgrown its niche market. However, there are differences: not all plant proteins are equally suitable for use in further processing. Their use is determined by the proteins' purity, the product yield and the functionality obtained – and along with it, their market value.

Flottweg offers you turnkey, automated, efficient process solutions, which enable you to get exactly the protein quality from plant-based raw materials required for your product strategy. Flottweg offers the correct answers to your challenges, such as:

- Which protein extraction process is best adapted to your raw material?
- How can other product by-products be used to add value?
- How to find the optimum from two worlds: protein purity and protein yield?
- How can we achieve consistently high levels of efficiency throughout the entire process?



Flottweg assists numerous protein producers all over the world. All of them benefit from a process line that we have planned and set up, or from machines that have been fully custom-made to meet what each company needs or desires. The thing that unites all our projects is highest customer focus and maximized efficiency. Our planning and configurations do not just live up to the “Made in Germany” label, but to our self-image as well. We are a specialist engineering company with seventy years of experience in separation technology and thirty years in protein extraction.

We would like to invite you to explore our plant protein extraction applications. Learn what ‘Engineered For Your Success’ can mean for you and for your company!





SUCCESS IS RECOGNIZING AND MAKING USE OF ADVANTAGES

Flottweg offers you three different applications or process lines for extracting plant proteins. These are just some of the advantages Flottweg processes offer you in extracting proteins:

Production advantages

- Specially designed machines and systems for starch and oil crops
- Integrated downstream processing and upgrading of plant fibers and/or starch
- Complete implementation and individual processes in line with hygienic design guidelines and automated CIP (Cleaning in Place)
- Exceptionally high protein yield and quality

Economy

- Minimized usage of additional materials and cleaning agents
- Avoidance of waste streams and valorization of side streams
- Maximized energy efficiency
- Effective minimization of waste streams

Ecological

- Contributes to sustainable protein extraction, with lower consumption of water and land (compared to animal proteins) and reduced carbon footprint
- Biodiversity in practice, with flowering legumes replacing animal feed monoculture
- Co-designing of food alternatives that focus on nutritional benefits and animal welfare.

... in a nutshell, Flottweg provides you with protein that is high-quality, economical and sustainably sourced.



Prerequisites and factors for Flottweg processes

Processing a wide range of raw materials

The following crops are suitable for protein recovery by wet fractionation in the Flottweg process:

- Starch crops: peas, beans, mung beans, lentils, etc.
- Oil crops: soybeans, lupins, sunflowers, canola, etc.

Pre-processes

The Flottweg application starts after the crops (e.g. peas) have been dehulled and milled. For oil crops, the oils are also extracted before the wet fractionation of protein takes place.

Factors which determine quality

The product quality of the pure protein obtained is determined by the properties of the initial product, i.e. the vegetable meal/flour. These factors include:

- the particle size
- the NSI value (protein solubility)
- ANF (antinutritive factors)



UP TO THREE PRODUCT STREAMS FOR YOUR PROTEIN PRODUCTION

In the wet fractionation of starch crops, up to three ingredients in total are separated and processed. The core process is always protein extraction, and from this, one or two further product flows can be obtained. All processes are usually followed by drying the proteins. In individual cases, protein, fiber, and starch are also directly processed in their wet form.



Flottweg's plant protein applications are a win for

- the food industry
- functional food/food supplement manufacturers
- animal feed producers
- cosmetics manufacturers

and many others.

Flottweg offers complete turnkey applications for processing, from approximately 200 kg (440 lb) to 20,000 kg (44,000 lb) of plant meal per hour.

PROTEIN **STARCH**
FIBER

WET FRACTIONATION OF OIL CROPS

In this Flottweg application, two product streams – protein and fiber – are obtained from oil crops like soybeans.

Protein extraction

The plant meal (alternatively flakes or press cake) is mashed in a water-based solution and extracted in an alkaline environment. As a result of this extraction, the protein is in a liquid form and the fiber remains solid. The liquified protein can be separated from the insoluble fiber using a decanter.

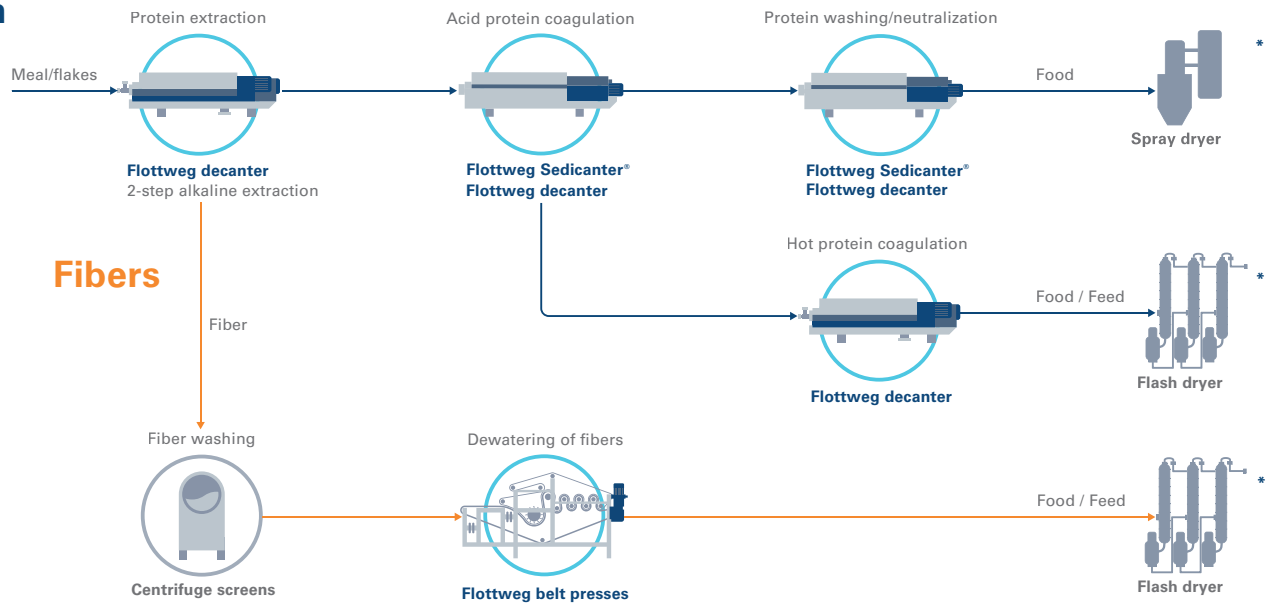
The liquified protein is then precipitated and separated in the acidic environment. In an extra washing stage, protein purity is increased and its sensory properties are improved. The highly functional proteins that are obtained through this process are gently neutralized and dried. The residual second protein fraction which is still in solution (albumins) can be denatured and dried by exposing it to heat.

Fiber extraction

The fibers that remain during the first extraction of proteins go to fiber washing, where the fibers are separated in centrifugal sieves or decanters. The water is then removed in a Flottweg belt press, in order to make the subsequent drying process more economical and efficient.



Protein



* Separate positioning of dryers done by Flottweg's technology partners

© = registered trademark in various countries.

Results

- Maximize protein and fiber yield in a wide range of products/follow-up applications
- High-yield extraction of high-value, high-functionality native proteins
- Economically optimized application with low energy needs, time and additives
- Almost unlimited scalability
- Yield: Protein 74%
- Purity: Protein over 90%

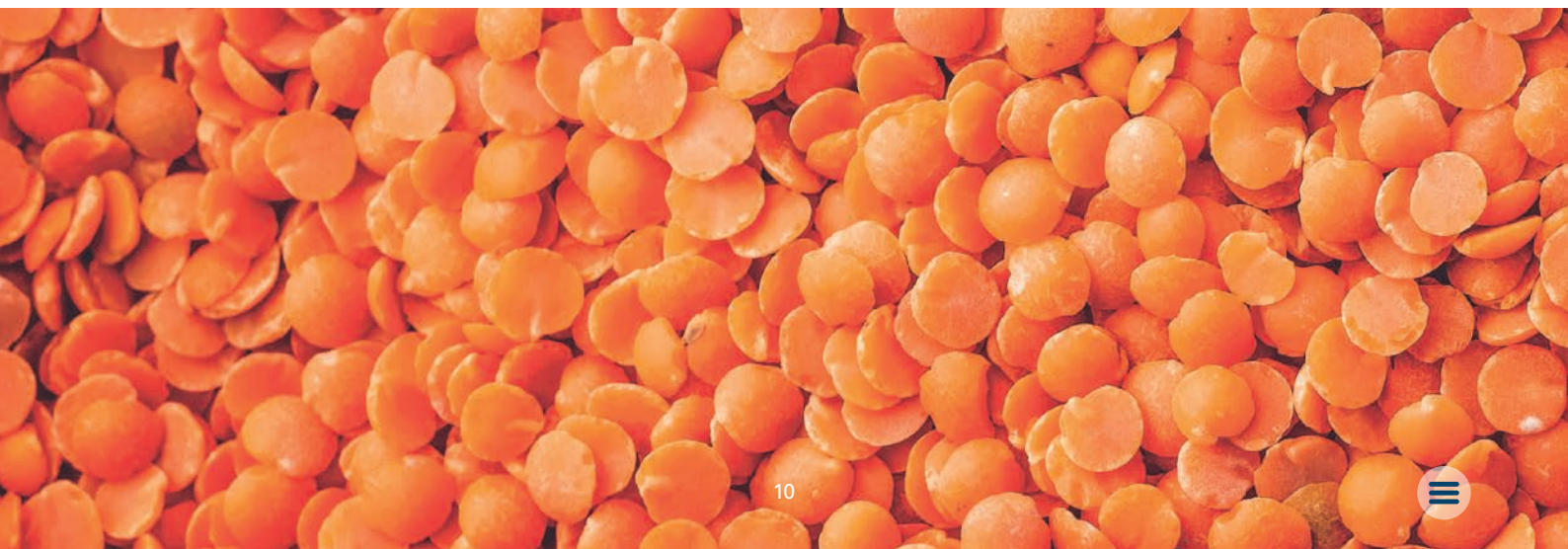


WET FRACTIONATION OF STARCH CROPS

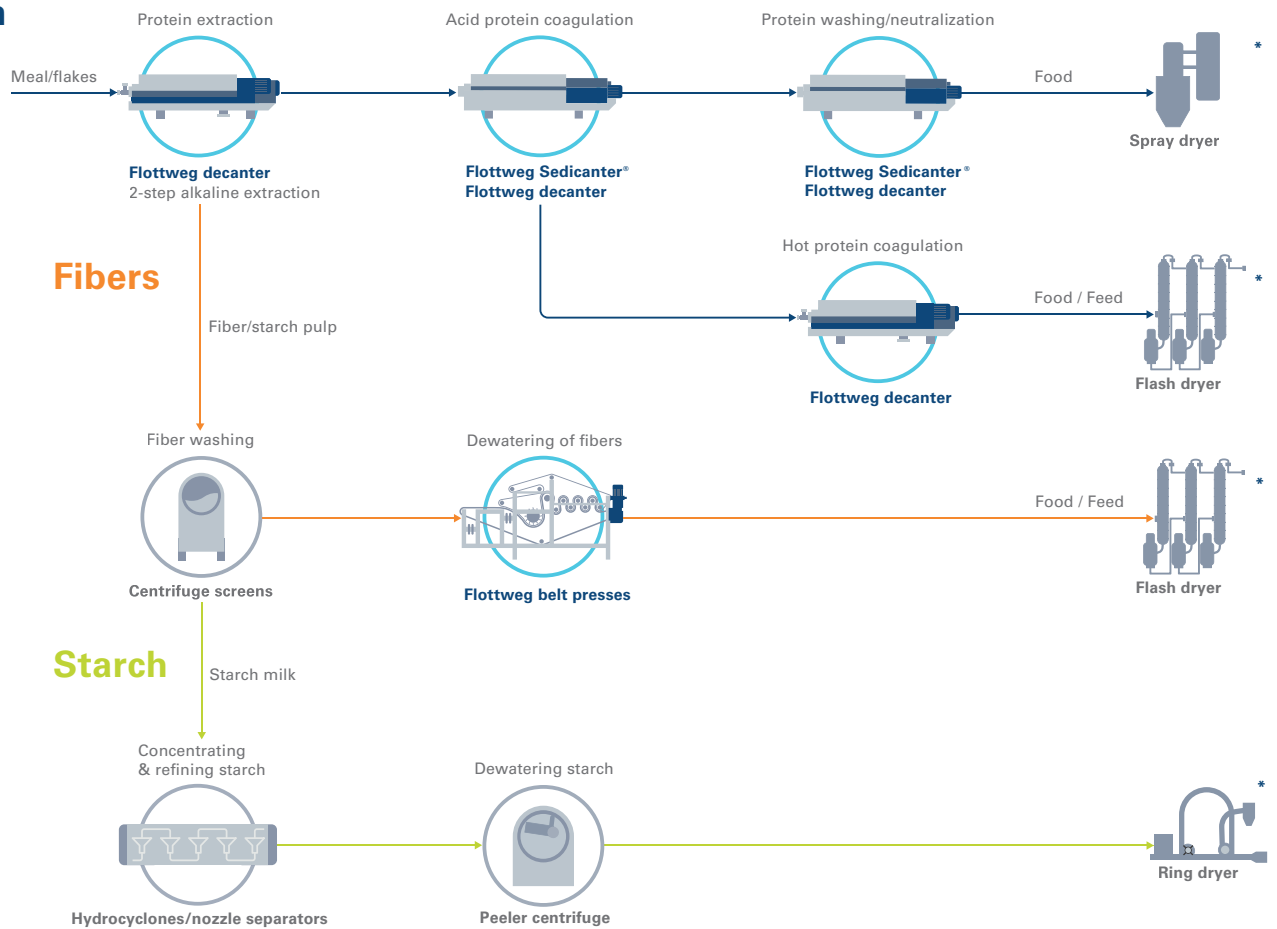
In this Flottweg application, three product streams – proteins, starch and fiber – are obtained from plants that contain starch (like peas). The separation of protein and fibers is identical to the wet fractionation of oil crops (page 8). Starch extraction also takes place here.

Starch production

Firstly, in the extraction step, the insoluble starch and fiber fractions of the plant are separated from the liquified protein. The starch-fiber mixture is then separated into the fiber and starch product streams using centrifugal sieves. The water can then be mechanically removed from the washed fiber fraction using a belt press. This ensures maximum dry substance before undergoing thermal drying. The highly diluted starch suspension is concentrated and washed using a hydrocyclone or nozzle separator. Again, from an energy perspective, mechanical water removal with a decanter or peeling centrifuge prior to thermal drying makes sense.



Protein



* Separate positioning of dryers done by Flottweg's technology partners

® = registered trademark in various countries.

Results

- **Maximized yield of proteins, fibers and starch for a wide range of products/follow-up applications**
- **Extraction of high-value proteins with outstanding functionality**
- **Economically optimized application with low energy needs, time and additives**
- **Almost unlimited scalability**
- **Yield: Protein 75%, Starch 95%, Fiber 95%**
- **Purity: Protein 85%, Starch 95%, Fiber 75%**



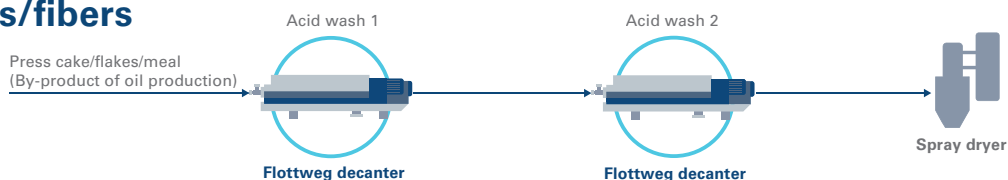
ACIDIC WASHING FOR OIL CROPS

Acid washing is a lean process solution for oil crops such as soybeans. Here, fiber and protein are not separated. By washing out the soluble components, protein purity is increased while improving the sensory properties.

Protein and fiber extraction

Using two-stage washing in an acid environment, the plants' proteins and fibers are separated together, then dried for subsequent processing.

Proteins/fibers



* Separate positioning of dryers done by Flottweg's technology partners

Results

- Even higher yields of proteins in combination with plant fibers
- A technically simplified, cost-optimized application for economically extracting protein and fiber
- Almost unlimited scalability
- Yield: Protein 75–85%
- Purity: Protein 65–75%

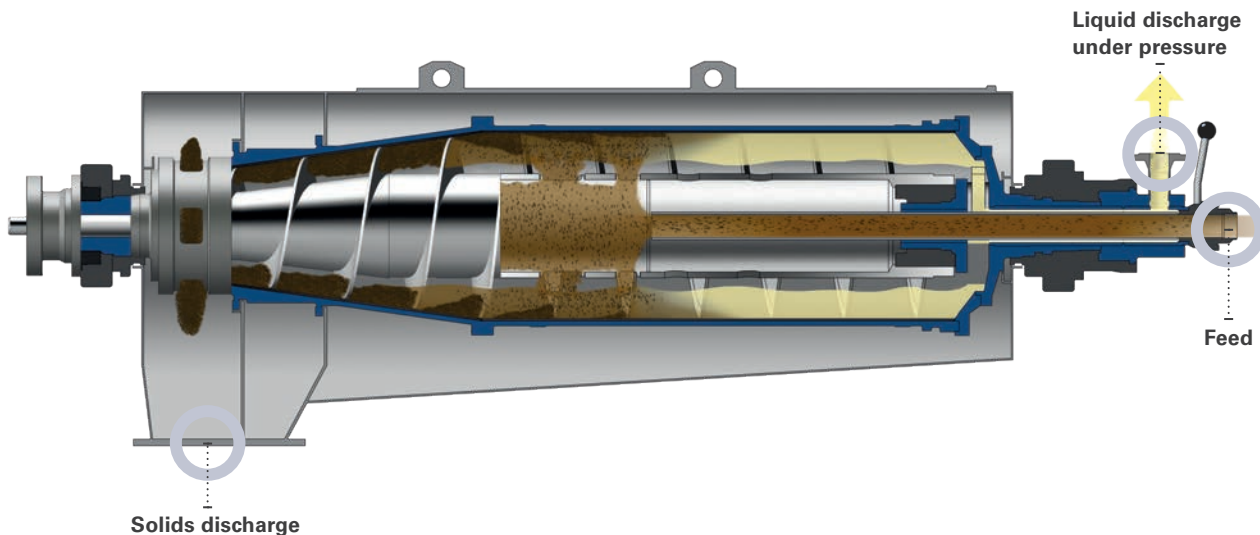


THE FLOTTWEG DECANTER

Decanters are involved in several of the process steps for extracting proteins from plants. The most important steps where Flottweg's experience and product benefits come into their own are:

- Extraction (separation of liquid plant protein and solid starch/fiber)
- Coagulation (separation of precipitated, native protein)

Highly specialized aggregates are used for each task, depending on the process step, the plants being processed and the result desired.



Flottweg decanter – an individual solution that can be comprehensively customized

Continuous operation mode

- Flexibility
- Fast, product-friendly processing
- Hygienic due to the closed design

Adjustable impeller

- Highest yield, even when there are fluctuations in the product
- Optimal cleaning
- Automatic CIP cleaning
- Fluid extraction under pressure

Simp Drive® drive concept

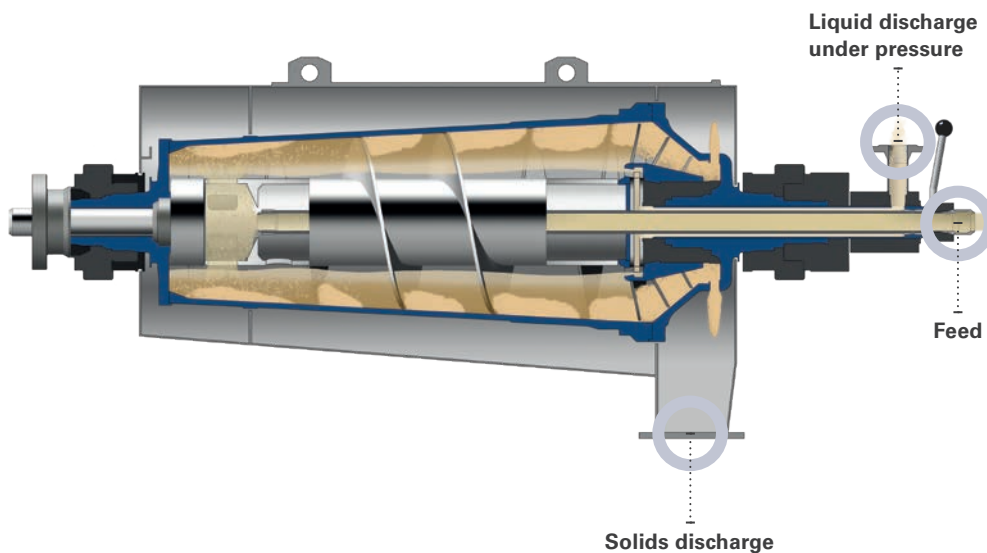
- Maximum energy efficiency
- In-house development based on 25 years' experience
- Constant differential speeds, even at high torque, guarantee that the fibers have a high dry solids content
- Can be 100% integrated with CIP processes



THE FLOTTWEG SEDICANTER®

The Flottweg Sedicanter® is a further development of our decanter technology, and specializes in processing soft or free-flowing solids. The adjustable impeller means that it achieves the best possible selectivity, even with fluctuating feed rates.

This makes the Flottweg Sedicanter® suitable for extracting plant proteins economically and, at the same time, in a quality-oriented way. It is used where process steps require further optimization and where the overall process is designed to be even more efficient.



Flottweg Sedicanter® - the specialist option for high-quality proteins

Decanter centrifuges for extracting plant proteins

- Optimal yield by separating microproteins
- Optimal dewatering of protein solids means cost savings for the subsequent processing steps such as drying

State-of-the-art separation technology

- Separation of extremely difficult-to-sediment solids by accelerating up to 10,000 g
- Available with the proven Flottweg Simp Drive®

Optimized for food production

- Available in a hygienic design
- Can be inertized, for instance for the processing of oxidation-sensitive products

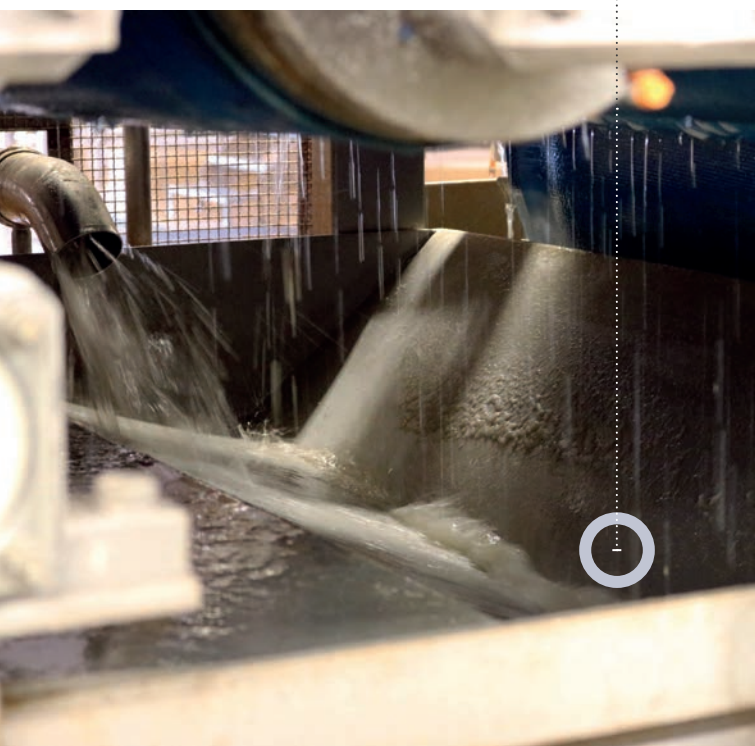
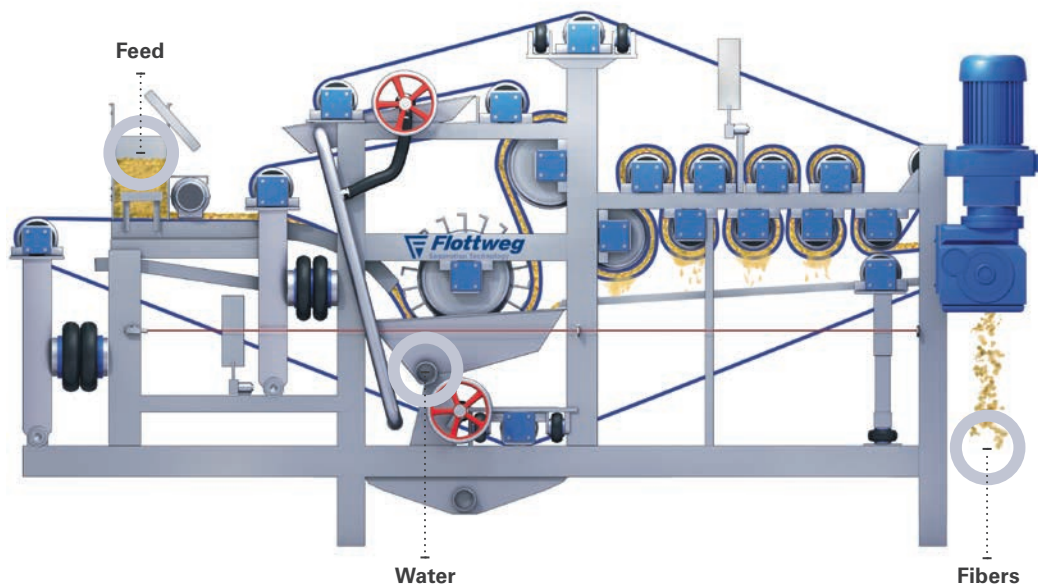


FLOTTWEG BELT PRESSES

The belt press is used for dewatering heavily water-binding products such as pea fiber. As a result, maximum dewatering can be carried out mechanically. The result means that significantly less energy is required for the subsequent thermal drying.



The special roller profile and belt alignment ensure alternating pressure and shear loads. This ensures efficient, rapid dewatering.



Flottweg belt press – automatically for maximum dewatering

Operates continuously

- Minimal operating costs
- Automatic belt controller
- Easy access
- Maximum yield
- Option of fully automated control
- Can be fully integrated into existing CIP concepts

Long lifespan

- Substantial use of stainless steel
- Robust construction/German engineering

SIMP DRIVE

FLOTTWEG DECANTER TECHNOLOGY

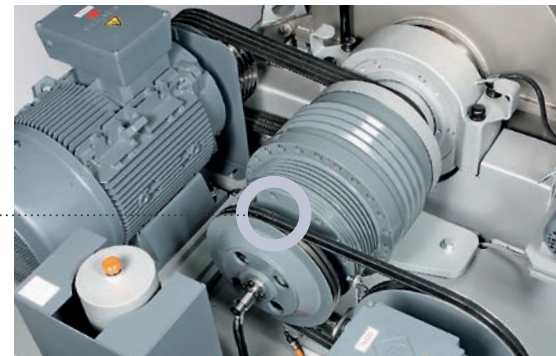
All Flottweg products associated with efficiently extracting protein from plants provide you with optimal yields of the highest quality. This also applies to highly functional proteins, fibers and starches, such as those used in functional foods or substitutes. Their maximum separation efficiency and their low energy consumption set them apart. Even when the operating conditions vary and the composition of the initial plants is diverse, the machines can ensure consistent separation results and high yields.



Flottweg Simp Drive®

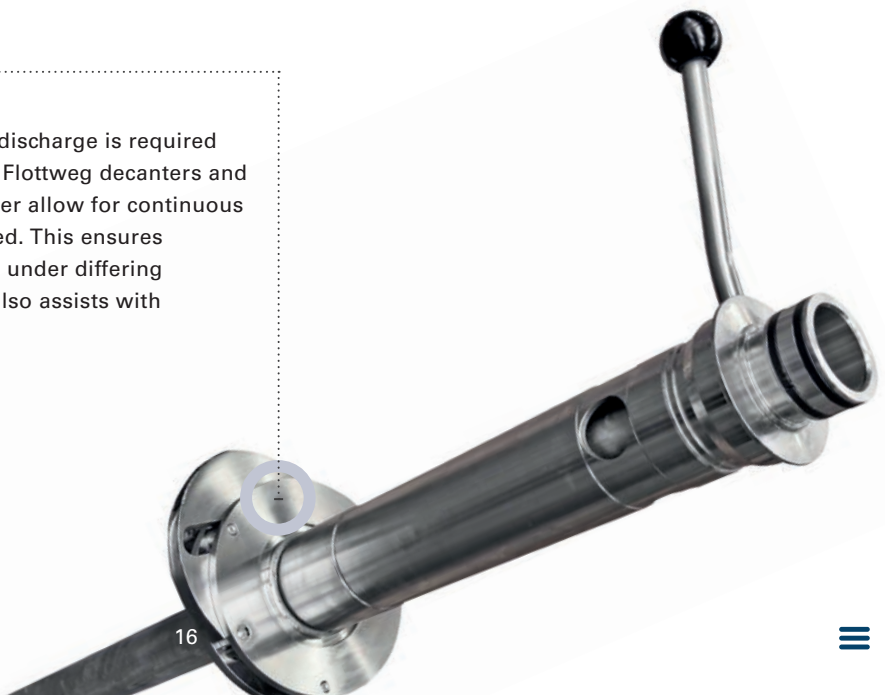
In addition to the gear drive, the screw is powered separately from the bowl by a secondary motor and with a special gearbox. This provides for torque-dependent differential speed control, resulting in the optimal separation of solids with a high dry solids content.

Saves energy and is efficient: The Simp Drive® drive regulates the differential speed between the decanter bowl and scroll as a function of the prevailing scroll torque. The differential speed determines the length of time the solids remain in the bowl, and so has a considerable impact on the separation process.



Adjustable impeller

A high-precision setting in the liquid discharge is required for optimal protein/liquid separation. Flottweg decanters and Sedicater® with an adjustable impeller allow for continuous adjustment, even while being operated. This ensures consistent separation efficiency, even under differing processing conditions. The impeller also assists with CIP cleaning within the machine.





SUCCESS IS WHEN VALUE CREATION IS COMPLETELY AUTOMATED

Flottweg is a driver in global technology in the centrifugal extraction of plant proteins. We have decades of experience in industrial separation, and we have developed applications that focus on process optimization, and so on maximizing our customers' profit margins.

Comprehensive systems – for smooth operation and higher yields

Protein extraction focuses on protein quality and yield. We offer turnkey systems to optimize both of these to achieve your business goals. These combine in an automated application all the individual steps of efficient protein extraction. Our customized solutions mean that each system is integrated into the company's processes in the most efficient way possible.

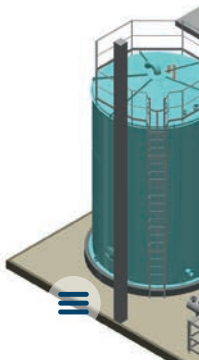
Global references are the best evidence

Individual Flottweg centrifuges and complete process lines are both used by well-known protein manufacturers worldwide. Our products are known for their reliability and high-quality engineering, and the name Flottweg stands for customized solutions and uncompromising customer-centered service. This means that we stand out as a beacon in the industrial separation technology market.

Flottweg applications for extracting proteins from plants ...

- ... all come from a single source, ranging from engineering and machine production to automation.
- ... are custom-made to suit every customer company and its own challenges.
- ... get the yield and quality of protein that you demand.

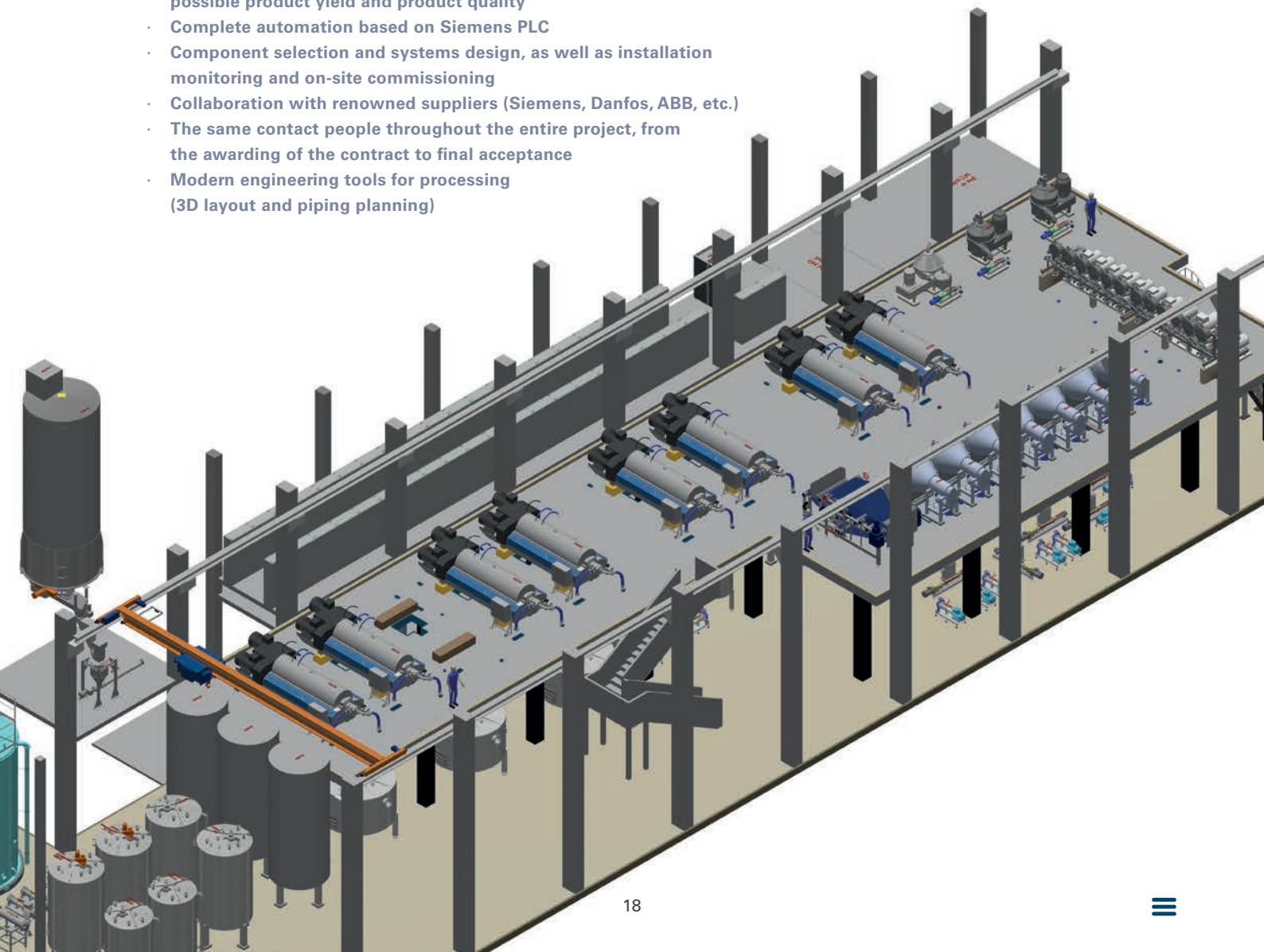
This will give you the significant advantages for achieving success in a competitive growth market!





The following key points are what characterizes our engineering processes:

- Flexibility in selecting the optimal equipment, taking into account the highest possible product yield and product quality
- Complete automation based on Siemens PLC
- Component selection and systems design, as well as installation monitoring and on-site commissioning
- Collaboration with renowned suppliers (Siemens, Danfos, ABB, etc.)
- The same contact people throughout the entire project, from the awarding of the contract to final acceptance
- Modern engineering tools for processing (3D layout and piping planning)



FLOTTWEG QUALITY AND SERVICE



Guaranteed Flottweg quality

Made in Germany. We have a clear image of quality, and we never compromise on it. Our customers often have to deal with aggressive materials. Components of Flottweg centrifuges that come into direct contact with the medium that will be processed (including the bowl, scroll, and inlet), are exclusively made from high-quality, rust and acid resistant stainless steel. This means higher strength and improved resistance.

Our machines are well-equipped, and can withstand your requirements in the long term – in extreme cases, that can mean 24 hours a day, 7 days a week. Additionally, our strict quality controls (DIN ISO 9001:2015) and the traceability of all critical components ensure product safety.



Our service – we are always there for you!

We have over 1,100 employees worldwide, in a network of over 60 sales and service stations that are available to you. We are not only striving to provide first-class advice about selecting and designing our systems. We'll be there for you whenever you need us – 7 days a week in over 100 countries all over the world.

You can plan success. In just three steps.

Would you like to make a success of the efficient extraction of high-quality plant proteins?
Then get in touch with Flottweg and benefit from our 3-step roadmap:

01

We will talk to you about protein separation and the business objectives you are looking to achieve.

02

In pre-engineering, we examine your raw materials in our laboratory and carry out customer-specific tests in the Flottweg technical center or on your own premises. Here, initial product samples can already be made available to you.

03

After the design and detailed development process has taken place, you will receive a specific and individualized offer. This includes all the relevant line KPIs for realizing your customized Flottweg application for the extraction of proteins.

Make Flottweg the key player in your success:
Our sales partners are looking forward to hearing about your ideas and challenges!



Flottweg worldwide

11
international
subsidiaries

Projects in over
100
countries

Over
50
service centers

- - Headquarters
- - Subsidiary
- - Representative





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