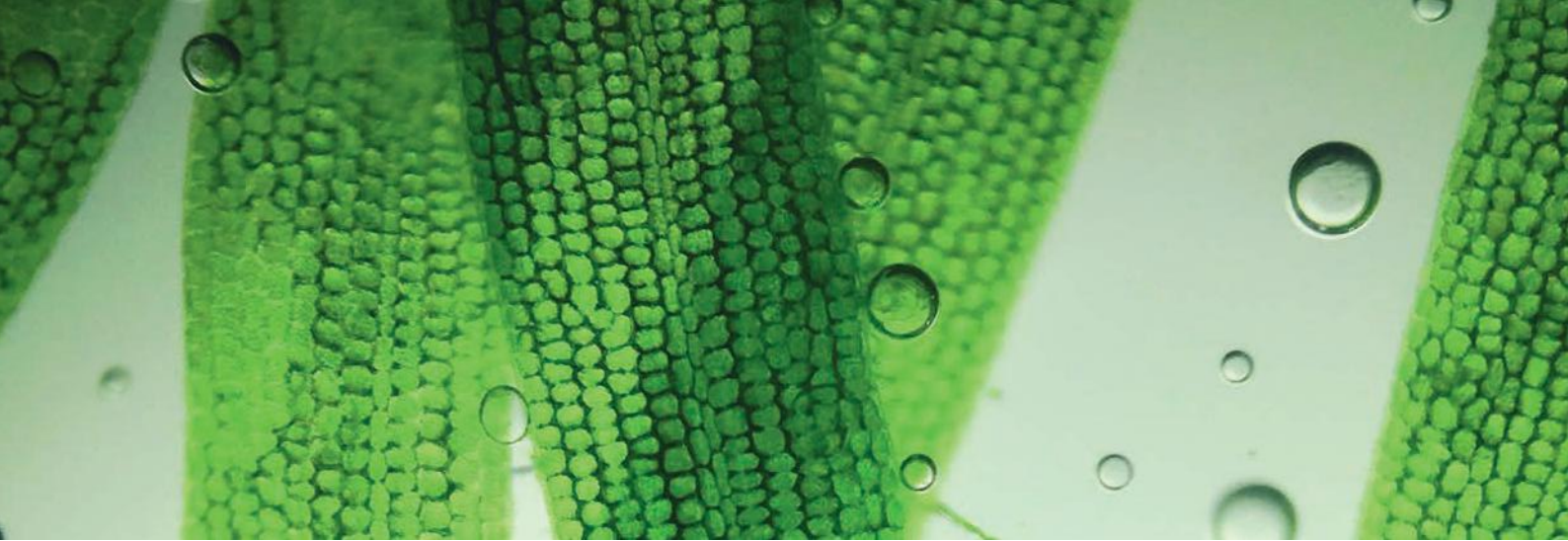




SEPARATION TECHNOLOGY FOR ALTERNATIVE PROTEINS PRODUCED BY FERMENTATION

Revolutionize fermentation with our advanced separation solutions



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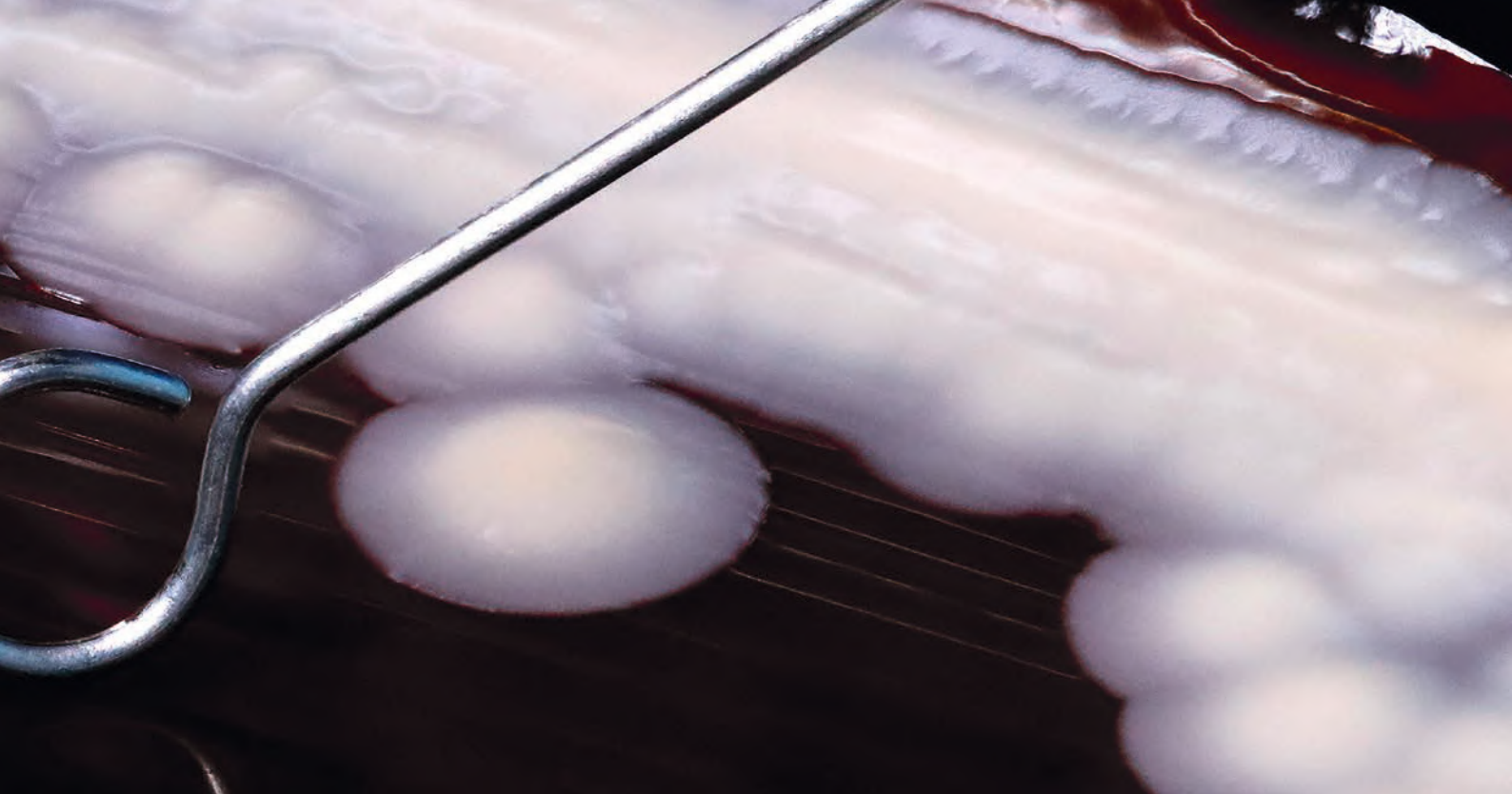
A close-up, microscopic view of several translucent, spherical protein droplets. The droplets are clustered together, with some showing internal texture and others appearing more uniform. They are set against a dark, out-of-focus background, highlighting their three-dimensional structure and liquid-like properties.

PROTEINS REVOLUTIONIZED: EFFICIENT RECOVERY AND SUSTAINABLE USE

In recent years, alternative proteins have emerged as a key factor in meeting the growing global demand for sustainable food and as effective drug in the pharmaceutical industry. However, the production process of these proteins presents unique challenges to manufacturers. From scaling up production processes to ensuring product purity and consistency, overcoming these challenges requires advanced technologies. Issues such as efficient recovery of cellular biomass, compliance with strict regulations and ensuring high product quality can have a significant impact on profitability and environmental sustainability.

Flottweg offers tailor-made solutions to address the critical points in alternative protein production. Designed for high efficiency, our technology optimizes solid-liquid separation processes, ensuring maximum recovery rates while maintaining the integrity of sensitive protein structures. With robust and reliable equipment, Flottweg helps producers minimize energy consumption, reduce waste and achieve consistent product quality – all while streamlining production at scale.

Flottweg has been a global leader in industrial separation solutions for many years. Our systems integrate seamlessly into existing production lines or new plants, delivering both economic and environmental benefits. By leveraging our expertise, alternative protein producers can meet market demands while contributing to a more sustainable future.



Flottweg supports the biotechnology industry in meeting its challenges by providing following services:

- **High efficiency:** Quick and efficient separation processes to maximize yield
- **Scalability:** Flexible solutions for various production scales
- **Consistency:** Reliable operation ensuring consistent product quality
- **Cost-effective:** Reduced operational costs through energy-efficient designs
- **New market opportunities:** Flexible use of the machines, e.g. through recipe control technology tailored to the customer process

Flottweg is certified to DIN EN ISO 9001:2015 and manufactures its products in compliance with the latest technical standards.

Flottweg separation technology is used, among other things, in

- Algae harvesting and/or separation of the components
- Separation of cultured meat protein
- Separation of protein derived from precision fermentation
- Separation of fungal biomass (mycoprotein)

Find out how our applications support the efficient and sustainable recovery of alternative proteins: Learn what 'Engineered for Your Success' can mean for you and for your company!

MAKING IT BIG EVEN WITH MICROORGANISMS

Flottweg has positioned itself as a leading supplier of innovative separation technologies and customized solutions for biotechnological applications. Our products e.g. the nozzle separator and the Sedicanter® are known for their efficiency and reliability.

Flottweg machines are characterized by maximum performance, outstanding service and adaption to individual applications to optimize your production process. Thanks to the products developed specifically for biotechnology, we are able to provide our customers with the best possible advice and offer customized solutions for every separation task.

Flottweg decanters, Sedicanters® and separators are easy to operate and characterized by high separation efficiency, robustness, and ease of maintenance as well as their hygienic design. This reduces the amortization period and the total cost of ownership.

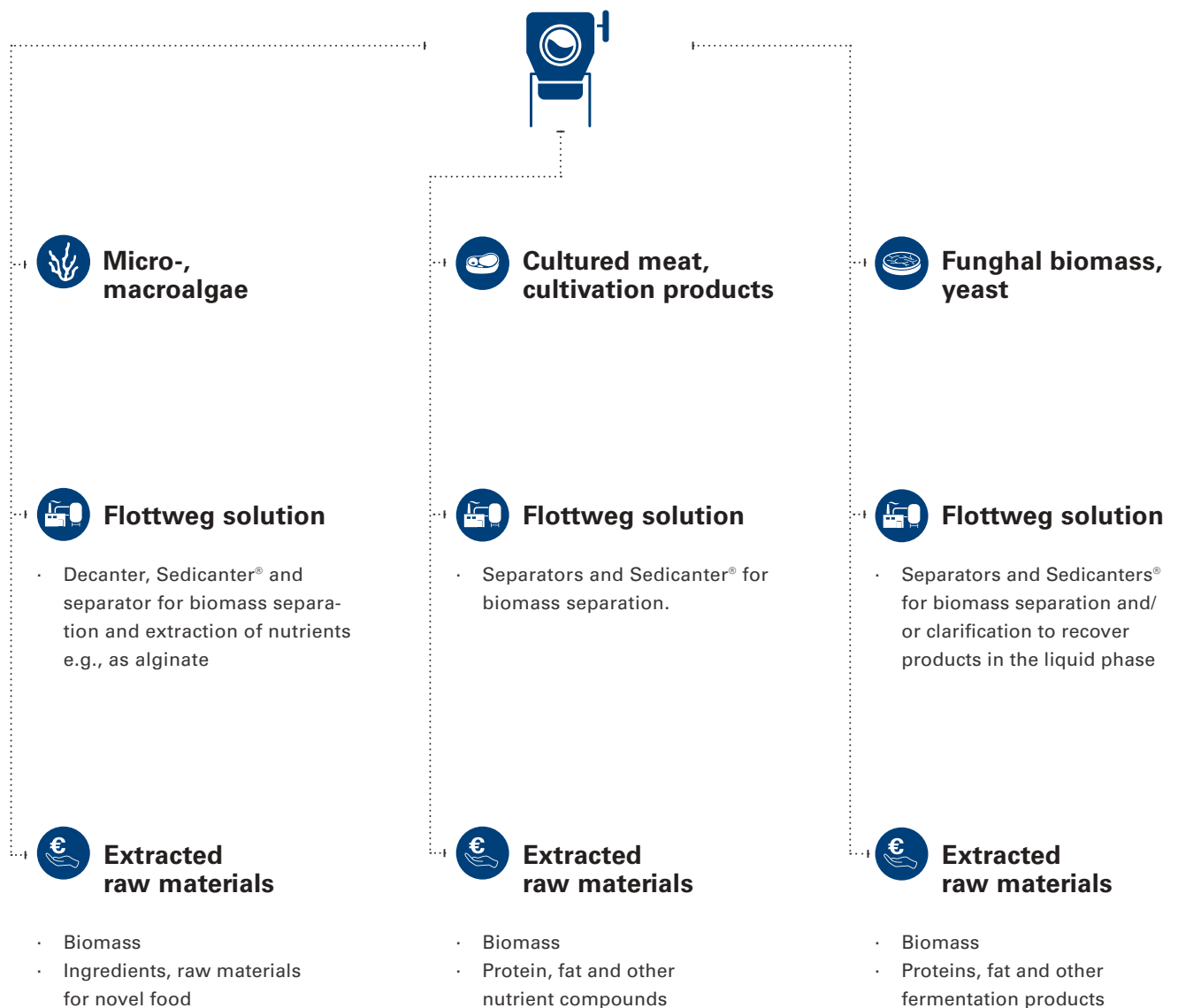
Flottweg centrifuges may be purchased as individual units - e.g. to optimize or modernize individual process steps. On request, we also offer individually configured plug-and-play systems that can be integrated into your existing plant with minimal effort.

Depending on the process and the source material, throughputs of 0.2 - 15 t/h (with decanter, Sedicanter®) or 0.5 - 35 t/h (with separator/nozzle separator) are possible (guideline values; actual values depend on the process and the raw material).





Process overview: Flottweg technology for the separation of alternative proteins

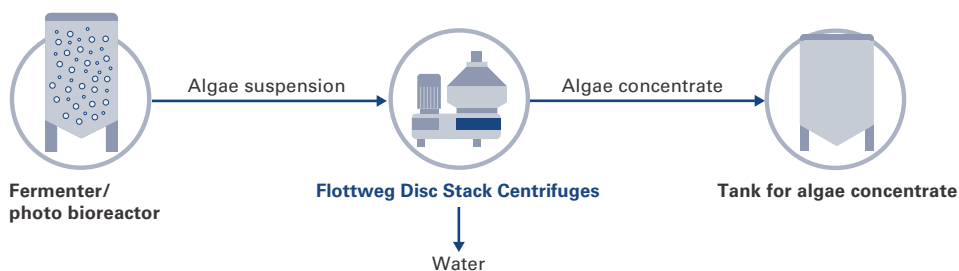




SEPARATION OF ALTERNATIVE PROTEINS E.G. FROM ALGAE

Flottweg separators and Sedicanter[®] are being used for concentrating, extracting and washing algae. Both centrifuge types are suitable for plants producing algae in open ponds as well for closed systems e.g. bioreactors.

Corrosion-resistant special steels are optionally available to meet the requirements of saltwater algae.



Benefits

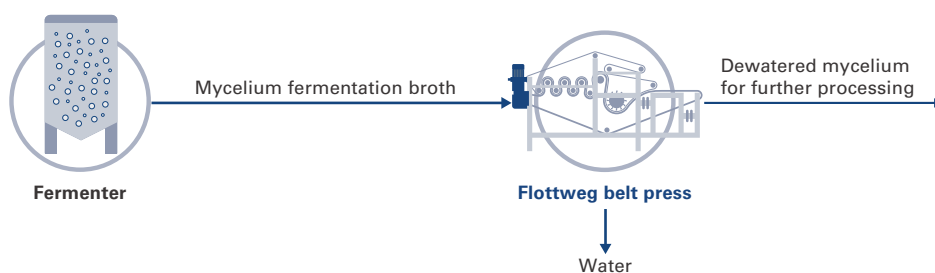
- High flexibility due to separator Soft Shot[®] FLEX
- High yield with different algae species by adapting the discharging system
- Easy to operate and clean
- Adaptation to different process setups and with scaling possibilities



DEWATERING OF ALTERNATIVE PROTEINS E.G MYCELIUM

Flottweg belt presses are ideally suited for the gentle yet effective dewatering of mycelium biomass. Their controlled pressing mechanism removes moisture efficiently while preserving the structural integrity of the biomass – a key advantage for downstream processing and product quality.

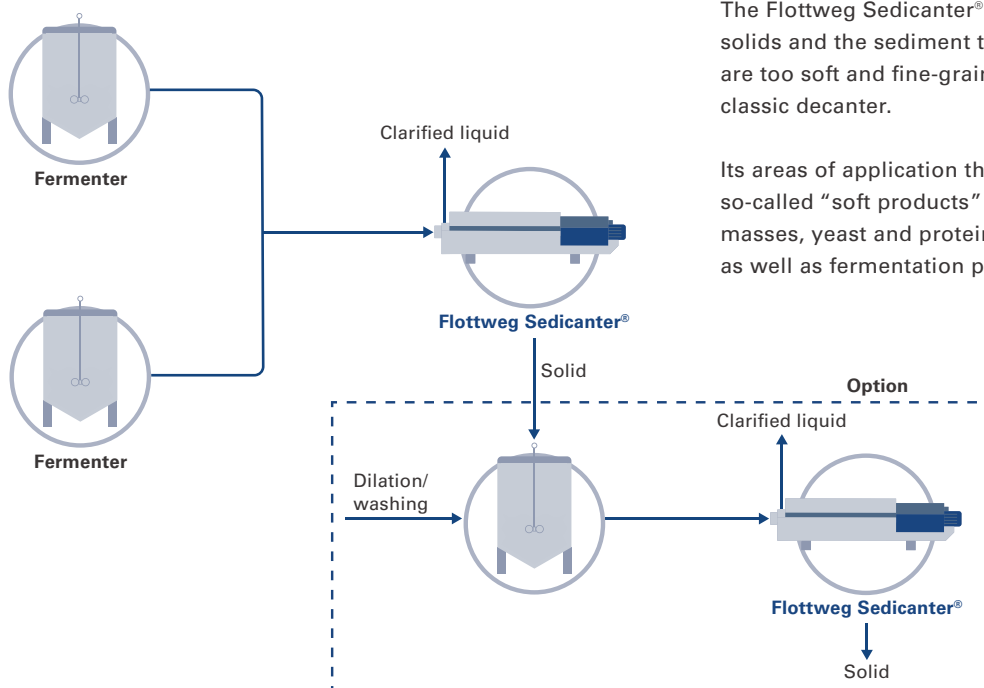
Depending on the solid content and structure, the belt press can be used directly after fermentation or following a pre-thickening step. The system's high adaptability allows for precise adjustment to different solid types, ensuring consistent performance and a high dry matter content.



Benefits

- Efficient and proven technology for dewatering fibrous foods
- Save production due to stringent hygiene standards: The Flottweg belt press is made entirely of stainless steel and food-safe plastic
- Flexible processing of a wide range of products is possible thanks to infinitely variable speed control and adjustable compression pressure

FERMENTATION-BASED PROTEIN SEPARATION WITH SEDICANTER®



The Flottweg Sedicanter® is used when solids and the sediment to be processed are too soft and fine-grained for the classic decanter.

Its areas of application therefore include so-called "soft products" such as bio-masses, yeast and protein suspensions as well as fermentation products.

Benefits

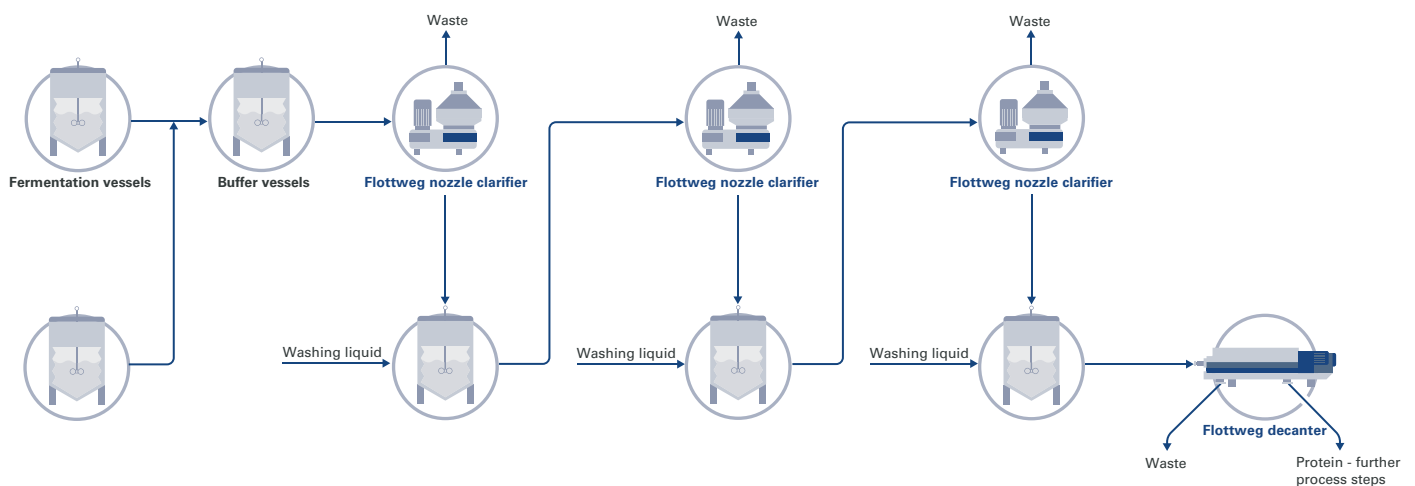
- Production of mycelium as meat replacement
- Production of alternative proteins by fermentation as meat replacement
- Separation of yeast cells
- Algae suspension (micro-/makroalgae)
- Separation of bacterial biomass

HARVESTING PROCESS OF ALTER- NATIVE PROTEINS E.G. FROM YEAST

Alternative proteins can also be harvested as inclusion bodies of microorganisms (e.g. silk protein, yeast protein). In this case, the main product must be extracted from inside the cells.

The first step is to separate the whole cells from the fermentation media, followed by cell lysis (mechanical, chemical, enzymatic). Subsequent washing and concentrating steps are taken for further inclusion body purification.

Depending on the solids concentration and the required clarification area, a disc stack centrifuge or nozzle separator is more suitable for the process.

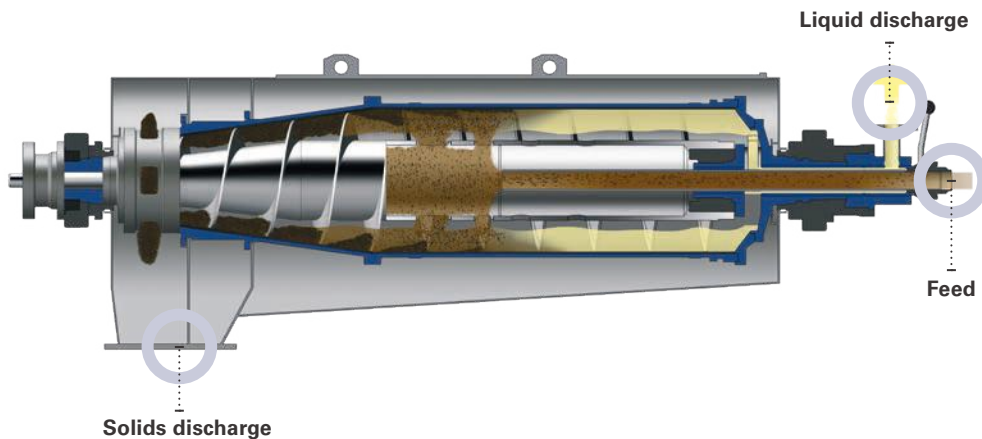


SPECIAL FEATURES OF FLOTTWEG DECANTERS AND SEDICANTERS®

Flottweg decanter

Flottweg decanter centrifuges used in precision fermentation processes are hygienically optimized in accordance with EHEDG guidelines and fully Clean-in-Place (CIP)-capable.

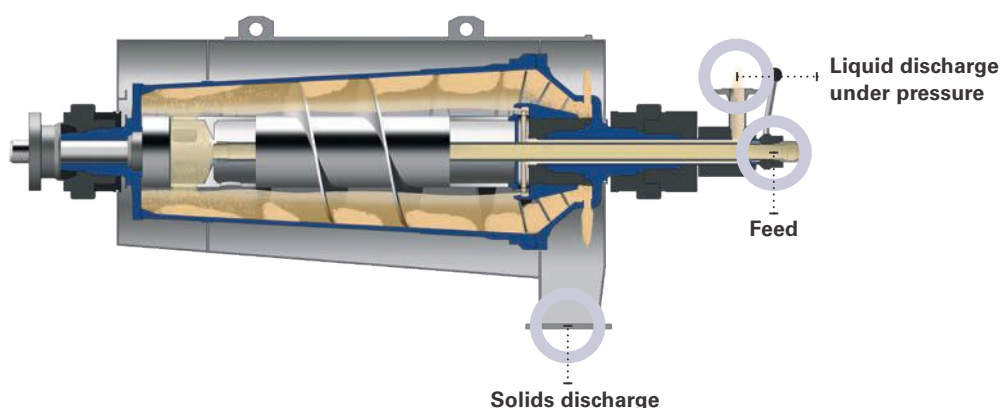
- Special CIP nozzles ensure effective cleaning of critical areas.
- All parts in contact with the product are made of high-quality stainless steel with appropriate surface treatment.
- Seals are available in FDA-approved material.
- The gearboxes are installed outside the machine.



Flottweg Sedicanter®

Soft or free-flowing solids, e.g. proteins are difficult with a standard decanter process. For processing in the separator, the solids content is often too high.

The patented Flottweg Sedicanter® is specifically designed to overcome these challenges. The Sedicanter® combines the advantages of separators and decanter centrifuges. It processes large quantities of solids and can handle small and soft particles while achieving dry solid. Even with fluctuating feed quantities – thanks to its adjustable impeller – it achieves the best possible separation efficiency.





Flottweg Simp Drive®

The Flottweg Simp Drive® regulates the differential speed according to the scroll torque. Thereby the Flottweg decanter/Sedicanter® automatically adapts to different load conditions and drains/dewaters the product to the maximum total dry solids.

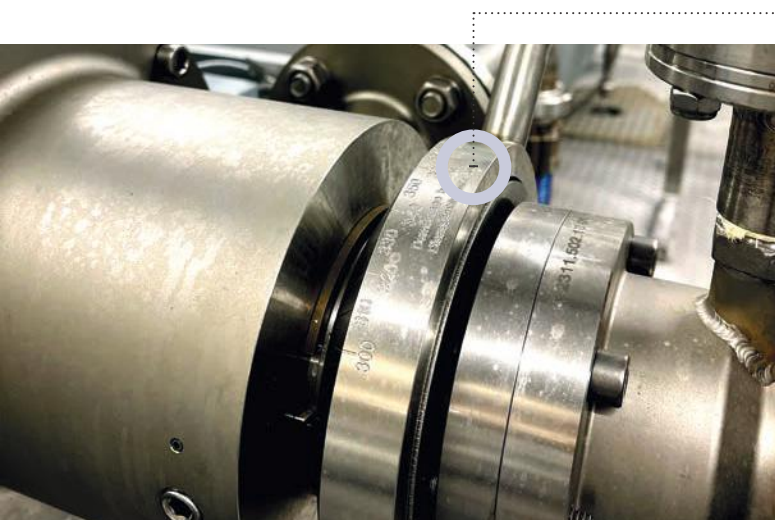
- Maximum energy efficiency
- In-house development based on 25 years of experience, resulting in high availability
- Constant torque guarantees high total dry solids in the separated solid even at high differential speeds
- Engineered for full CIP-compatibility with existing processes



Material and hygienic design

Our machines are designed for the high requirements of biotechnology and meet the high hygiene standards.

- FDA-certified sealing material
- All components in contact with the product made of high-grade stainless steels
- CIP cleaning nozzles in all critical areas
- All components in contact with the product: Ra max. 0.8-1.6 µm
- Hygienically polished welded seams in the production space
- Hygienic wear protection (Stellite®)



Adjustable impeller

The adjustable impeller can vary the pond depth continuously during operation, allowing for quick and precise adaptation to changing feed concentrations. In addition, the impeller supports the CIP cleaning effect inside the machine.

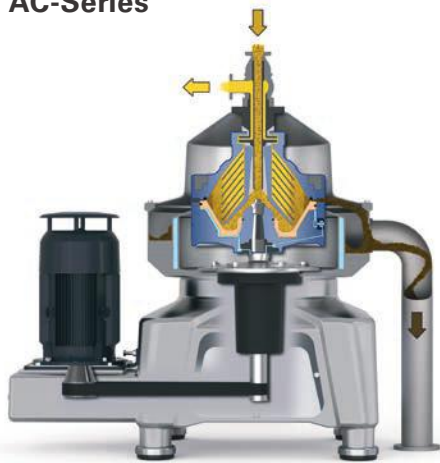
- Maximum yield even with product fluctuations
- Optimum cleaning effect
- Automated CIP cleaning
- Fluid discharge under pressure

FLOTTWEG SEPARATORS

Flottweg AC- and FDS-Series

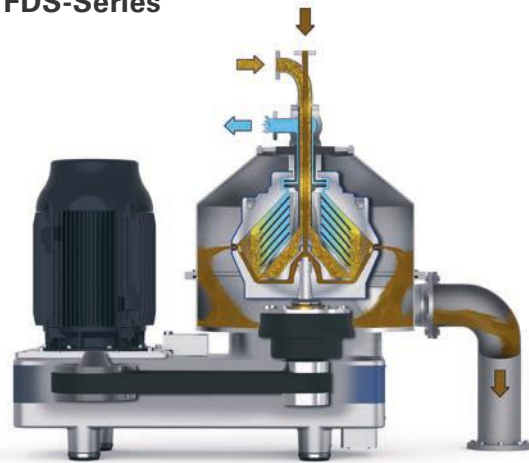
Flottweg separators are characterized by their compact, robust design, smooth running and ease of maintenance. The number of wearing parts and seals is reduced to a minimum, which reduces downtimes and operating costs. The disk pack and the distributor ensure optimum flow conditions in the drum. This enables highly efficient solids separation and maximum separation efficiency when separating liquid phases.

AC-Series



The Flottweg AC-Series is equipped with the new Soft Shot® FLEX discharge system. This ensures a high dry substance content in the discharged solids and thus highest yields.

FDS-Series



Our Flottweg FDS-Series ensures continuous separation of high solids concentrations meeting hygienic requirements, ideal for biotechnology processes. With easy maintenance and low energy consumption our Nozzle Separator can be integrated into production processes with high flexibility.

AC-Series Benefits

- Periodic discharge of separated solids with the Soft Shot® FLEX discharging system
- Processing capacities of 1-40 t/h *
- Processing of suspensions with a solids content of 2-15 % [by Vol.] *

FDS-Series Benefits

- Continuous discharge of separated solids via nozzles
- Processing of high capacities: 20-80 t/h *
- Processing of suspensions with a solids content of 5-35 % [by Vol.] *

*The listed figures are merely guidelines. Actual capacity depends on the individual characteristics of the feed and process. Subject to technical changes.



The Flottweg Soft Shot® FLEX system

Even faster, even more variable, but still quiet as always – Flottweg's proven Soft Shot® discharge system has taken a new evolutionary step, the Soft Shot® FLEX discharge system.

- Maximum yield and high throughput
- Silent solids discharge
- Minimized wear of highly stressed components
- Flexible and exact discharge times
- Maximum product yield due to flexible combination of partial and full discharges



Material and hygienic design

- High surface quality of components in contact with the product for efficient CIP cleaning
- Automatic rinsing programs for effective CIP cleaning
- Seals with FDA certificate or FDA conformity on request
- Optional: Super duplex stainless steels for higher resistance to chlorides



Drive concept

- Force transmission through a heavy-duty belt drive controlled by a variable frequency drive
- Simple, robust design for low-vibration and quiet operation
- Easy maintenance, low wear
- Flexible adaptation to product requirements through simple, variable speed control
- Reduced starting current, working speed reached rapidly
- Fast, smooth reacceleration after solids discharge



AUTOMATICALLY GOOD

The new Flottweg InGo

Automation technology has become an integral part of modern industry. An optimally programmed system helps increase and assure product quality. Intelligent networking of machines accelerates processes and increases the degree of automation of your system.

Automation today is the alpha and omega of mechanical engineering. To lower costs, nearly all of our customers now rely on fully automated, un-supervised operation of their systems. Since high-speed centrifuges are naturally used in key industries, such as the pharma and chemical industry, subject to extreme safety requirements and using complex process technology, this means that automation technology is facing a significant challenge. Efficient and perfect concurrence of all automation components is essential for a flawless process and one of the characteristics of our visualization system for machines and systems, called InGo.

Flottweg was awarded the German Design Award 2018 for its new interface. I

Advantages

- Revolutionary color design
- Perfect concurrence of individual components (high process security)
- Easy integration into existing systems
- Complete control over all process parameters at all times
- Intuitive user guidance
- Complete customer documentation can be displayed in HMI
- Visually based on PC and smartphone interfaces





CENTRIFUGE CLEANING

Centrifuges are usually flushed clean before shutdown. Depending on the application, different cleaning systems may be incorporated into the centrifuge design.

For pharmaceutical, biotech, and food processing applications Flottweg centrifuges are designed for the integration into CIP systems. For the majority of applications (e.g., wastewater, separation of crystalline products), it is sufficient to flush the centrifuge through the feed pipe to remove deposits of solids before shutdown. The flushing time and type of cleaning fluid are product-dependent. In most cases, the use of solids-free centrate will be adequate. Additional rinsing nozzles for cleaning the housing, the bowl exterior, and the scroll interior can be installed if requested.

Key features of the hygienic design

- **Dead zone elimination:** The design avoids areas where residues or contaminants could accumulate, ensuring thorough cleaning.
- **Optimized product-contact surfaces:** These are shaped and finished to facilitate fast and effective cleaning.
- **Customizable cleaning systems:** Depending on the product and process, cleaning nozzles are positioned specifically and can be integrated into manual or fully automated CIP (Clean-in-Place) systems.
- **Automated impeller adjustment:** A remotely adjustable impeller allows for complete cleaning even when the pond depth changes, without manual intervention.
- **The drives are frequency-controlled for CIP-cleaning at low speed.**
- **Flexible integration:** Hygienic decanters can be seamlessly integrated into both new and existing process environments.

Compliance with international standards

Flottweg ensures that all hygienic decanter components meet or exceed key international regulations. These standards guarantee that Flottweg's hygienic decanters are suitable for sensitive production environments, offering both safety and efficiency:

- **EC 1935/2004:** Ensures materials in contact with food are safe and do not alter food composition.
- **FDA (U.S. Food and Drug Administration):** Compliance for materials and lubricants used in food processing equipment.
- **EHEDG (European Hygienic Engineering & Design Group):** Recommendations for hygienic design and cleanability.
- **H1-approved lubricants:** All lubricants used are food-grade and certified for incidental food contact.

FLOTTWEG QUALITY AND SERVICE



Guaranteed Flottweg quality

Typical “Made in Germany”: We have a clear understanding of what quality is and do not compromise on it. In the food industry, our products must comply with high standards of hygiene. Therefore, the Flottweg centrifuge components that come into direct contact with the medium to be processed (e.g. bowl, scroll, and feed) are made exclusively of high-grade, rust- and acid-resistant stainless steels. This makes it possible to increase the strength and longevity of our materials.

Our machines are equipped to meet your requirements permanently – in extreme cases 24 hours a day, 7 days a week. Our strict quality controls (ISO 9001:2015) and the traceability of all critical components ensure additional product safety.



Our service – always there for you!

Over 1,100 employees worldwide in a network of over 60 sales and service locations are on hand to assist you. We not only strive for first-class advice on the selection and design of our systems, but we are also there for you afterwards, whenever you need us – in more than 100 countries around the world.



Success can be planned. In just three steps.

Are you planning your own success story for your products?

Then get in touch with Flottweg and benefit from our 3-step roadmap:

01

We discuss your separation task and business goals with you.

02

In the pre-engineering stage, we analyze your raw materials in our laboratory and carry out customized tests at the Flottweg Technical Center or on site at your business premises. The first product samples can also be provided at this point.

03

After the design and detailed development process, you will receive a concrete offer including all relevant line figures for your individual Flottweg application.

Make Flottweg the engineer of your success:
Our sales partners are looking forward to hearing about your ideas and challenges!



Flottweg worldwide

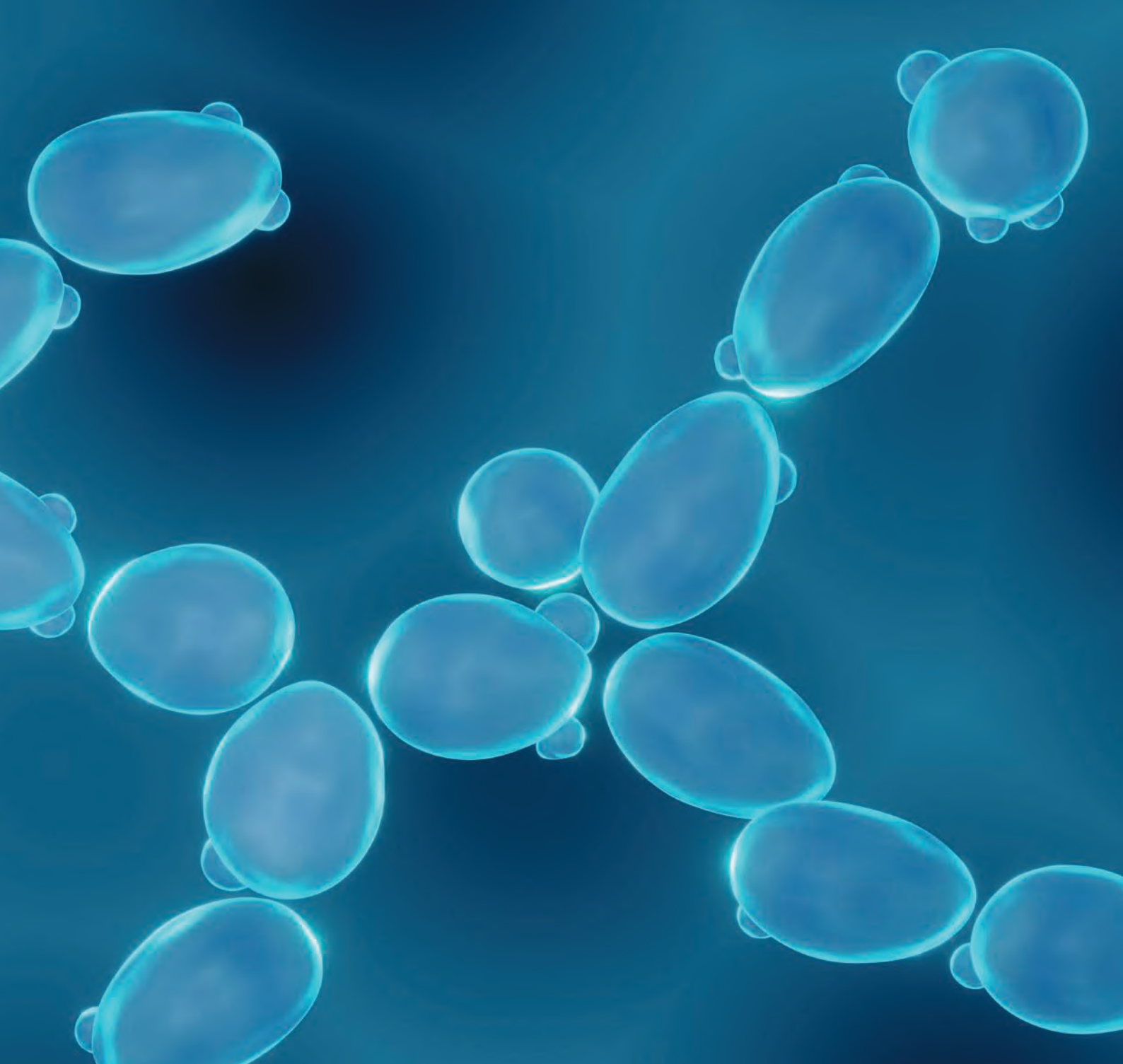
To be able to serve our customers worldwide, we maintain an international sales and service network: We are represented in over 100 countries. All branches and representatives have specially trained service technicians, some of whom we train in our in-house Flottweg Academy.

11
international
subsidiaries

Projects in over
100
countries

Over
50
service centers

- – Headquarters
- – Subsidiary
- – Representative



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