Flottweg
Separation Technology

FLOTTWEG CENTRIFUGES

The Most Efficient Industrial Fish Processing

TRENDS AND FIGURES

The latest figures for the global production of fish, crustaceans and molluscs published by the FAO* in 2014 show that in recent years, the total amount has reached 160 million tons per year. This figure includes both the capture production which has been nearly constant with approx. 90 million tons per year, as well as the aquaculture production which currently amounts to approx. 70 million tons per year and has shown continuous growth over the last several years.

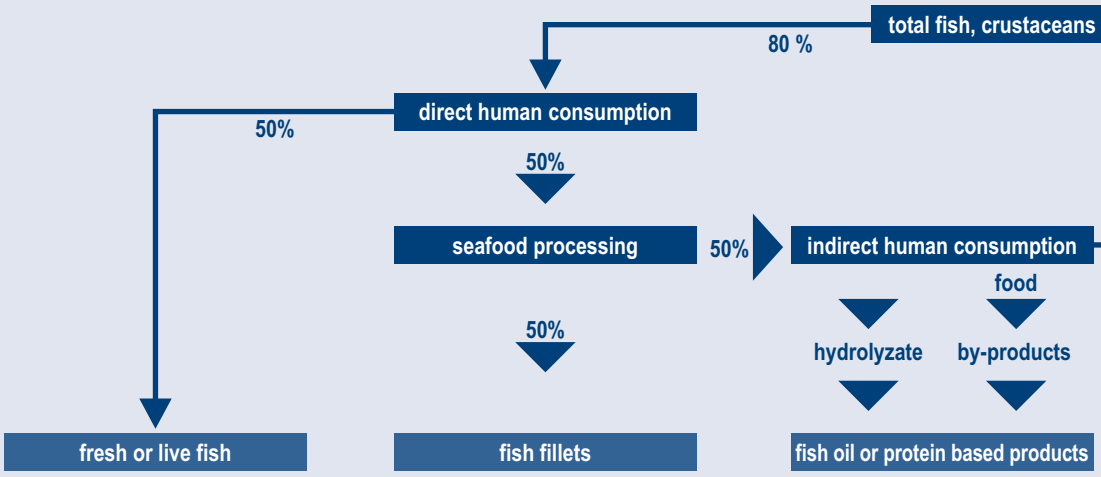
Nearly 80 percent, i.e. 130 million tons per year, are used for direct human consumption. The other 20 percent of the global production, 30 million tons per year, are by-products such as by-catch, heads, bones and skins which are separated during the various stages of industrial processing.

The amount destined for human consumption is divided into two: One half is sold live or fresh while the other half is processed into convenience sea-food products, marinated or canned. Approximately 50 % of the raw material to be processed for seafood is edible. This means that a quarter of the production destined for human consumption is not useable for direct human consumption. A part of this portion is used for elaborated food products such as fish soup, sauces, flavors etc., whereas the rest ends up as residuals.

In total, each year there are globally approx. 50 million tons of residuals from fish production and processing which could either be a hazard when carelessly discarded into the environment or a source of additional profit when converted into something of value, e.g., fish oil and fish meal for feed, as well as for industrial use.

*Food and Agriculture Organization of the United Nations

TECHNICAL INFO

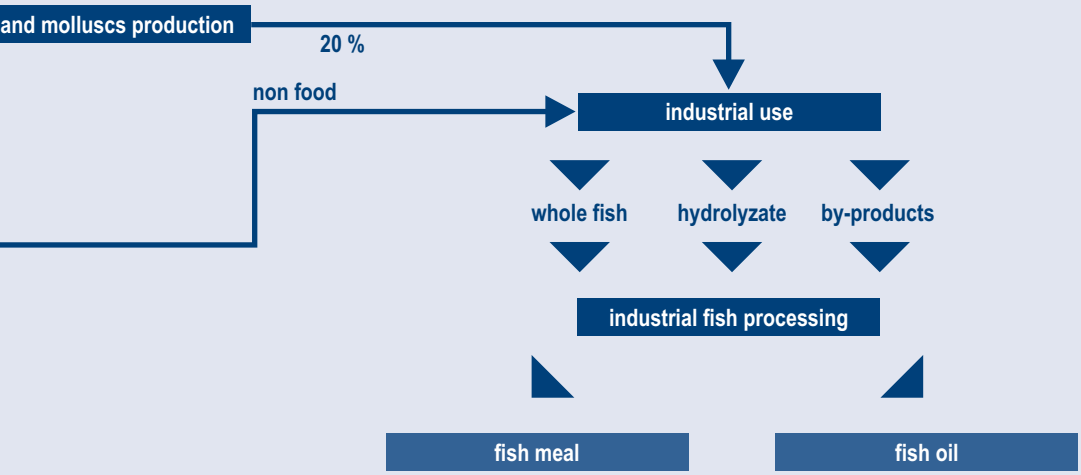


FLOTTWEG CENTRIFUGES FOR FISH PROCESSING

Industrial centrifuges are able to separate oil from water, solids from water as well as oil, water and solids simultaneously. So they play a key role in all of the processes for the recovery of fish meal and fish oil as well as in some processes for seafood production, e. g. surimi. Many Flottweg Centrifuges have been in service for decades in all of the major fish processing regions worldwide. The reasons for this are the following key success factors:

Key success factors

- No alteration of the product due to quick processing, even in cases of large volume
- Reduced emissions of odors or vapors due to the closed design
- Cleaning in place (CIP) capability (option)
- High performance and separation efficiency
- High cost efficiency due to continuous and automatic operation
- High reliability and availability



THE TRICANTER® PROCESS

Recovery of Fish Meal and Fish Oil

The Tricanter® process is considered to be the standard fish meal process and was developed to recover fish meal and fish oil from whole fish or from residuals such as heads, fins, bones, etc. This procedure is usually applied in large scale fish filleting plants which process more than 8 tons per hour. In South America it is the most used process to produce fish meal and fish oil from anchoveta.

In the first process stage the raw material is heated so that it disintegrates and releases the fish oil. After cooking, the material passes through a screening stage to be separated into a protein-rich solid phase and a liquid phase containing oil, water and fine solids. Next, the solids phase from the screens is separated further via presses into a press cake and a liquid phase. Finally the press cake is dried to obtain the fish meal.

The liquid phase from the screening and pressing stages is separated into fish oil, stick water and solids. For this separation there are two options: A two-stage separation where a clarifying decanter separates the solid material followed by a disk stack centrifuge to skim the fish oil from the stick water. In contrast, the Flottweg Tricanter® enables this 3-phase separation in one single stage.

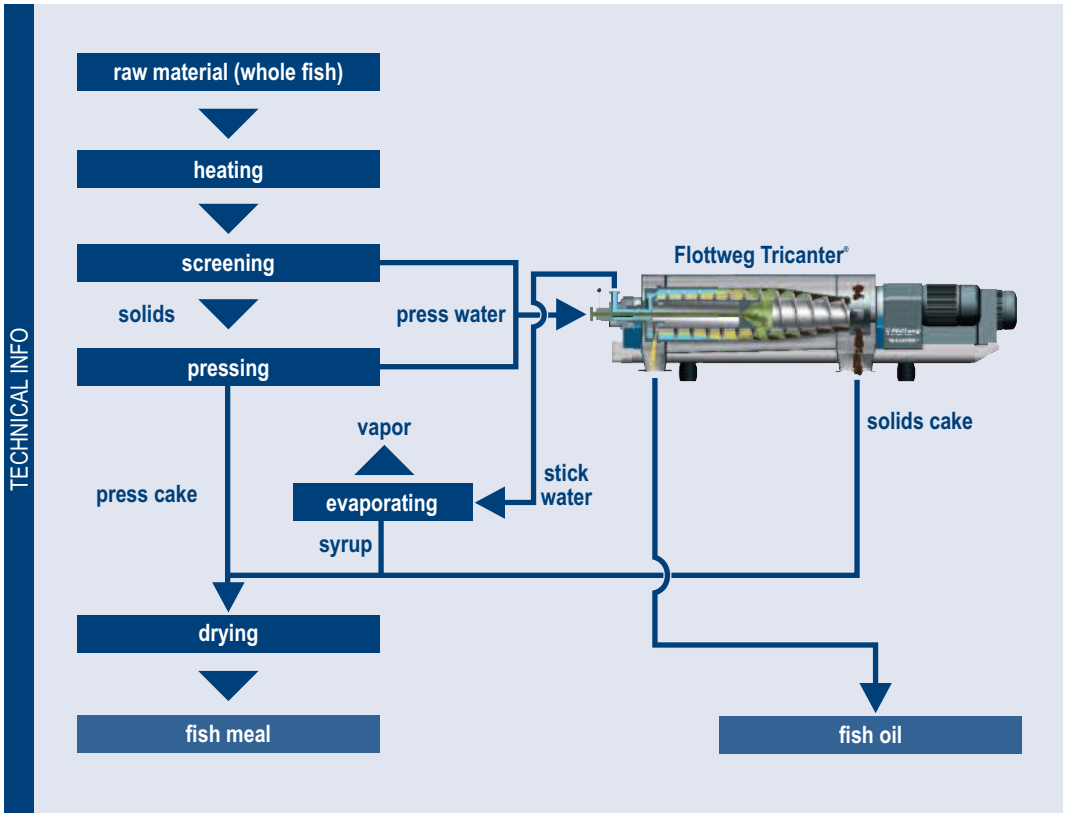
Afterwards, the stick water is concentrated into a syrupy consistency through evaporation. This syrup and the solids cake from the Decanter/Tricanter® are mixed together with the press cake and thermally dried.

Benefits of the Flottweg Tricanter® in comparison to two-stage separation

- **Faster processing**
- **Reduced investment costs for machines and accessories**
- **Saves operation costs for heating, maintenance and service**
- **Saves space inside the building**
- **Saves power consumption**

® = registered trademark in various countries

TECHNICAL INFO



HYDROLYSIS
Innovation for Added Value

Hydrolysis is the enzymatic disintegration of proteins located in muscles or other tissues. Typical raw products are by-products and residuals from fish processing.

ENZYMATIC HYDROLYSIS

Another process is the production of fish oil and fish meal from fresh material which is not used for filleting or canning but is used for food or animal feed. Typical examples for use in human consumption are elaborated fish products or additives such as fish soup, fish sauces, flavors, energy drinks, etc.

The separation into fish oil, stick water and protein-rich solids is performed in one to three stages, depending on the raw material and the desired purity of the final products. In the first stage there is always a Tricanter®. Optionally the oil can be separated further using a disk stack centrifuge for higher purity. Another option is a second clarification via the Flottweg Sedicanter® to separate the fine solids from the stick water in order to reduce its viscosity for a higher concentration as well as to reduce fouling inside the evaporator.

Customer Benefits

Flottweg Tricanter®
in hydrolysis processes
- **Enables quick processing to avoid alteration of the product**
- **Energy efficient operation**
- **High flexibility**

Flottweg Sedicanter®
- **Unique innovative centrifuge for enhanced efficiency of the entire process**
- **Higher yield in protein due to high separation efficiency**
- **Reduced cleaning efforts due to less fouling since a smaller quantity of solids go to the evaporator**

Flottweg Disk Stack Centrifuge
- **High purity fish oil**
- **High yield of purified oil due to partial bowl discharge**

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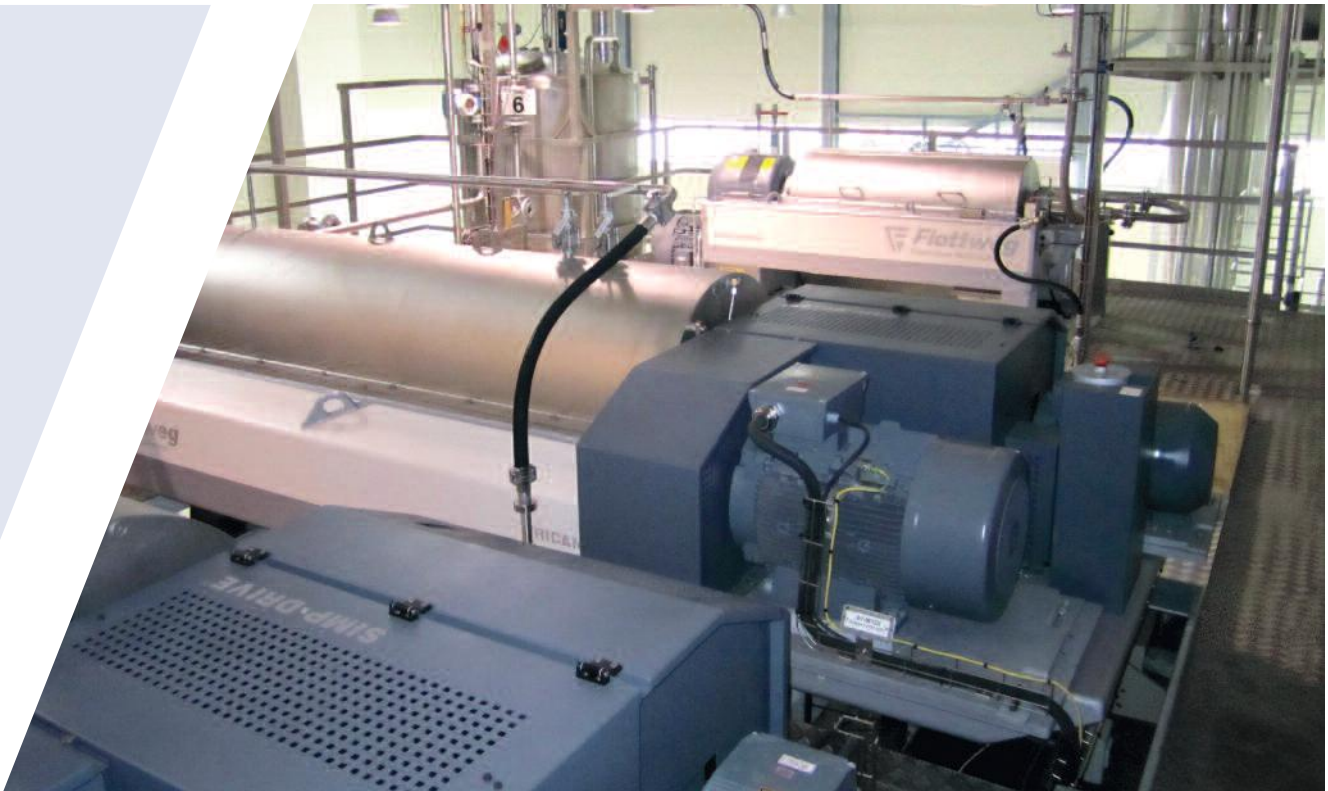
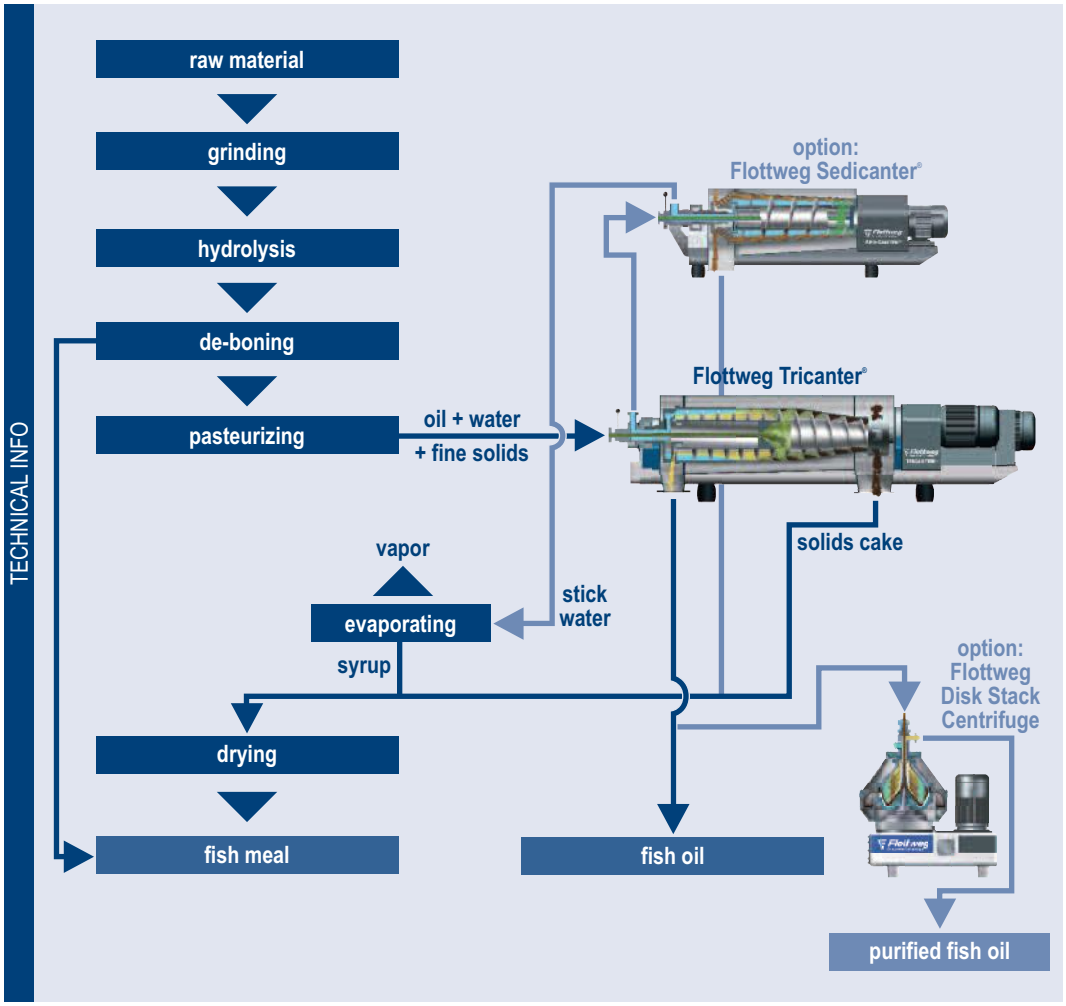
Flottweg Tricanter® Z5E and Sedicanter® S4E in a Norwegian facility for processing fish hydrolysis





Flottweg Disk Stack Centrifuge AC 1500 for oil purification

DIRECT PROCESSING OF FISH BY-PRODUCTS

Everything Has Value

Direct processing means that the raw material is ground up and then goes directly to the heater. After heating, it is separated into fish oil, stick water and a solids cake via the Flottweg Tricanter®. The stick water is concentrated to a syrupy consistency through evaporation. This syrup and the solids cake from the Tricanter® are blended for thermal drying.

Direct processing is suitable for the production of fish oil and fish meal from whole fish, by-catch, by-products from filleting plants as well as residuals from canning. Sometimes direct processing is also used with spoilt material, which causes problems when handling in screw presses, as well as for processing special species. Typical capacities range up to 6 tons per hour.

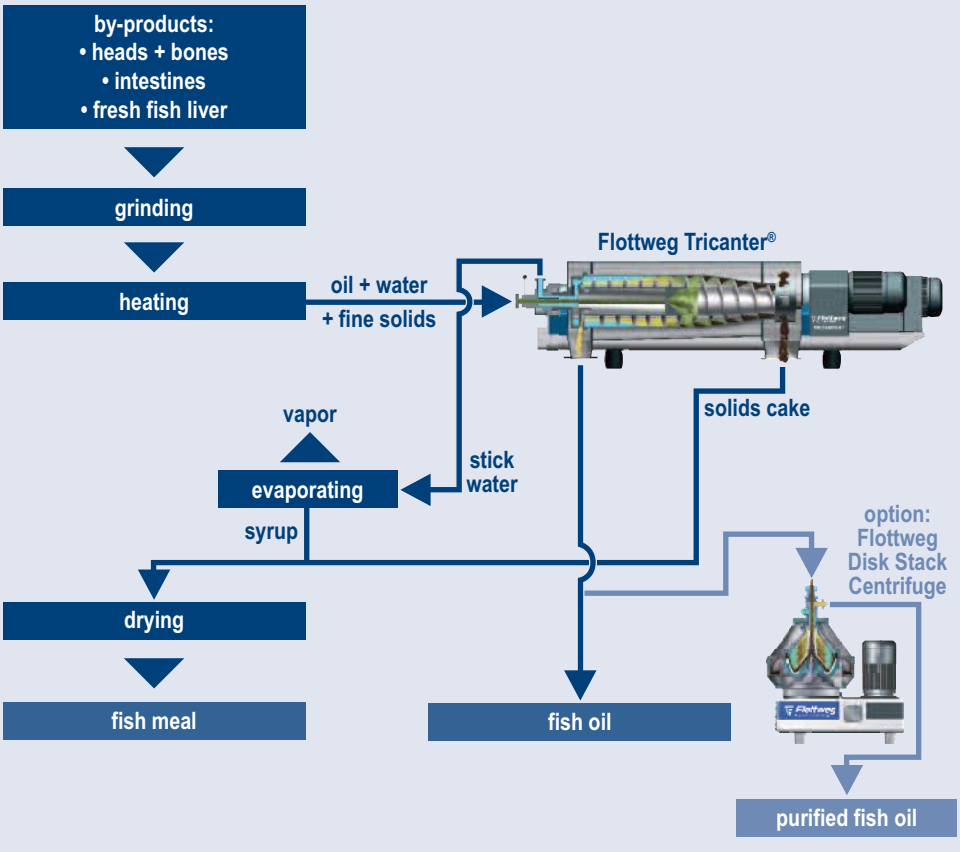
Direct processing is also used for the recovery of fish liver oil for direct human consumption. In this case the entire process line is laid out in hygienic design and nitrogen blanketing is available as an option in order to avoid oxidation of the liver oil.

An option in cases where a particularly high oil purity is needed, e.g. for recovery of Omega 3 fatty acids or high quality oil for human consumption, is to purify the oil coming from the Tricanter® using a disk stack centrifuge.

Benefits of the Flottweg Tricanter® in direct processing

- Quick processing to avoid alteration of the product
- High quality fish oil without an increase in free fatty acid (ffa) content
- Reduced amount of waste to be disposed of
- Energy efficient operation
- Available as skid mounted package unit on a platform or inside a container

TECHNICAL INFO



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FISH SILAGE

Raw materials from decentralized processing facilities are collected and stored in tanks; sometimes the material is ground. An enzymatic reaction is performed using either the native enzymes of the fish or bacterial activity. The biological reactions are controlled by adding acid, thus adjusting the pH-value. Due to this treatment the material becomes storable. Before processing it into fish oil and fish meal, it is pasteurized. This kind of hydrolysis is also suitable for processing material which comes from contaminated, virus infected or dead fish.

However, this so-called category 2 material must be strictly kept away from the food supply chain. So the oil from category 2 material is only suitable for industrial use or fuel. After continuous sterilization, protein substrate made from this material can be used for biogas production.

Customer Benefits

Flottweg Tricanter®
for processing fish silage

- **Quick processing**
- **High oil purity in one separation stage**
- **Suitable for processing cat 2 material**
- **Process integration including continuous sterilization**

Flottweg Tricanter® Z5E in a Norwegian facility for fish silage, category 2 material

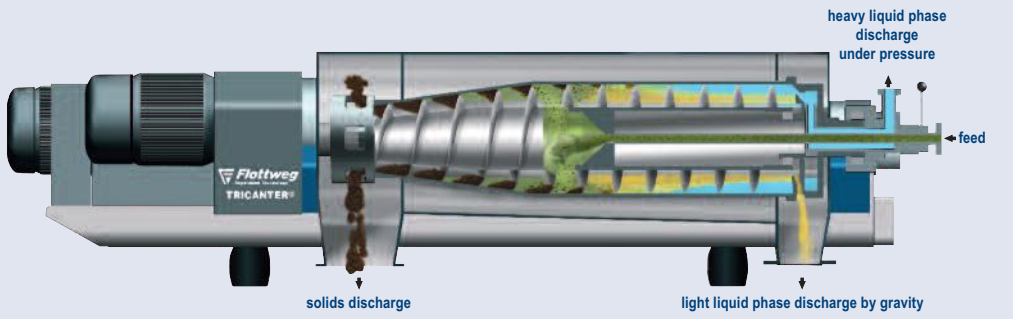
FLOTTWEG TRICANTERS®
a Proven and Convincing Technology

In 1971, Flottweg presented the first Tricanter®, a centrifuge which simultaneously separates oil, water and solids. Compared to other 3-phase decanters the Flottweg Tricanter® stands out by its high separation efficiency which results in high purity of the separated oil and virtually no oil losses in the separated water. The reason for this unique separation efficiency is an impeller disk which can be adjusted during operation. The adjustable impeller allows a fine adjustment of the boundary line between oil and water so that the separation of oil and water is always accurate.

Key success factors at a glance

- 24 hour operation with minimum supervision
- Low specific energy consumption
- Compact design, small footprint
- Easy control and monitoring due to continuous and automatic operation
- Differential speed control can be regulated for a consistent cake dryness using the Flottweg Simp Drive®
- Sealed construction that prevents odor emissions
- Accurate separation of water and oil since the impeller disk can be adjusted during operation at full speed
- Hygienic design available

TECHNICAL INFO



Flottweg Tricanter® (Three Phase Decanter)
Discharge of the centrate: heavy liquid phase under pressure, light phase by gravity

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TECHNICAL DATA FOR FLOTTWEG TRICANTERS®			
Type	**Z4E-4**	**Z5E-4**	**Z6E-4**
Materials of construction	All product wetted parts are made of high grade stainless steel such as 1.4463 (Duplex), 1.4571 (AISI 316 Ti), etc.		
Dimensions* (L x W x H)	3735 x 1000 x 1200 mm 147" x 39" x 47"	4524 x 1564 x 1121 mm 178" x 61" x 44"	5147 x 1705 x 1500 mm 203" x 67" x 59"
Gross weight*	3000 kg 6614 lb	6200 kg 13,670 lb	9750 kg 21,500 lb
Motor for bowl drive	22 kW 30 hp	45 kW 60 hp	75 kW 100 hp
Motor for scroll drive Flottweg Simp Drive®	11 kW 15 hp	15 kW 20 hp	30 kW 40 hp

** The listed figures are guidelines for information only.*

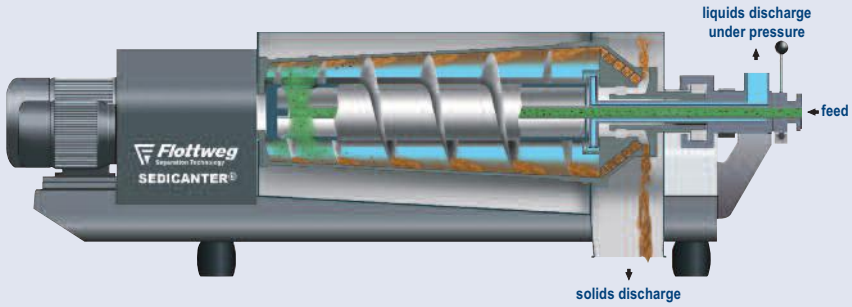
FLOTTWEG SEDICANTERS®
Perfection in Separation

The Flottweg Sedicanter® is an innovative centrifuge built for the separation of fine soft solids difficult to separate via a Decanter or Tricanter®. Due to its unique bowl design the Flottweg Sedicanter® operates at much higher g-force than a Decanter or Tricanter®. So in fish processing, the Flottweg Sedicanter® is the perfect option when fine protein rich material is to be separated from a water stream.

Benefits of the Flottweg Sedicanter®

- **Unique design**
- **Outstanding separation efficiency**
- **High cake dryness**
- **Continuous processing**

TECHNICAL INFO



Flottweg Sedicanter®

TECHNICAL DATA FOR FLOTTWEG SEDICANTERS®			
Type	**S3E-3**	**S4E-3**	**S6E-3**
Bowl diameter	300 mm / 12"	470 mm / 18"	670 mm / 26"
Bowl speed	7750 rpm	5000 rpm	3650 rpm
Differential speed	1.5 – 30 rpm	1.5 – 30 rpm	1.5 – 30 rpm
Materials of construction	All product wetted parts are made of high grade stainless steel such as Duplex, AISI 316 Ti and superior		
Dimensions* (L x W x H)	2304 x 700 x 752 mm 91" x 28" x 30"	3222 x 1000 x 1200 mm 127" x 39" x 47"	4527 x 1705 x 1270 mm 178" x 67" x 50"
Gross weight*	1210 kg / 2668 lb	3100 kg / 6834 lb	10,530 kg / 23,215 lb
Motor for bowl drive	15 kW / 20 hp	37 kW / 50 hp	75 kW / 100 hp
Motor for scroll drive Flottweg Simp Drive®	4 kW / 5 hp	5.5 kW / 7.5 hp	15 kW / 20 hp

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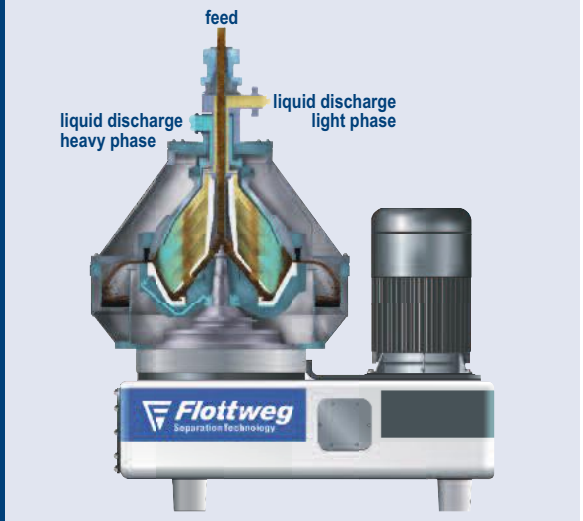
FLOTTWEG DISK STACK CENTRIFUGES
for Perfect Oil Purification

Disk stack centrifuges are the best option to polish the oil phase coming from the Tricanter® in cases where particularly high oil purity is required, e.g., recovery of Omega 3 fatty acid or fish oil for food production.

TECHNICAL INFO



Flottweg Disk Stack Centrifuge

TECHNICAL DATA FOR FLOTTWEG DISK STACK CENTRIFUGES			
Type	**AC1000**	**AC1500**	**AC2000**
Bowl volume	4 liters	14 liters	25 liters
Solids space	1.5 liters	7 liters	11.5 liters
Dimensions* (L x W x H)	1100 x 600 x 1000 mm 43" x 24" x 39"	1500 x 1000 x 1700 mm 59" x 39" x 67"	2000 x 1100 x 2100 mm 79" x 43" x 83"
Gross weight*	390 kg / 860 lb	1600 kg / 3530 lb	2900 kg / 6400 lb
Bowl drive max.	5.5 kW / 7.5 hp	18.5 kW / 25 hp	37 kW / 50 hp

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RECOVERY OF FISH MEAL FROM WATER TREATMENT

from Waste to Value

Water streams in the fish processing industry such as pump water, flush water from cleaning and waste water contain a remarkable portion of protein which should not be released into the environment. On the other hand, when recovered as fish meal it might be a source for additional income.

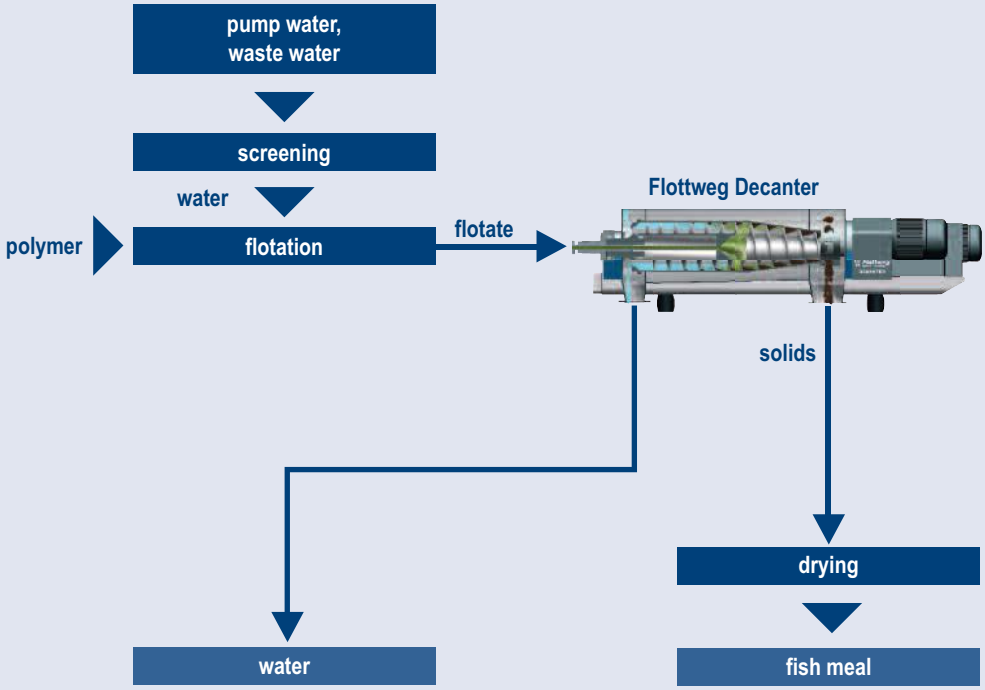
Incoming water passes a screening stage where the coarse material is separated. In a dissolved air flotation unit (DAF) the suspended solids build up as a floating layer which is pumped into a decanter centrifuge for dewatering. With the addition of polyelectrolytes, the fine solid particles clump together to form larger flakes which enhance the efficiency of the flotation as well the decanter performance. The solids cake from the decanter is dried in a process downstream.

Benefits of the Flottweg Decanter in comparison to other dewatering techniques

Optimized operation/labor costs by

- **Continuous and automatic operation**
- **Easy cleaning by flushing without dismantling**
- **Durable wear protection and field-replaceable spare parts**
- **No consumables such as filter aids, filter cloth, etc.**
- **Reduced drying costs due to maximum cake dryness**
- **Outstanding energy efficiency**

TECHNICAL INFO

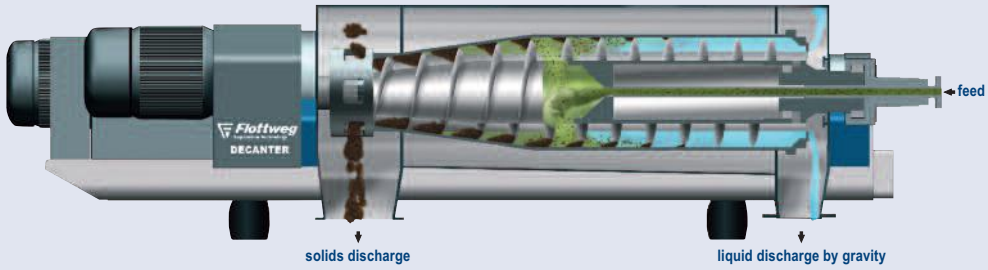


FLOTTWEG DECANTERS

Just as the Flottweg Tricanter® for the 3- phase separation, the Flottweg Decanter is the right equipment for two phase separation tasks such as the dewatering of sewage sludge in industrial and municipal waste water facilities. Since the 1950s, when Flottweg started to build centrifuges, providing decanters for waste water treatment has been one of Flottweg's core strengths.

Today Flottweg Decanters efficiently operate in waste water facilities all over the world. In the fish industry Flottweg Decanters are in use for the dewatering of waste water sludge or flotate from pump water.

TECHNICAL INFO



Flottweg Decanter for liquid-solid separation with gravity overflow of the liquid phase (centrate)

QUALITY "MADE IN GERMANY"

Flottweg is ISO 9001 certified and manufactures its products in compliance with all the latest technical standards.

TECHNICAL DATA FOR FLOTTWEG DECANTERS				
Type	**Z4E-4**	**Z5E-4**	**Z6E-4**	**Z73-4**
Materials of construction	All product wetted parts are made of high grade stainless steel such as Duplex stainless steel 1.4571 (AISI 316 Ti), etc.			
Dimensions* (L x W x H)	3500 x 1000 x 1200 mm 138" x 40" x 47"	4180 x 1560 x 1400 mm 165" x 61" x 55"	4800 x 1705 x 1500 mm 190" x 67" x 60"	4815 x 2350 x 1500 mm 190" x 92" x 60"
Gross weight*	2600 kg 5700 lb	6200 kg 13,700 lb	9230 kg 20,350 lb	11,000 kg 24,250 lb
Motor for bowl drive*	22 kW 30 hp	45 kW 60 hp	75 kW 100 hp	90 kW 125 hp
Motor for scroll drive* Flottweg Simp Drive®	4 kW 5 hp	7.5 kW 10 hp	15 kW 20 hp	22 kW 30 hp

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Flottweg Separation Technology – Engineered For Your Success

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