

Separator's Digest

November 1999

The Magazine of Westfalia Separator AG

Faster Spin-Off

Separators in Breweries

New Communication Concept

Take the Best – Separate the Rest

3E Quality

Quality has a New Mark of Distinction

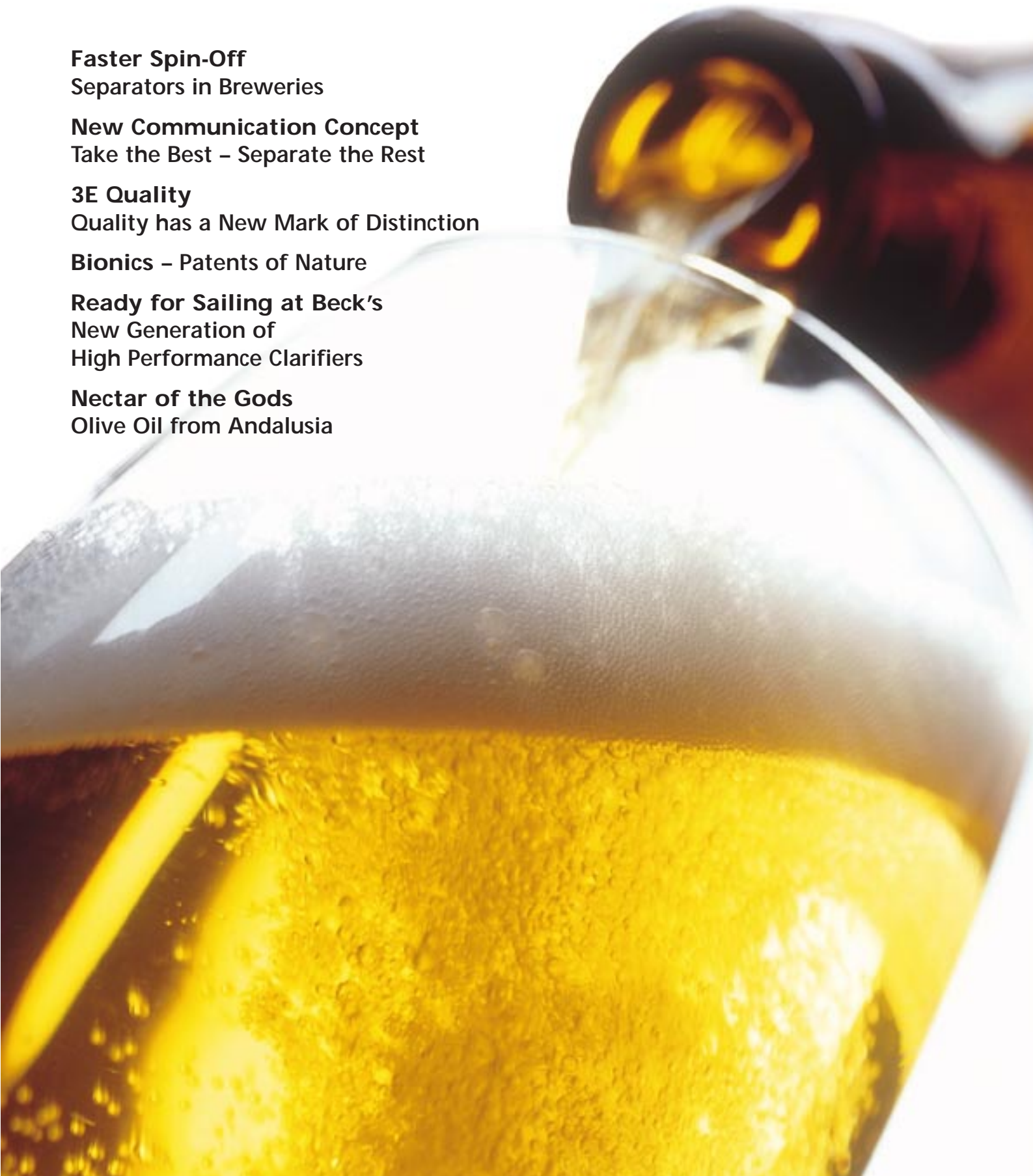
Bionics – Patents of Nature

Ready for Sailing at Beck's

New Generation of
High Performance Clarifiers

Nectar of the Gods

Olive Oil from Andalusia



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IMPRINT

Publisher:
Westfalia Separator AG
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From left to right:
Stefan Rehnert and
Peter Schenk

Open and Offensive

This edition of the Separator's Digest presents a changed Westfalia Separator. The familiar traditional Westphalian company is opening up. "Success no longer depends solely on the quality of the products and services, but rather on the holistic behaviour of a company in the public eye". We have fully understood the implications of this message. As we are a successful core division of the GEA Group and Metallgesellschaft, and want to stay that way, we will gear up and speed up the dynamics.

To come even closer to fully satisfying the demands of the market, Westfalia Separator decentralized the organizational structure on January 1 1998, creating five production and operative companies. These companies can focus on the most important market segments, and can act without the "strategic constraints" from other market segments. The net result is a customer proximity which allows us to directly address the needs of the market.

Direct customer contact in the field is assured by our global presence. Despite the structure which is still characteristic of a medium-sized company, 47 subsidiaries put us in a good position to serve our customers expertly and speedily. In addition to the international sales organization, Westfalia Separator has set up an equally broad-based service network.

Our experience and current advertising campaign make it clear that we are always willing to listen to our customers. Now we are going a step further. We are speaking out: our new communication concept is presented on pages 3/4 of this issue.

The fascination with the possible and not-yet-possible is our incentive. In this regard, you will experience a number of surprises with us in the years ahead. We will keep you updated: in the next issues of our Separator's Digest. Enjoy reading!

Peter Schenk
Chief Executive Officer

Stefan Rehnert
Executive Director
Chief Financial Officer

Take the Best –

The task of drawing up a new communication concept for a specialised German engineering company which is a world leader in its field is as difficult as it is rewarding. Many “hidden champions” are to be found in this very branch; in other words, companies, which are top performers in their field but choose to keep this a well-guarded secret.

This new communication concept, from which we have selected two examples in this magazine, ushers in the end

of the era of polite reticence. Not brash-brazen, but oozing self-confidence; not frivolous, but on the offensive. “If you do what you always do, you will get what you always got”, is a fact that was already recognized by Abraham Lincoln back in his time.

If its alright for our colleagues on the consumer side to do it, why shouldn't we? We will be telling you about our decanters, which played a major role in cleaning up the Spanish Doñana National Park after it had been the victim

Take the Best - Separate the Rest

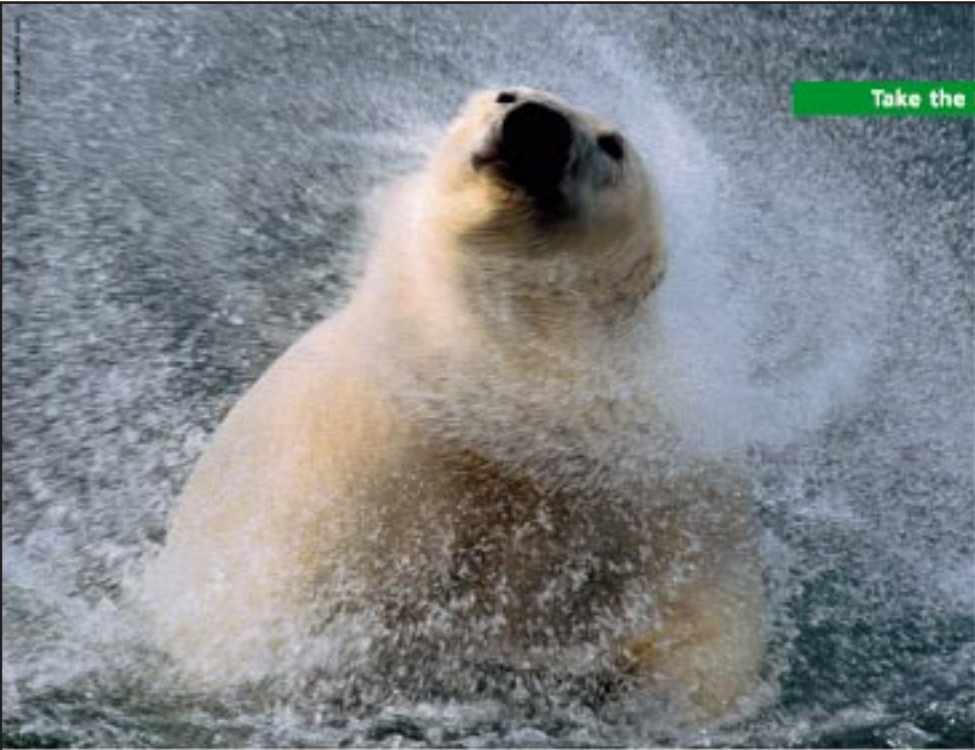
The Principle of Gravitation is Over 10 Billion Years Old. But we are Finding New Ways to utilize it Every Day.

The phenomenon that holds our entire universe together also connects all our company activities: the principle of gravitation. Using separation and decanters, which we have been developing for over a century, we have perfected the process of mechanical separation of countless materials. We consequently offer our customers constantly optimized solutions for highly specific needs - in chemicals and pharmaceuticals, in biotechnology, and in the food industry, as in environmental technology and mineral oil treatment. The 21st century will present new challenges. We are looking forward to them - day by day.

Peter Schenk
Chief Executive Officer

GEA Westfalia Separator

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Take the Best - Separate the Rest

We Didn't Invent Centrifugal Separation. But Nobody Masters It More Skilfully Than We Do.

It is inevitably Nature who provides the best and most imaginative ideas. She, too, was the one who gave us the principle of the centrifugal separation of materials and substances. However the perfecting of this technique fell to us. Our success in this field is being constantly verified day in, day out by our separators and decanters, which are in operation under tough conditions throughout the world and indeed in the most diverse spheres, such as chemistry, pharmacy, biotechnology, the food processing industry, environmental technology as well as the mineral oil industry. And this has not just been going on since yesterday. Our success spans more than 100 years which means any other competition is really history. Today we are selling the stars.

Stefan Reinert
Executive Director
Chief Financial Officer



GEA Westfalia Separator

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Separate the Rest

of one of the worst ecological disasters in Western Europe! We will be reporting about your morning milk, which has been skimmed thanks to Westfalia separators. We are also pleased that you can enjoy an evening beer which is not cloudy but clear, because the yeast cells have been removed by our separators!

You will soon encounter a polar bear freeing itself centrifugally from water. You will experience the birth of a galaxy symbolizing the principle of centrifugal force. And you will see a small krill, which might just become a food of the future with the help of our separation technology.

In line with this holistic approach, we will be addressing our customers in our communication, and showing them what we can achieve together. We have already achieved a lot in the past.

You can only be close to the customer if you constantly reach out to him. We're coming – get ready for us!



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Separators in a dairy

From Separator Manufacturer to Problem-Solver

Westfalia Separator has been manufacturing centrifugal separators for over 100 years. The company has undergone a radical transformation in this time. The number of applications for centrifuges has witnessed phenomenal growth. Over 2000 applications in the separation technology sector have been tested or successfully established in the field.

Customized and Customer-Oriented

Based on decades of experience, coupled with intensive research and development, Westfalia Separator manufactures machines using the latest technological expertise which fulfill the most stringent quality requirements. Westfalia Separator has been working to DIN ISO 9001 standard since 1989. New tasks arise daily which must be solved by finding appropriate solutions in the form of machine design and process engineering.

Process Engineering

Separators or decanters are often at the heart of a process. Since the pool of knowledge of process engineering requirements has steadily grown over the years, it seemed logical to include upstream and downstream equipment in our programme. Consequently, Westfalia Separator today offers turnkey separator systems and lines for a large number of processes.

Customer- and Product-Oriented

Five highly efficient units operate in the different market segments as autonomous companies.

- Westfalia Separator Food Tec
- Westfalia Separator Industry
- Westfalia Separator Mineraloil Systems
- Westfalia Separator Umwelttechnik
- Westfalia Separator Engineering

Westfalia Separator Food Tec



Dairy Technology

It all started with the milk centrifuge. Today, Westfalia Separator supplies sophisticated separators, decanters, process lines and installations for the production of milk and milk by-products. Special processes such as the DPL process for further defatting of whey or the DCP process (calcium phosphate separation) have been developed by Westfalia Separator.

Beverage Technology

Separators and decanters have been indispensable units for decades in the production of beer, wine, fruit and vegetable juices as well as other beverages like tea, cocoa, and soya milk. In the decisive process stages, continuously operating centrifuges assure economical processing and high quality of the end product.

Oils and Fats Processing

On account of the large number of possible applications, edible oil is increasingly gaining significance as an essential constituent in the food industry. Westfalia Separator has made a decisive contribution to the development of continuous refining processes through the application of centrifugal separation technology.

Westfalia Separator Industry

Chemicals/Pharmaceuticals/Biotechnology

Mechanical separation processes find application in numerous processes in the chemical and pharmaceutical industries.

There is a wide range of product applications for centrifugal technology in organic and inorganic chemistry; petrochemistry and plastic production; base substances and in the pharmaceutical industry and biotechnology.

Oils and Fats Recovery

Modern processes for the recovery of oils and raw fats are characterized by the widespread application of centrifugal clarification and separation techniques.

As stand-alone machines or integrated in complete processing lines, separators or decanters are used not only for the recovery and processing of, for example, olive oil, palm oil, avocado oil but also edible fat, cocoa butter and wool fat.

Starch Technology

Westfalia Separator is a technology leader in starch recovery. Centrifugal separation technology is of central economic significance in this field. In close cooperation with the starch industry, Westfalia Separator has developed environment-friendly process techniques that ensure optimum utilization of the raw materials.

Service – Our Basis for Good Partnership

The Westfalia Separator service team helps you direct on-site, quickly and reliably.

An intelligent, global storage and logistics system makes possible short delivery times for genuine spare parts.

Specially developed training programmes, practice-oriented instruction and training courses – on your premises if required – or in our modern training centre ensure that your operating and servicing personnel is kept abreast of the latest technological developments.

Industrial Biotechnology

Westfalia Separator is a competent partner for processing fermentation products. Uniform product treatment and product quality must be assured with high efficiency and economy.

Westfalia Separator Mineraloil Systems

Westfalia Separator Mineraloil Systems is regarded as a market leader in the centrifugal treatment of mineral oils and their derivatives. The sales programme includes centrifugal separators, decanters and the corresponding system components for application on board ships, in power plants, in the recovery of crude in oilfields and in industry for the treatment of industrial fluids.

Westfalia Separator Umwelttechnik

Protection of the environment is crucial to conserve natural resources. Westfalia Separator offers innovative solutions with separators and decanters for municipalities and industry. Fields of application include the maximum possible dewatering of sludge, the thickening of surplus activated sludge as well as the recovery of valuable substances from production processes.

Westfalia Separator Engineering

Due to the process engineering know-how of the Westfalia Separator Group, there has been a steady increase in demand for system-based solutions with corresponding automation from one and the same supplier.

Ready piped and wired on a frame and equipped with all the necessary measuring instruments, fittings and control systems, customized modules offer the user a complete, tested unit which can be quickly and easily integrated in this process.

Westfalia Separator Engineering plans, assembles, automates and commissions complete process lines.



Applications in Technology

Centrifugal separation technology using separators and decanters today plays a key role in the

- Clarification of liquids
- Separation of liquid mixtures
- Concentration and dewatering of solids
- Wet classification
- Extraction of constituents

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Head of Communication
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Global Presence

The domestic sales activities for the sectors Food Tec, Industry and industrial environmental technology are the domain of Westfalia Separator Deutschland whose head office is located in Oelde. The sales offices in Oelde, Hamburg, Dessau, Frankfurt, Stuttgart and Munich assure a speedy and smooth service.



Globalisation has been reality for Westfalia Separator for decades. Whether in Europe, America, Asia, Africa or Australia – Westfalia Separator maintains a global presence through 47 sales and service companies as well as distributors in a further 60 countries.

High-Tech for Processing Baker's Yeast

For the sixth time in succession, the "Industrial biotechnology" business unit of Westfalia Separator Industry has beaten strong competition on the international market for processing baker's yeast.

SAF-Argentina, a subsidiary of the French Lesaffre group, has awarded Westfalia Separator an order for supplying the entire separating technology for processing baker's yeast including an installation for molasses clarification.

The core of yeast processing is the newly developed nozzle-type separator using the VISCON® system type HFB 130. The main feature of this system compared with conventional separators is the viscosity-dependent concentration regulation system using the special nozzles of the patented VISCON® system. This permits a virtually constant biomass concentration even when feed quantities and concentrations are not constant.



Process line with nozzle separators for the recovery of yeast.

The hydro-hermetic product feed system ensures gentle treatment of the product and an optimum clarifying effect particularly with products that are sensitive to shearing forces.

Starch Technologies

The 50th international starch symposium was held in April in Detmold. 350 scientists and engineers from throughout the world demonstrated further possible applications as well as new technologies for the starch industry. Starch is now used in more than 650 practical applications.



Three Steps in One

In their lectures, Dipl.-Ing. Markus Seiler and the head of starch technology Dr. Willi Witt from Westfalia Separator AG provided information concerning new developments in starch technology, for instance 3-phase technology. This new technology using separators and decanters of Westfalia Separator achieves a significant improvement in the cost/benefit ratio.

Separation into starch and other flour constituents takes place in the first process stage. Three process stages (washing, classifying and concentrating) are combined in one stage. The advantages of this procedure are flexibility in choice of raw material and product quality as well as high yields and economical operation. The new decanter type CallBridge TP 505 and the nozzle-type separator type SDA 130 are at the leading edge of 3-phase technology. Examples of applications for this technology are: Maize, wheat, rice, potatoes and soya.



Gentle Milk Treatment and Optimum Skimming at the Upper End of the Performance Range

For the rational and economical separation of milk into skim milk and cream or whey into skimmed whey and cream, Westfalia Separator has developed the "soft-stream" separator type MSE 400 with a capacity of up to 45,000 l/h (for skimming milk and whey) or up to 50,000 l/h (for clarifying and standardising milk).

This means that the range of products at the upper end of the performance range has been extended based upon the

tried-and-tested concept of the separator type MSD 300. Particularly important aspects were trouble-free "24-hour permanent operation", a robust design and high operational reliability. The gentle product feed with the "soft-stream" system avoids shearing forces when the product enters the bowl and optimises the skimming effect.

Small Mineral Oil Separator: Reduced to the Essentials

In close cooperation with the users, Westfalia Separator has developed the new mineral oil separator type OTC 2 specially for small capacities up to 1400 l/h. This separator is smaller, better, but with all the advantages of its "big brothers". The new type OTC 2 centrifuges separates water or impurities from dirty fuel oil.

A Deck for Four

Fields of application for this new separator are the treatment of fuel oils,



lube oils, oil-water-sludge mixtures and stuffing box oil. This system was principally designed for four large fields: shipping, power plants, the oil field sector and industry. The complete system is supplied as a ready-to-connect module. The space required is minimal (less than 0.5 m²).

Westfalia Separator Acquires TOP Degumming Patents

Westfalia Separator was involved in developing the process, and has now acquired the patent rights for the TOP Degumming process from Vandernoortele International N.V. (see also page 11).

Westfalia Separator is accordingly able to supply such installations and provide licences for operating them. However, a licence fee is no longer required.

Separators for New Polycarbonate Production Plant in Korea

The LG-DOW Polycarbonate Ltd joint venture will see the emergence of a new and important production plant for polycarbonate in Korea. Polycarbonate is a high-grade plastic which is finding increasing application in the automobile and electronics industry, for example, in the production of mobile phones and compact discs. The global PC market is a growing market with a predicted annual growth rate of 7 to 10% in the next few years.

After expansion of the production capacity in the DOW Plastics Stade plant by installing a new production line in 1998, type TA 275 separators specially designed for the DOW process will also be used in Korea for multi-stage, extractive washing of the polycarbonate solution.

Germ-Free Milk for India

In many newly industrializing countries, milk is an important basic food stuff, but it is not always entirely safe. Pathogenic germs can cause illness, with young children being particularly vulnerable. 100% bacteria-free drinking milk, "the milk of the new millennium", is being put on the market by the Indian producer Hatsun. Backed up by a large-scale advertising campaign, "Arokya Milk" is being heralded as India's first pathogenic germ-free drinking milk: "Just like the milk drunk in the industrialized countries". This unique additional benefit was made possible using separation technology supplied by Westfalia Separator. And this is made crystal clear in the dairy's adverts.

Quality has a New Mark of Distinction

Only reliable partners can afford to give quality marks. These marks are given for equipment and machines which need not shy away from any comparison and for efficient and economical operation and an approach characterized by commitment and engagement.

Westfalia Separator has a new mark of distinction for the marine, energy, oilfield technology and industry sectors. It is the 3E Quality. It stands for Efficiency, Economy and Engagement.

E Stands for Efficiency

In comparison to conventional separators and competition models, the mineral oil centrifuges with the new Unitrol system achieve up to 50% higher performance and optimum separation efficiency. Over 90% of all abrasive solids are reliably separated. How does that sound?

Patented systems make sure it works. The "soft-stream" feed system is gentle on the product. The "HydroStop" system allows controlled bowl ejections at full operating speed. Reduced wear substantially prolongs maintenance intervals. The "Unitrol" system lets the separator think for itself in the unmanned engine room. Only clean, water-free oil enters the engines.

E Stands for Economy

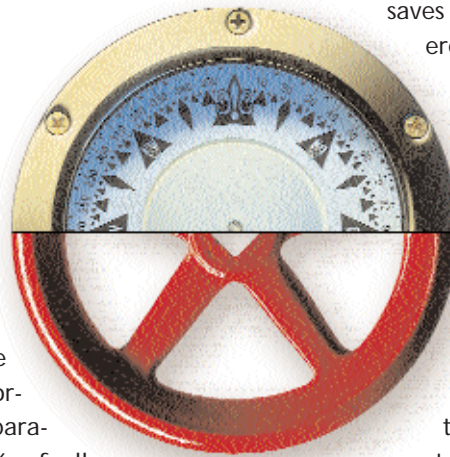
The new C-Generation separators allow maintenance intervals between the main service of up to 16,000 operating hours. These intervals coincide with the maintenance

times for the diesel engines. That is Westfalia Separator's idea of economy. Economy is reflected also in a host of other innovations.

A new disk stack compressing device and a new bowl lock ring together with the hinged hood allow simple maintenance. The compact design configuration with integrated valve blocks, cable box and flexible connections makes installation easy and saves time and space during erection. 30% fewer components have a positive impact on purchase prices and servicing.

E Stands for Engagement

This is also an integral part of the 3E Quality: You, the customer, are the focus. Westfalia Separator works flat out to give you the best. The machines and equipment are developed using the experience gained over decades, and in close cooperation with the partners in the market place. The machines undergo rigorous testing in our own test bay and in continuous operation under field conditions. Customer proximity is assured by 47 subsidiaries world-wide and distributors in a further 60 countries. Complete system solutions with separators, heat exchangers, booster units and fresh water generators are tailored to meet the user's needs. Westfalia Separator is committed to engagement for your benefit. The package ranges from planning through design and manufacture right up to customer-oriented service contracts. The whole was always more than the sum of its parts: 3E Quality.



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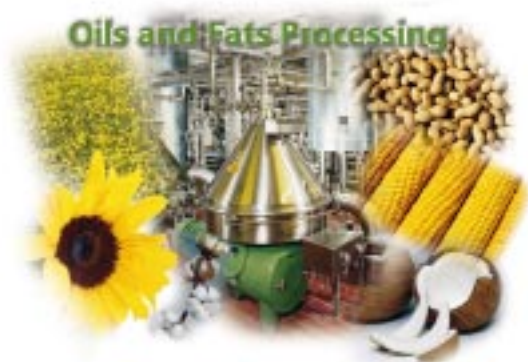


TOP Degumming Patents Acquired

As is frequently the case nowadays, problems are turned into advantages. The TOP Degumming method for degumming edible oils can be used as a preliminary stage. It opens up the possibility of physical refining which is much more sewage-friendly than conventional refining using chemical means. As a result of acquiring the patent rights from the Belgian Vandenmoortele International N.V., Westfalia Separator is now in a position to grant licences for this phosphatide removal process free-of-charge.

Physical Refining Reduces Sewage Freight Considerably

In the chemical process of refining edible oils, the free fatty acids in the raw oil are neutralised by means of caustic soda and the resultant soapstock is removed with the aid of separators. The soapstock may be used for lower quality soaps or has to be split into fatty acid and water by means of the addition of sulphuric acid. This process results in sewage which is very contaminated with sulphate, and can only be disposed of with strict regulations and at a high cost.



In order to avoid this problem, a physical method was developed several years ago. This method does not use chemicals to neutralise the free fatty acids, but distills these free fatty acids off under vacuum conditions and at higher temperatures. However, this process requires removal of most of the phosphatides, namely the gums.

Simple, Compact, Quick and Flexible

TOP Degumming guarantees degumming to a content of less than 10 ppm phosphorous. The attractive aspect of this procedure is that it is relatively simple to handle with clear processing. The installation is compact, quick and very flexible, i.e. "straight forward". The process is based on a skillful combination of two separators.

The refined degumming procedure is used primarily for mass oils such as rape seed, soja or sunflower oil. Two fully automatic lines were commissioned for this last year in Austria and Slovakia. Now that it is possible for licences to be granted by Westfalia Separator, a broad market has opened up for the TOP Degumming method.

Clear Processing: Combination of Two Separators

Raw or water-degummed oil is initially mixed intensively with a small quantity of diluted acid. After a brief reaction time, the added acid is partially neutralised with diluted caustic soda. The total reaction times are only six minutes. The phosphatides that are hydrated in this way are removed in the first separator with minimum oil losses. In order to remove the extremely fine phosphatide particles remaining in the oil, the oil is fed into the second separator after a small quantity of hot water has been added. A self-cleaning high performance clarifier CRA 160 is used for this purpose.

The gums that contain a very high level of oil and that are removed in this way are recycled directly into the first separator. Subsequent drying produces an oil with a low residual water, phosphorous and iron content – factors which are vital for the oxidation stability of the end product.

The TOP Degumming method offers the advantages of higher production yield, low operation and investment costs and avoids environmental problems.

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FRIOLEX®

Centrifugal Technology for Oil Recovery

A yield similar to that achieved in the hexane extraction process. A stability as is the case with oil after lecithin has been removed and quality of cold pressed oil. A short amortisation period. This is the wishful thinking of all manufacturers.

Westfalia Separator is making good process towards fulfilling this wishful thinking. With Friolex®, the new oil recovery process, vegetable and animal raw materials that contain oil can be used for obtaining high quality oil or fat with an extremely efficient method without a solvent extraction procedure. Friolex® is a physical water-based oil recovery process. A water-soluble agent that is suitable for food applications is used as a process aid. A special decanter centrifuge is used for separating the oil from the raw material mass. The remaining impurities are removed in a separator. This process is already being used in practical applications. More than 40 different raw materials have so far been tested.



Sharp Distinction Between Oil Phase and Solids

Traditional oil recovery methods are pressing and solvent extraction. In the pressing method, a high residual oil content of 8 to 10% is retained in the press cake. The oil content of the raw materials must accordingly be min. 10 to 12% if oil is to be extracted at all. The hexane extraction method is state of the art for many mass products such as

In Practical Application

The Friolex® process has been developed as a result of joint research by Westfalia Separator and Dr. Frische GmbH. The method is protected by patent in Europe as well as the USA and Canada, and patents have been filed at international level. The initial industrial application of the process is to be found at Dr. Fische GmbH in Alzenau, with a capacity of 1,000 kg/h seed. This process is applied for grapes as well as sunflower seeds in order to recover grape seed oil with excellent nutritional aspects as well as sunflower oil containing a high degree of oleic acid.

soja, maize or rape seed. Combined processes involving pressing and extraction are used in certain cases for these products.

Centrifugal oil recovery follows a different method. The aqueous method is used for extraction in this case. Fruit flesh, e.g. from olives or avocados is separated into an oil fraction and pulp in a specially developed decanter centrifuge. This is only possible if there is no emulsion between oil

and the aqueous phase. However, this is the case with most natural raw materials such as seed, fish or eggs.

Aqueous alcohol is added as an agent in order to break down this emulsion. It is not used as a solvent for extraction purposes; on the contrary, it is used as a purely physical tool for breaking down the emulsion. This enables efficient separation to take place between the oil phase and solid mass.

Absolute Prevention of Oil Oxidation

This results in a further advantage. Compared with the pressing method, the Friolex® method separates only the purely oil-soluble constituents with the oil phase. Lecithin separation which normally follows, namely degumming, is no longer necessary. The oil is merely dried and subsequently polished in a high performance separator. The solids are also dried. Water and the alcohol agent can be recycled back into the process, and the oil-free solids are available for further applications, e.g. for protein recovery.

The entire Friolex® process is also blanketed with an inert gas (nitrogen). On the one hand, this guarantees explosion protection for work carried out in the alcohol industry. On the other hand, the blanketing of inert gas has an extremely beneficial effect on product quality. All oil oxidation is avoided. The PUFA oils with frequently unsaturated fatty acids, e.g. in fish oils which can be used for nutraceuticals, or vitamins such as tocopherol (vitamin E) are retained in this way.



High Value PUFA Oils

Processing is very gentle at low temperatures, and solvent extraction is not used. Refining steps such as bleaching or disodorification are not necessary. This avoids product damage, for instance the formation of trans-fatty acids. The phosphatide content in the oil can be significantly reduced. Sensory comparative analyses result in excellent assessments: Virtually cold pressed quality.



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From Hip Oil to a Substitute for Plastic

High-value vegetable oils and special oils are the main areas of application due to the excellent balance of valuable substances provided by the procedure. Recipes and processes have so far been developed for more than 40 special oils, including seed such as grape seed, hip, cocoa, borage, ricine, sunflower seeds, neem, fruits, mustard as well as other raw materials such as jojoba, wheat/maize, seed, rice grains, eggs and fish. This includes oils which are used not only as food but also in the pharmaceutical industry.



Rapid Amortisation Due to Excellent Yield

Depending on the particular raw material used, the Friolex® method can achieve average yields of 90 - 95% (99% for cocoa and two-stage processing), and is also suitable for products with a lower oil content. This new process can result in amortisation times of six months to around three years, depending on the particular product. One example: Raw cocoa with an oil content of 5% currently costs around EUR1/kg on the world market. Around EUR4/kg is currently paid for cocoa butter and around EUR2/kg is paid for cocoa powder. With conventional pressing techniques, approx. 10% oil remain in the cocoa powder, whereas the corresponding figure with the Friolex® method is max. 2%. With a plant capacity of 30.000t/a, the Friolex® method produces additional added value of EUR 7.2 m per annum.



Elephants do not Perspire

The “dragon-fly has four wings. When the two front wings are rising, the two rear wings are falling.” Dragon-flies can rotate their wings through 28 to 30 degrees and make optimum use of flow conditions. What the artist and engineer Leonardo da Vinci recognised and recorded in 1508 in Milan was precisely the principle of an extremely modern flying machine – the helicopter, which in reality was only built four hundred years later.

Symbiosis Between Nature and Technology

In 1958, the American scientist Jackie Steele coined the term “bionics”, consisting of the first syllable of biology and the second syllable of technical. He was attempting to identify symbiosis between nature and technology, the process of “learning from nature”. Indeed, nature has already found ingenious solutions to an incredible large number of problems; it has a huge reservoir of inventions, constructions and procedures. Nevertheless, it is frequently not sufficient to slavishly copy the natural phenomenon in order to achieve technical solutions that are capable of being implemented.

Leonardo da Vinci’s Helicopter

The attempt to use a bird’s flight as a pattern for a flying machine reached a dead end. When birds wings are in motion, they produce something which is achieved separately in an aircraft: uplift by means of strong wings and drive by means of propellers or jets. Development only made progress when the pioneers of flight recognised that their machines could never imitate the flight of birds by producing uplift and drive simultaneously by means of a flapping motion.

The two aspects have to be combined: – the frequently fantastic phenomena produced by the process of evolution and man’s wealth of knowledge and implemented inventions, which can be provided by technical means. This is because technical success is always a factor of current development level. So da Vinci’s observation of the flight of a dragon-fly simply came too soon. Before powerful engines had been developed, the discovery of ideal flow conditions in the 16th century could not be used at the time.



Architecture and Town Planning

The recent science of bionics can nowadays be found throughout the entire field of technology. Nature teaches us the optimum way in which processes run. It teaches us how to achieve optimum functioning of sensors and tracking systems or how data analyses and information processing could be improved. Architecture benefits from the structures found in nature. This is evident in the parallels between diatoms and cupola structures. The steel elasticity of spider's webs has been incorporated in the design of the roof structure of the Olympic Stadium in Munich.

Nature shows us how routing systems can be optimised. The web of arteries in a maple leaf is – from the technical point of view – a minimum routing network. All arteries taken together have a minimum length which is just sufficient for supply purposes – certainly the most economic method of routing. On the other hand, in major cities such as Paris and New York, you will find a large number of inefficient roads and routes which could have been avoided if a skillful arrangement had been used. However, such experience has only been available in the computer age. This is because local authorities as well as industrial companies are subject to the same restraints: No progress without optimum supplies.

The Elephant Ear Method

Elephants do not perspire. If they were to cool themselves by means of perspiration, which is the method used by humans, they would lose around 11 litres of water per hour. This quantity of water is impossible to replace in the Savanna. The African Savanna elephants regulate their body temperature by means of the cooling tubes in their large ears, which represent up to 20% of their body surface. Nowhere else is the extensive network of arteries so close to the surface to the skin. By flapping their ears, they create a breeze and intensify the cooling effect. Modern cooling equipment operates on the basis of the same principle. In the tubular heat exchanger, the walls of many tubes add up to form a huge surface. In this way, it is possible for liquids to be cooled rapidly or – if the elephant ear method is reversed – they can also be heated very rapidly.

“We Have Not Invented the Principle of Centrifugal Separation...”

The big bang was the birth of centrifugal force. Inconceivable masses moved (and indeed are still moving) away from the core in all directions at extremely high speed. The spiral is the representation of centrifugal force. The spiral form, e.g. of the Andromeda nebula or many other galaxies, clearly illustrates centrifugal force. The washing centrifuge, the honey centrifuge or the milk centrifuge have taken advantage of this principle.

“... But Hardly anyone Masters it Better”

Phases of different densities are separated in the bowl of advanced modern centrifuges with g-forces of up to 15000 times acceleration due to gravity. In this case engineers used a disk stack consisting of hundreds of conical disks in order to make optimum use of the clarifying area of disk-type separators. Rising channels in the disk stack ensure that the phase mixtures are distributed evenly over the entire disk surface and reduce contamination effects. In order to achieve optimum separation of liquid mixtures, the boundary between the phases must be located inside the rising channels, and the position of the rising channels must be based on the ratio between the phases. This is highly sophisticated, and copied from nature. Man has learned his lesson.

Modern bionics is starting to break down scientific boundaries and bring together different ways of thinking – for the purpose of better, natural and more humane technology.



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Ready for Sailing at Beck's

New Generation of High Performance Clarifiers

Beck & Co is by far the most important German Export brewery. The traditional green bottle with the oval label, the full sails of the "Alexander von Humboldt" and the unmistakable "sail away" voice of Joe Cocker characterise the image of a beer which is appreciated in around 120 countries throughout the world. Output of the premium brand "Beck's" rose to significantly more than 5 million hl in 1998, the year in which the company celebrated its 125 year anniversary.

Not only the unmistakable image but also the uncompromising quality are key factors for the success on the German and international markets. Beck's brewery has traditionally been an innovative operator. New technologies have been installed sooner than has been the case elsewhere; the brewery was also one of the first companies to operate ice machines so that beer could be cooled evenly. Today, it is the high performance clarifier which is now being used for the first time on this scale by Beck & Co for cold wort clarification.

Three-Fold Increase in Capacity

Apart from the established process applications for separators in the brewery such as hot wort clarification, beer recovery from surplus yeast or beer pre-clarification before filtration, there are also processes which had only been possible with small and medium capacities, e.g. cold wort clarification



tion or polishing of beer. Westfalia Separator has now developed a new dimension of high performance clarifiers with its clarifier type CSA 500. Offering the same separating efficiency in comparison with previous types, the new type has achieved a three-fold increase in capacity. This means that there are no more obstacles to using the machine for cold wort clarification and polishing even in large breweries.

Cold Wort Clarification for Rounding Off the Taste of Beer

The aim is to partially separate the cool trub to a defined residual quantity without compromising the stringent quality requirements applicable for the beer. The following are possible advantages of this reduction:

- The taste of the beer is rounded off; this is applicable particularly for the bitter taste.
- The beer foam is improved by the removal of residual hot trub and the associated removal of fatty acids.
- Taste stability is improved.
- There is no contamination of the yeast surface with cool trub; the fermentation process is more intense and the yeast can be reused more frequently.
- Substances which are a problem for filtration purposes are removed at an early stage.





Cool Trub Removal at 700 hl/hours

Cool trub has a very fine structure, i.e. the density difference with respect to the wort is minimal. In addition, the viscosity of the cold wort is very high. This has meant that separators in the past have been limited to capacities of approx. 250hl/h. Procedures for removing cool trub such as flotation, filtration and sedimentation are generally associated with complicated equipment and/or a lot of handling. This is one of the reasons why this process stage is frequently not used in breweries.

In the new cooling house of the Beck & Co. brewery, five CSA 500 separators together with nine whirlpools have been integrated in five cooling lines, each with a capacity of 700hl/h.

Preferred During Tasting

At the brewery Beck & Co, partial separation of cool trub to 120 - 160 mg/l measured in terms of initial wort has a positive effect on the quality of the beer, particularly as far as the quality of the bitters and the taste of the beer is concerned. This finding has been confirmed in several internal test series.

The chemical analysis was not able to establish any differences between the beers from the sedimentation process and from the separation process. The tasting also provided a positive picture: Whereas the tasters actually preferred the fresh beers from the separation process, it was not possible for any distinction to be established between aged beers from the separation and sedimentation processes.

Polishing of Beer

Alternative filtration systems are becoming increasingly important due to the disposal and handling problems asso-

ciated with diatomaceous earth filtration. A three-fold increase in the capacity for polishing beer (equivalent to rough filtration in the conventional method) was also achieved in comparison with conventional separators.

High performance clarifiers are thus able to take the place of rough filtration. The separated beers do not contain any measurable residual solid contents, which means that the trub load on downstream filtration systems is reduced to a minimum.

Optimised Method

The prototype for cold wort clarification has been optimised as a result of close co-operation with the Bremen-based brewery Beck & Co. This has resulted in a process capable of being used in full-scale applications with the following characteristics:

- Capacity of the clarifier: 700 hl/l
- Separation rate more than 50%
- Fully automatic integration in the product and CIP line
- Low losses (approx. 0.15 - 0.20% of initial wort quantity)
- All analytical and sensory requirements are fulfilled
- Protection against hot trub contamination
- Cold wort standardised before entering the next process step.



Calcium Recovery from Whey

The DCP Process Line is also to the Taste of the Trade

Teeth are the hardest substance found in the animal as well as the human organism. Our bodies achieve this most extreme compaction of tissue by means of using the materials calcium, phosphate and magnesium. The alveolar arch, in which the teeth are rooted, is the bone with the greatest turnover of calcium in our bodies. We therefore need to ensure an adequate supply of calcium if we wish to continue to use our teeth properly in future.

In terms of bone structure, calcium is the inorganic building material par excellence. We have to build up our stock of calcium for our bone substance by the time we are 30 years old. After that time, we can only draw on existing stocks. The greater the amount of bone substance built up when we are young, the greater is our resistance to myelophthisis and osteoporosis when we are old.

Calcium results in healthy hair, makes us fit for sports and calms our nerves. Anybody who constantly feels sleepy and who complains of lack of drive, loss of appetite and weight and diminished powers of memory does not necessarily have to ascribe these problems to old age. The problem may merely be a shortage of calcium.

Calcium for Functional Food

In view of the large number of positive characteristics of the mineral substance for the human organism, it is not surprising that manufacturers of beverages, snacks or body-building food for athletes incorporate calcium as an additional benefit in their products. Calcium has established a fixed place in the market for functional food and beverages. In the USA alone, the market for functional food is worth USD 250 bn. Increasing self-medication due to the increasing cost restrictions in the health industry and low-cost marketing of building materials means that demand for minerals such as calcium is likely to continue to increase.

It is already very difficult to satisfy the daily demand for calcium phosphate with milk alone. The price of this versatile mineral is accordingly very high. This is because original calcium obtained from milk is particularly well reabsorbed physiologically by the body.

Valuable Substance Instead of Disposal Problem

Calcium phosphate recovery from whey is accordingly a process which will become more and more significant on the international scene. It is estimated that dairies and cheese-making factories throughout the world produce between 100 and 120 million tonnes of whey per year. On the one hand, this huge quantity represents a genuine disposal problem. The problem of high BSB and CSB loads in the whey means that disposing of whey as sewage is a very expensive solution. The process of evaporating and drying whey to form whey powder involves a lot of energy. On the world market, the unspecific raw product whey powder does not produce much in the form of revenues because of the surplus supply. On the other hand, whey contains valuable protein, lactose and salts such as calcium phosphate.

Preliminary Stage for Lactose Recovery

In general, the process of calcium phosphate recovery (DCP) of Westfalia Separator is used for whey permeate (simple concentration) and preconcentrated whey permeates (up to four-fold concentration). The whey permeate is obtained from the upstream ultrafiltration process which is used for recovering protein concentrates.

The DCP process combines several advantages. On the one hand, the valuable substance original milk calcium is obtained. On the other hand, integration of this step in whey processing provides significant advantages for subsequent process management and lactose recovery.

Production times without having to clean the downstream evaporation installations can be increased between two- and four-fold. Here the heat exchanger surfaces are no longer fouled to the same extent by calcium compounds precipitated as a result of heat action.

Accordingly, an evaporation installation with a smaller capacity can be designed. This means that it is possible to reduce energy costs, consumable costs (cleaning agents and additives) as well as wage costs.

A further major advantage is that the DCP process improves lactose processing which follows evaporation and crystallisation. The quantities of water required for washing the raw lactose can be reduced. Purer lactose is recovered, as precipitated calcium no longer forms to the same extent as crystallisation core – that cannot be removed by washing in the resultant lactose crystal.

Valuable By-Product

Appr. 70% of calcium can be recovered from whey with the DCP method developed by Westfalia Separator. The permeate obtained by ultrafiltration is heated and generally set to a neutral pH value – depending on the composition of the whey. A precipitate forms due to the action of heat. This flocculate can be separated in special whey clarifiers, which are additionally equipped with fine nozzles and also operate with an automatic hydraulic solids discharge process. The dry matter content of the discharged flocculate is between 12 and 15%. The composition of this flocculate can be varied by setting the process parameters. To a certain extent some content of whey proteins or other compounds in the calcium phosphate concentrate are explicitly desirable. Different levels of purity of calcium phosphate can be achieved in a subsequent washing procedure.

This DCP process, which has already proved important in many practical applications, produces a valuable by-product which boosts the profitability of a company. From the point of view of environmental aspects, which are also becoming more significant in developing countries, this procedure dramatically reduces the strain imposed on sewage by whey.



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Faster Spin-Off

Separators in Breweries

Separation is an integral part of the brewing process. This starts with running off (a future? domain of centrifugal separators), continues with the separation of hot and cold break right through to end filtration. Centrifugal separators have an astonishingly wide range of duties in the brewery.

In addition to the general requirements of maximum clarification, ease of service, noise development, etc., brewery technology has some additional requirements:

- Low-shear feed, as proteins, etc. have a labile structure and cannot be separated if they are destroyed;
- Minimum oxygen pick-up;
- Hygienic design;
- Maximum dry substance with high trub loading in the feed

Because it is not possible for all aspects of these requirements to be achieved with a single machine type, a distinction is made between clarifiers that are used for higher solid loads and high-performance clarifiers that are used as polishers in conjunction with low solid loads.

Hot Break Separation

The application of centrifuges for the separation of hot break assures short contact times of the trub with the wort



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and defined, guaranteed separation efficiencies as well as low wort losses. Oxygen intake is negligible. The application of whirlpool and centrifuge meets the operator's requirements for a continuous operating mode and high economy.

Cold Wort Clarification

Separation of the cold break from the wort is considered to be optimum pre-



paration for rapid and trouble-free fermentation and maturation. This has a positive effect on the subsequent taste. Newly developed separators achieve separation rates of 50% at throughputs up to 800 hl/h. (See also the article entitled "Ready for Sailing at Beck's", page 16).

Beer Clarification

Beer clarified with the new high-performance centrifuges has only a minimal residual solids loading. As such, it is has been ideally pre-treated for alternative filtration systems (membrane technology, deep-bed filter systems). With short shelf lives, efficiently clarified beer can be bottled directly; however, separators cannot completely replace filtration.

Green Beer Clarification

To assure a controlled, rapid maturation of the beer during storage, it makes sense to pump a defined number of "living yeast cells" between fermentation and maturation. This can be done using a centrifuge. With green beer clarification, the process produces the desired number of yeast cells for a defined maturation.

Green Beer Clarification with Yeast Addition in the Separator Feed

Excess fermentation cellar yeast is added to the green beer in the separator feed. The yeast is separated in the centrifuge and discharged from the bowl with a dry substance of approx. 25%. The quality advantage of green beer separation is consequently combined with the economic advantage of beer recovery. The separator only has to be designed for one capacity range. Special beer recovery installations are not necessary; the proceeds generated by selling yeast are better with high dry substance levels.

Beer Preclarification before Filtration with Addition of Yeast

The yeast addition method is also used in beer preclarification before diatomaceous earth filtration.

“Stopped” Fermentation

A special application for the separator in the brewing process is the technique of “stopped” fermentation for the production of low-alcohol and nonalcoholic beers. In addition to premium product quality, this system offers an excellent price-performance ratio.

Turbidity Adjustment in “Weizenbier” (Wheat Beer)

In wheat beer production, it is particularly important to provide the customer with a product with uniform turbidity quality. The centrifuge is ideally suited to compensate fluctuating yeast concentrations. Stored beer is separated. Simultaneously, non-separated beer is added via a bypass, thereby guaranteeing constant turbidity levels throughout the entire production cycle.

Beer Recovery from Tank Bottoms

Thanks to their trouble-free operation, separators can be optimally integrated in the process for beer recovery from tank bottoms. Provided that processing is carried out with fresh yeast or tank bottoms (e.g. direct from the fermentation tank), a good quality beer will be obtained. A special two-stage process can be used to produce low-alcohol and nonalcoholic beers.

Treatment of Washer Caustic

The application of separators for beers in returnable bottles also makes sense. The environment-friendly and economical treatment of washer caustic with separators has a good track record.

Additional Fields of Application

Improvements in machine design have opened up new possibilities in the brewery which were previously only possible at the lower end of the capacity range. Polishing duties can be carried out in a capacity range up to 800 hl/h. Models equipped with the “Hydrostop” system produce optimum solid dry substance levels. The hydrohermetic feed minimizes shear forces. The new generation of machines have reduced oxygen intake and risk of infection to negligible factors

Further Technical Developments

Hydrohermetic Bowl Seal

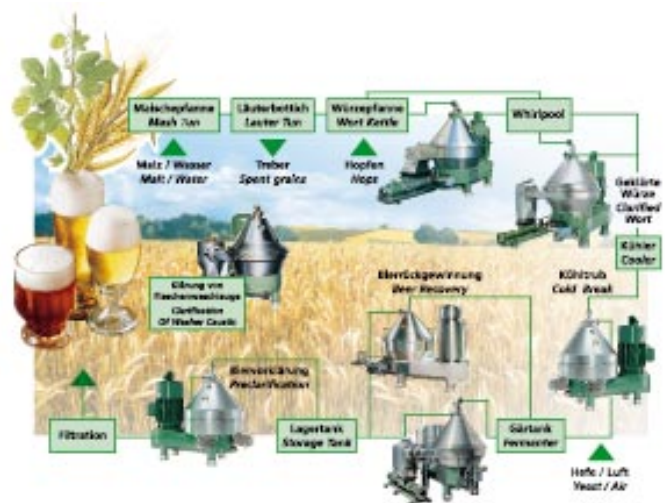
The hydrohermetic seal dynamically seals the bowl by means of an immersion disc in a rotating water ring. Compared to previous fully hermetic seals, this arrangement can be efficiently cleaned and does not wear.

Hydrohermetic Feed

With the patented hydrohermetic feed system, acceleration is achieved by damming below the sealing disc – gentle liquid in liquid. Shear forces are largely eliminated. Hydrohermetic machines achieve a substantial reduction in the particle count compared to standard machines, even in the fine range.

Ejection Systems

Modern clarifiers are equipped with high-speed bowl ejection systems, whereby the solids are discharged virtually without liquid loss – the patented Hydrostop system. The disadvantage of the lower solids dry substance is of no significance with polishing duties as few ejections are necessary when the solids loading in the feed is low.



System Technology

An aerial photograph of a large offshore oil platform. The platform is a complex of white and grey structures on a dark hull, situated in the middle of a blue sea. A prominent feature is a large circular structure in the center, surrounded by various pipes, tanks, and smaller buildings. A red and white striped crane arm extends from the platform. In the foreground, a helipad is visible with a large white 'H' and yellow markings. The sky is clear and blue.

System Technology from a Single Source

- Fuel supply
- Fresh water generator
- Cooling water with plate heat exchanger
- Bilge water treatment
- Lubrication, bearing and stuffing box oil treatment
- Fuel oil treatment

System Technology on the Move

As soon as the ship casts off, it has to cope on its own. On the high sea, it has to produce its own requirements, purify and dispose of any products in an environmentally sound manner without the assistance of any outside resources. This is when technology is needed. The sensitive ecosystem of the world's seas has to be protected.

Separators are an important aspect of engine rooms. Westfalia Separator has customised complete system solutions which are responsible for the economic and efficient treatment of oils and oil-water mixtures.

- Lubricating oils are contaminated during use by foreign substances and metal particles, dust and condensation water. Centrifugal treatment is a simple method of purifying lubricating oil and extending service life. The same is applicable for bearing and stuffing box oils.

- Oil sludge occurs in large quantities when fuel oil is treated. Patented installations with centrifugal separators ensure that the oil sludge can be treated inexpensively directly on board. The original sludge volume is reduced to only one tenth of the original volume. Recovered fuel oil can be recycled into the drive unit, thus reducing operating costs.

- A new ship produces eight to ten tons of bilge water every day. A new system for treating bilge water has for the first time been based on centrifugal force. The bilge water separators are already operating with excellent results on a number of large ships.

- Oil spills have to be skimmed off the surface of water as quickly as possible and contaminated sea water has to be cleaned. Centrifuges with their compact form are also extremely well suited for application on smaller ships.

Booster Units and Fresh Water Production

Westfalia Separator has now taken a significant step forward. In the future, the company will be able to provide not only separation technology but also virtually the entire engine room technology – apart from the main engine. This is system technology from a single source.

- Booster units provide fuel to the drive unit. The highly viscous and already treated pure oil from the day tank is heated and adjusted to the injection viscosity specified by the engine manufacturer. The new fuel supply installations from Westfalia Separator are designed as turnkey modules for 24-hour unmanned operation, and comply with the regulations of the classification societies.

- Sea-going ships have an enormous demand for fresh water. In general, container ships require between eight and ten tons every single day. Passenger ships and cruise liners require many times this amount. It makes sense for sea water to be processed into fresh water. Westfalia Separator has developed a fresh water generator which is now being presented for the first time and which complements the engine room.

- Return cooling of cooling water and lubrication oil of marine engines has recently been handled by plate heat exchangers from Westfalia Separator. These are designed to be operated with fresh water as well as sea water.

With these three new units in its programme, Westfalia Separator not only provides tried-and-tested marine separators and decanters; the company has now become a system provider for the engine room in the ship building industry. All this is done for reliable and economic operation and effective protection of the world's seas.

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Olive Oil from Andalusia



Andalusians enjoy “un tostada con aceite” for breakfast: toast with olive oil. The oil with the oldest cultural history is a very special juice. Olive oil is extremely difficult to beat in terms of its abundance of facets. In many aspects, olive oil is similar to wine. Type of olive, area of cultivation, vintage and climate determine the character of the oil.

The Phoenicians discovered the many advantages of olive oil more than 6,000 years ago. Even then it was one of the basic foods, it was balsam for the skin and hair, and was a healing agent. For the Greeks, olive oil was considered to be “nectar of the gods”; olive oil has its own place in the bible. Even the U.S. Senate now praises Mediterranean cuisine with one of its main constituents, namely olive oil, as an exemplary form of nutrition.

Versatility for Body and Soul

Olive oil is good for everything. The fine juice of the olive is used for shallow and deep frying, it is used for marinades, sauces and salads, and is also used for preserving cheese, fish, sausage and vegetables. The health advanta-

ges of cold pressed olive oil are beyond dispute. Nutritional science ascribes the best composition of saturated, simple and multiple unsaturated fatty acids to native olive oil extra, and thus describes it as the most healthy vegetable oil; the fat which most closely approximates a mother's milk.

Simple unsaturated fatty acids are present in large quantities and support the metabolism; they can prevent high cholesterol values and thus many disorders of the heart and circulation. The vegetable dyes and phenols protect the heart and circulation. Vitamin E native to the oil is considered to be an extremely effective anti-oxidant and strengthens the immune system. Olive oil entices vitamins A, D and K out of salads and vegetables and makes them available for the human body.

Olive oil is readily digestible and promotes healing of stomach ulcers and digestion problems.

In external applications, good olive oil provides relief for bronchitis, strengthens the resistance of the skin, and ensures that the skin is taut and fresh. Olive oil strengthens hair and vitalises the scalp: Versatility for body and soul.

Optimum Cultivation Conditions in Andalusia

Today, Spain is the largest European producer of olive oil. More than 200 million olive trees grow in the country. In Andalusia, almost 700,000.00 hectares of land are cultivated with olives. “There is no landscape which can be designated as Andalusian; instead, there is a variety of stimulations to senses which extends in all four directions of the compass without any interruption and without any

Quality Feature: Acidity

The acidity of an olive oil defines the content of oleic acid, a simple unsaturated fatty acid. This occurs as a result of oxidation when the olives fall from the tree and burst on the ground or if the olives are stored for an excessively long period before being pressed. The lower the content of fatty acid, the finer and fruitier is the taste of the oil.



monotony and includes all possible types of landscape and all forms of transparency of a light which is identical everywhere in only one aspect: namely its intensity". This is how the author Antonio Munoz Molina describes the home of Flamenco and the bullfight. Here the olive tree has found ideal conditions. Long dry summers, a lot of sunshine and only a few days of frost are optimum conditions for the evergreen trees with the silver shimmering leaves which are able to attain a biblical age of several hundred years.

In the main cultivation area in Andalusia, namely Jaen, Picual is the main olive type. Picual provides a decidedly fruity oil which is reminiscent of dry figs and peach in its scent and taste with its yellow-green colour, and it leaves a clear olive taste. The high content of polyphenols and oleuropeines guarantees a long and natural shelf life. Picual is particularly suitable for excellent salad dressings, vegetables, boiled fish and also for adding the final touch to desserts.

Court Supplier to Spanish Royalty

The quality of olive oil is determined mainly by the type of olive and the age of the olive. The olives are harvested between October and April. An early harvest in mid-October produces a fruity oil with the scent of freshly cut grass. The harvest by mid-December provides a harmonious oil with a balanced taste, whereas olives harvested after that time produce a mild and sweet oil with a taste of almonds. This is the exciting aspect of olive oil (as is the case with wine): no two olive oils are identical.

Three qualities are officially distinguished:

- **Aceite de Oliva Virgen Extra (native olive oil extra):**

The highest quality level for Spanish olive oil. This quality is guaranteed cold pressed and must not exceed an acidity level of 1.0 (1g fatty acid per 100g of oil).

- **Aceite de Oliva Virgen:**

Also always cold pressed oil. The acidity level must not exceed 2.0.

- **Aceite de Oliva:**

Refined olive oil or a mixture of refined and cold-pressed oil. In terms of aroma and nutrient content, this oil is less valuable than cold pressed oils.

The small co-operative "S. José Artesana de Mondrón" in the region of Vélez-Málaga with its 350 co-operative members specialises in cultivating the Verdial variety. Managing director Francesco Martín himself cultivates around 700 olive trees. The dark green to black fruit is harvested late, between February and April. The sweet almond taste of the golden green very mild and fruity Mondrón Virgen Extra is therefore typical. One tree bears between 100 and 300 kg of olives; with an average yield of 24%, this is equivalent to 24 to 70 litres of olive oil.

Rapid and gentle processing of the harvested olives is extremely important for Francesco Martín. The harvested olives are crushed in the oil mill within 24 hours; they are then treated in a centrifuge in order to avoid oxidation. Mondrón can therefore guarantee an acid content of less than 0.5° on the label.

The heavy rain in the autumn of last year and the subsequent dry heat have been very good for the Mondrón olive oil. The co-operative is therefore entitled to use the title "Court Supplier to Spanish Royalty" with its 1998/99 vintage. Francesco Martín also proudly points to the decanters and the separator of Westfalia Separator. Installed just before the harvest; he is very satisfied with these machines. Olive cultivation means everything for many Andalusians. They live from, with and for a single product, an essential component of daily, natural and healthy life in the Mediterranean countries and increasingly also of the entire population of Europe.





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The Renaissance of Cruise Liners

Unfortunately, you are not able to cruise through the Panama channel with the "Grand Princess". Its beam of around 44 meters means that it is simply too wide. The largest (and most expensive) passenger ship ever built made its maiden cruise in May this year from Istanbul to Lisbon. The summer cruising season in the Mediterranean Sea is fully booked. In the winter, the floating luxury hotel will cruise in the Caribbean for the first time. The "Grand Princess" offers unashamed luxury to the max. 2,600 passengers. Most of the cabins are equipped with balconies, an unhindered view of the Mediterranean. Entertainment shows run in parallel in three rooms, the disco on the 18th deck is impressive with its all-round view, a nine-hole golf course offers unusual putts and potential honeymooners can be married in the on-board chapel. The kitchen offers feasts 24 hours a day. Entertainment, relaxation, indulging round the clock.

Expectations relating to a cruise are high. The aim is to ensure that such expectations are not disappointed. When the Grand Princess cuts through the light blue water of the Caribbean for the first time in the winter of 1999/2000, the new certified bilge water treatment system from Westfalia Separator will ensure that the dream liner will not leave a rust brown trail of dirt behind when pumping off bilge water. The mixture of water and oil, bilge water, which collects in every ship keel, may only be pumped back into the sea with a maximum residual oil content of 15 parts per million in accordance with international guidelines. The new Westfalia Separator system not only remains considerably below this threshold; it also ensures that the bilge water is treated in such a way that it is clear and has the colour of water. All is done to ensure undisturbed cruise dreams.

Longing for New Shores

What is the attraction of a cruise? The fact of voyaging, man's eternal longing for new shores, experiencing the wide open spaces of the oceans, in a luxury atmosphere that is unparalleled. Relaxation in a maritime climate, a pinch of adventure, and possibly also a certain amount of prestige. It provides an opportunity for relaxed communication, meeting and getting to know like-minded people, and possibly also avoiding them if necessary. In the second half of the 19th century, British and Norwegian shipping companies started to fill their scheduled ships with "excursions". The British shipping company P&O organised a trip to the North Cape in 1882; this is considered to be the first real luxury cruise in the world. Nowadays it is still the dream of many people to take a cruise at least once in their life – even if such a holiday is expensive it is now affordable. The audience ratings of the German television programme "Das Traumschiff" (The dream ship) have remained at a high level for many years.

The Force from the Depth

The word algae brings tears to the eyes of many a garden pond owner. They grow and multiply and are extremely difficult to tame. However, algae differ. In the world's seas and fresh waters, there are a total of around 260,000 algae types. Most of them have existed since time immemorial. Of the Chlorella green algae, there are fossils which are more than 2.5 billion years old. However, algae have only been deliberately cultivated and processed on a large scale since the start of the 19th Century as food and as a healing agent.

The biologist distinguishes between marine and freshwater algae, and they can be classified according to colour as blue, green, brown and red algae. There are microbiologically small single cell algae, as well as highly organised tree-high large algae, which form colonies of submarine forests.

Fresh on the Table

Because they are rich in protein, vitamins, minerals and trace elements, marine algae in particular are part of the daily bread in many coastal regions in Asia. This perception is perhaps not immediately apparent for persons living in Central Europe; however, algae are also to be found on the menu in the USA, Canada, Scandinavia and France. And indeed, they are frequently to be found in Haute Cuisine. Around 300 million tons of large algae are harvested every year from the sea, and the Japanese alone consume one tenth of this figure. There are also freshwater algae which are frequently cultivated on algae farms.

Chlorella pyrenoidasa is a single-cell green freshwater algae with a diameter of between 2 and 12 μm . It is said to have surprising effects as a probiotic food additive. The Chinese are convinced that, by eating Chlorella they are eating health in the truest sense of the word. In addition to the protein and amino acid content, the particularly high chlorophyll content is appreciated as a "solar collector".

Wellness, strengthening of resistance, balsam for the skin, help for the stomach and intestines, binding of halitosis, removal of toxins are concepts associated with Chlorella.

Wide Range of Applications

Separators have a central role to play for obtaining algae. By using centrifuges from Westfalia Separator, the separated mass, which is a few hundredths of one percent in cultivated algae basins, can be concentrated up to 15%. This algae paste is then sterilised and dried.

In addition to applications for human nutrition, body care and health maintenance, algae are used in many applications in the food industry, e.g. as a vegetable binding agent, special animal fodder, natural fertiliser, for binding heavy metal or treating sewage. A very promising future application of algae is dye recovery. And reproduction is not a problem: The small giant in terms of growth, Chlorella for instance multiplies 40 times in 24 hours (see garden pond).



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