Alfa Laval in brief

Alfa Laval is a leading global provider of specialized products and engineered solutions.

Our equipment, systems and services are dedicated to helping customers to optimize the performance of their processes. Time and time again.

We help our customers to heat, cool, separate and transport products such as oil, water, chemicals, beverages, foodstuffs, starch and pharmaceuticals.

Our worldwide organization works closely with customers in almost 100 countries to help them stay ahead.

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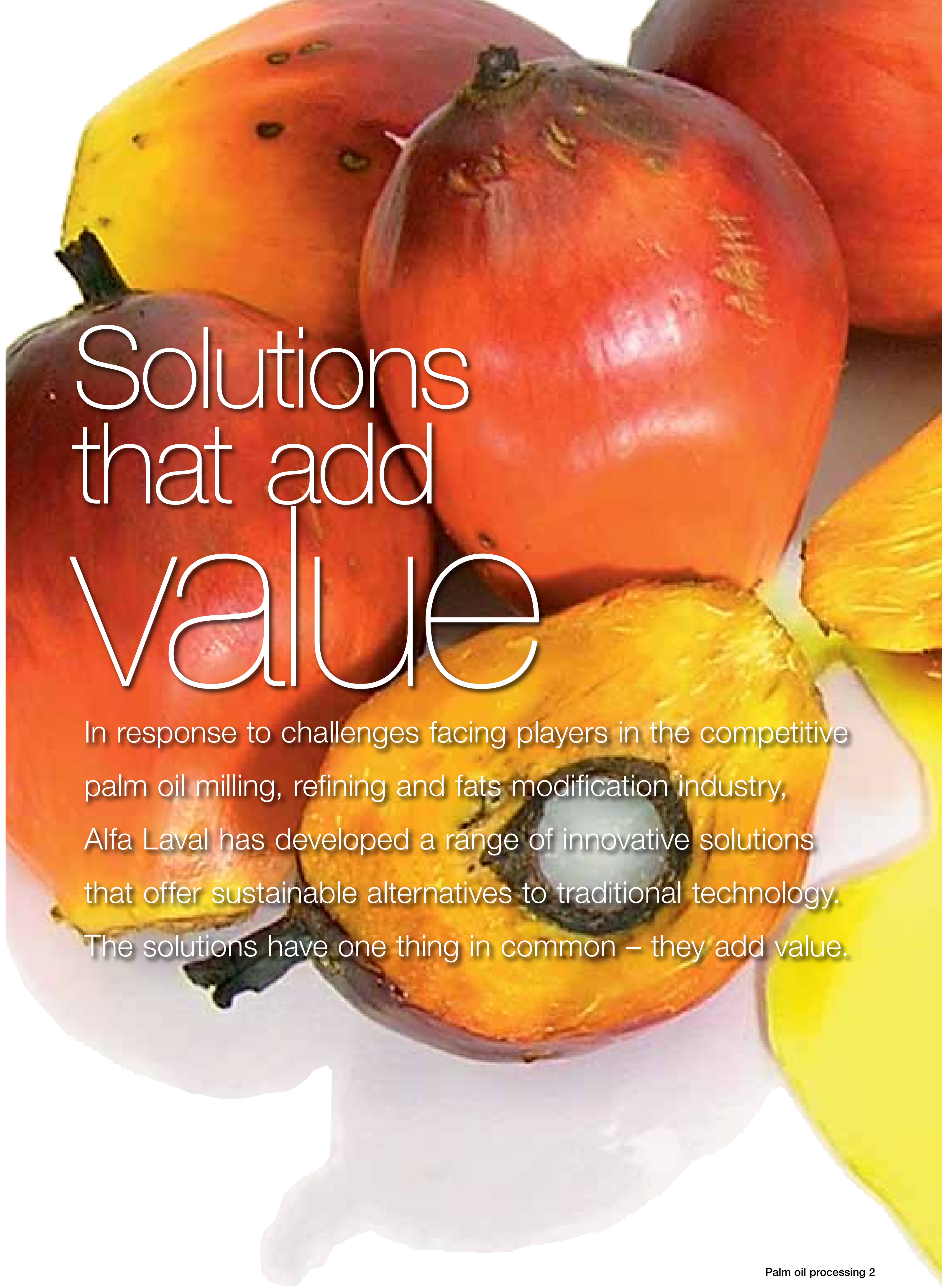
From fruit to food - and beyond

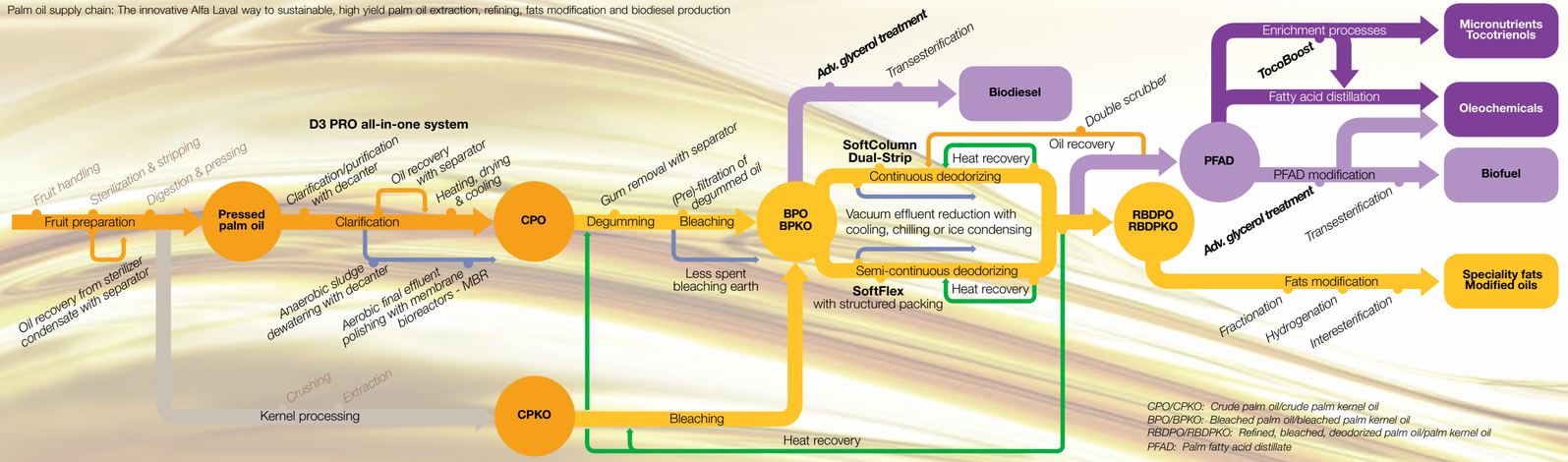
Innovative, sustainable processing solutions for the palm oil industry



Solutions that add value

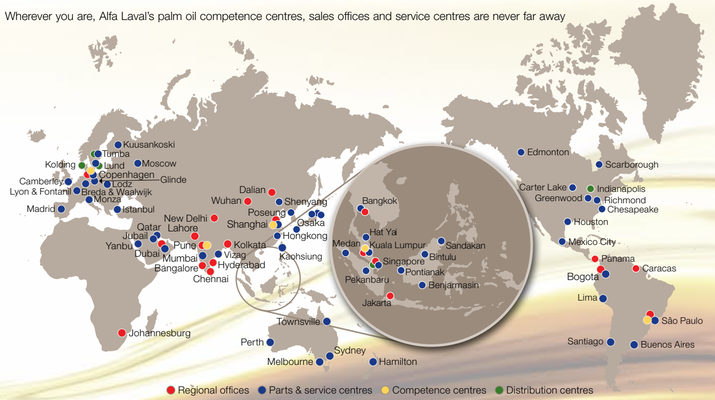
In response to challenges facing players in the competitive palm oil milling, refining and fats modification industry, Alfa Laval has developed a range of innovative solutions that offer sustainable alternatives to traditional technology. The solutions have one thing in common – they add value.

Palm oil supply chain: The innovative Alfa Laval way to sustainable, high yield palm oil extraction, refining, fats modification and biodiesel production



CPO/CPKO: Crude palm oil/crude palm kernel oil
BPO/BPKO: Bleached palm oil/bleached palm kernel oil
RBDPO/RBDPKO: Refined, bleached, deodorized palm oil/palm kernel oil
PFAD: Palm fatty acid distillate

Wherever you are, Alfa Laval's palm oil competence centres, sales offices and service centres are never far away



Your challenges are our inspiration
Demand for palm oil and palm kernel oil is constantly increasing due to their excellent nutritional and other properties. To achieve growth in production it is essential to find new, more efficient ways to increase yield and minimize negative impact on the environment.

Leading the way
With palm oil know-how and experience gained since the 1960's, Alfa Laval takes care of your processing needs – from milling and refining to fats modification, from by-products and related processes through to end-products. As specialists in centrifugal separation, heat transfer and fluid handling, we lead the way with innovative, sustainable process solutions that set new standards in the industry. On the following pages you will find examples of our latest innovations.

Our well-proven, energy efficient solutions with capacities from pilot scale to 3,000 t/d and beyond enable sustainable production of first-quality palm oil with lowest operating costs. Since they ensure highest yield with lowest effluent discharge, you get the most from the raw material, which also benefits the environment.

Your versatile solutions provider
At Alfa Laval, we are both process engineers and equipment designers. Our complete process lines are engineered around our own well-proven equipment, giving you the best possible performance. They are modularized and thus offer a high degree of flexibility compared to all-in-one plants.

We think outside the box, finding new solutions to your process challenges. Whether it's a new plant, or upgrading or optimizing processes in an existing one, we offer customized solutions that benefit both your bottom line and the environment.

Alfa Laval is much more than an equipment supplier. We handle engineering, design and turnkey deliveries. During project execution we offer supervision of mechanical and electrical installation work, commissioning, testing and training of your operational and maintenance staff.

If it's a complete plant we take responsibility for the overall solution.

Challenge: Maximum uptime while constantly improving your processes
Downtime is a costly business. To keep your operation up and running, a professional partner with the know-how to service your equipment and systems plus a reliable supply of spare parts are essential.

Solution: 24/7 service
Alfa Laval's Parts & Service staff helps optimize and keep your operations on-line throughout the lifetime of the equipment.

Our service facilities for palm oil are situated close to the main palm oil growing regions of the world.

Our distribution centres for spare parts ensure short delivery times.

We take care of your service needs at our workshops or at your mill. Call us 24/7 for technical assistance or a visit by a field service engineer. Our services include system trouble shooting, retrofits, balancing of decanters and separator bowls, repairs, hands-on staff training, and site audits.

To minimize downtime in your factory we provide spare conveyors and rotating assemblies that you can use while your decanters and separators are being serviced.

Performance Agreements
Our individually tailored service packages can include everything from basic maintenance to complete process optimization. Alfa Laval keeps track of the condition of your equipment, and all services are planned in advance.

A Performance Agreement gives you true peace of mind and full control over your service budget. Let us handle the practicalities while you focus on your core business.

Crude palm oil with maximum yield

D3 PRO in action

Alfa Laval's D3 PRO combined clarification, purification and oil recovery process has been adopted by numerous crude palm oil mills across the world.
Photo left: Since 2009 a D3 PRO process incorporating 3-phase decanters has been clarifying and purifying crude palm oil at a Malaysian oil mill with a total capacity of 80 tons FFB/h.

Milling

For decades Alfa Laval has provided palm oil mills with efficient equipment to convert sterilized and pressed palm fruit into crude oil, playing a key part in shaping the design of today's clarification room.

Challenge: To achieve maximum yield in a sustainable process
A growing number of industry players are now calling for a process that can recover more crude palm oil, minimize costs and optimize yield. It should also be simple to operate and sustainable.

Solution: D3 PRO, all-in-one clarification/purification
The Alfa Laval D3 PRO process is a combined 3-phase clarification/purification and oil recovery solution. It offers a profitable alternative to traditional settling tank technology that requires huge continuous clarification tanks for skimming pure oil and decanters/separators to recover oil from the underflow of the tank. D3 PRO can be configured as an automated system capable of operating 24 hours a day, with minimum maintenance or supervision.

After de-sanding, the pressed palm oil is fed to the 3-phase decanter. This is capable of high capacity separation with no need for dilution water, which means much less effluent for smaller, more manageable ponds.

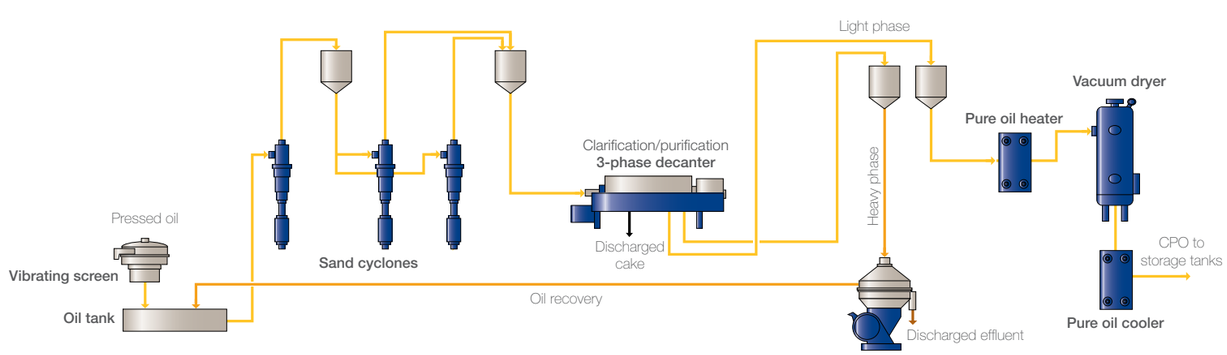
The "ready to go" light phase oil can be sent directly to the vacuum dryer for final moisture removal before refining with no need for purification.
This not only saves on equipment and maintenance, it also ensures consistent quality.

At the same time the cake and heavy phase oil are separated and can be treated differently. The cake can be re-used, e.g. as fertilizer to generate other income sources. In the D3 PRO process, oil from the heavy phase can be further recovered using a nozzle separator.

Oil recovery from sterilizer condensate
Large amounts of water are used during sterilizing and pressing of palm fruit. With an Alfa Laval nozzle separator the residual oil can be recovered from the sterilizer condensate effluent.

D3 PRO – benefits
- Up to 30% reduction in water consumption and effluent
- Maximum oil recovery, higher yield and profit
- Consistent separation and oil quality – no unnecessarily long holding time and exposure to oxidation.

D3 PRO process with 3-phase clarification/purification and oil recovery



Nozzle separator

Energy efficient drying and cooling
Centrifugal separation alone will not produce an oil sufficiently dry to be stored or to meet standard specifications from industry associations like PORAM. The amount of dissolved water present in the homogeneous oil phase depends on the amount of free fatty acid (FFA) in the oil and the temperature. The Alfa Laval vacuum dryer system utilizes vacuum to create a potential for the water to go over into the vapour phase.

With a temperature close to 90°C the oil leaving the dryer is more sensitive to oxidation and should be cooled before storage. An Alfa Laval Plate Heat Exchanger is ideally suitable for cooling as well as pre-heating before drying. An even more energy-efficient solution is heat recovery provided by an extra economizer – the capital cost is often recouped in a few months.

Larger scale production – with less water, energy and effluent
Palm oil mills and refineries are increasing in size to meet the growing demand in the world market. Hence, high capacity, high yield and energy efficient equipment is needed.

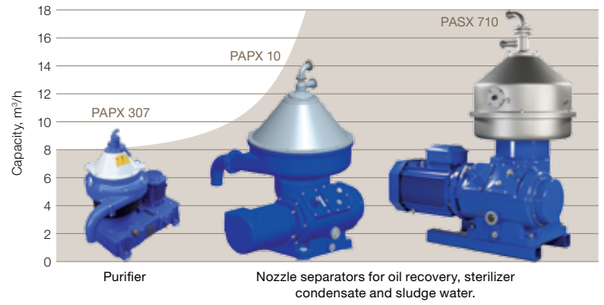
Alfa Laval has therefore extended its portfolio with new, very large and innovative separators and decanters.

Our self-cleaning separators can handle up to 18 m^3/h of feed in the mill.

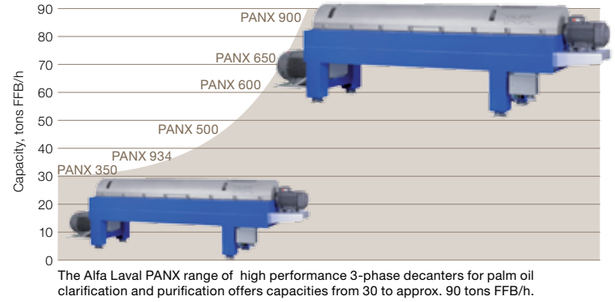
Separators for refining are available with capacities of up to 85 m^3/h.

Our latest decanter technology for clarification and purification can handle a mill throughput of up to 90 tons fresh fruit bunches (FFB) per hour, and enables significantly reduced effluents and lower energy consumption.

Large capacity separators for the palm oil mill



Large capacity decanters for the palm oil mill



The Alfa Laval PANX range of high performance 3-phase decanters for palm oil clarification and purification offers capacities from 30 to approx. 90 tons FFB/h.

Efficient effluent treatment

Up to 90% solids removed

An Aldec G2 decanter is used to dewater palm oil mill effluent (POME) and removes solids from the anaerobic ponds at an 80 t FFB/h palm oil mill in Malaysia. Thanks to automatic torque control, the decanter is able to deliver a consistent cake dryness.

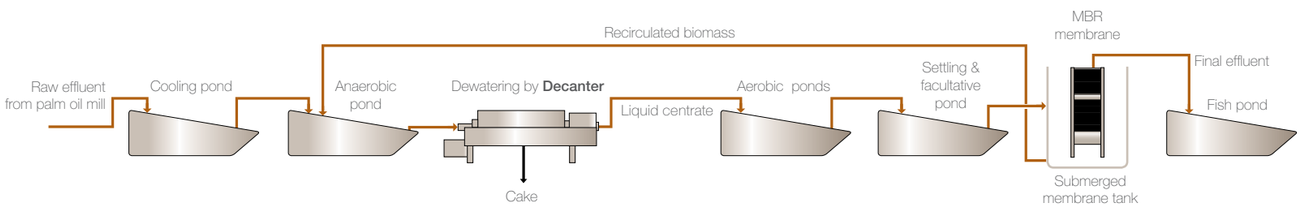
Effluent treatment

Challenge: To reduce effluent discharge from mills
The use of anaerobic digestion as a first-stage treatment of palm oil effluent results in a gradual accumulation of organic matter that silts up the ponds. This makes it difficult to achieve the desired, increasingly stringent discharge parameters.

Solution: Sludge dewatering using decanters
Alfa Laval designs and supplies solutions based on decanters for dewatering palm oil mill effluent (POME) and de-sludging of anaerobic ponds.

The latest decanter technology for effluent dewatering, Aldec G2, has a new liquid outlet design that provides energy savings of up to 30% compared with its predecessor.

De-sludging of anaerobic ponds with a decanter and aerobic final effluent polishing with membrane bioreactors (MBR)



‘Plug-and-play’ module
The complete waste decanter module is equipped with a feed pump and a polymer dosing system. It can be commissioned quickly and easily on-site.

Located near the effluent ponds, the decanter removes up to 90% of the solids present by the addition of bio-degradable chemicals. Removing the solids decreases the organic loadings in the ponds, substantially reducing the biochemical oxygen demand (BOD) which, in turn, reduces silting. The module offers continuous operation with minimum supervision.

Decanters for sludge dewatering – benefits
- Energy savings of up to 30%
- Solids removal of up to 90%
- Raises pond “performance”
- Modular design.

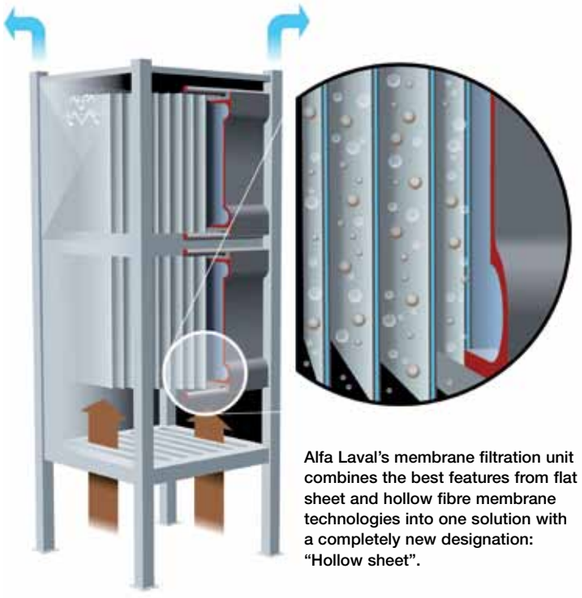
Mill effluent (left) before dewatering in a decanter. This separates it into 10% cake (middle), which can be used as fertilizer, and 90% liquid centrate (right), that can be further polished to meet final effluent discharge parameters.

Challenge: Meeting final effluent discharge parameters
Increasingly stringent final discharge parameters stipulated by local environmental regulations are posing problems for many palm oil mills. Continuously adding effluent ponds is not a sustainable solution.

Solution: Effluent polishing with a Membrane Bioreactor (MBR)
Membrane Bioreactors are a very effective way to treat the effluent, and to ensure correct discharge values before it is discharged to the waterway or re-used. It is one of the most advanced technologies within municipal and industrial wastewater treatment.

An Alfa Laval membrane filtration unit can be added to existing settling ponds for polishing of final effluent. Or it can be installed in a new plant and run as a MBR, where ponds are not needed, as the MBR is a simple yet effective combination of an activated sludge biological treatment process and membrane filtration. The membranes act as a physical barrier, allowing the passage of clean water, while trapping suspended solids, bacteria, pathogens and some viruses. The treatment is sufficient to produce a permeate quality that is low in BOD and total solids.

Saves space and construction costs
The MBR process supports a high biomass concentration and increases the removal of organic matter, thus reducing the size of biological tanks needed. This, together with a small footprint, reduces overall construction cost. The MBR process has low energy requirements, and does not require high chemical consumption or high pressure.



Alfa Laval’s membrane filtration unit combines the best features from flat sheet and hollow fibre membrane technologies into one solution with a completely new designation: “Hollow sheet”.

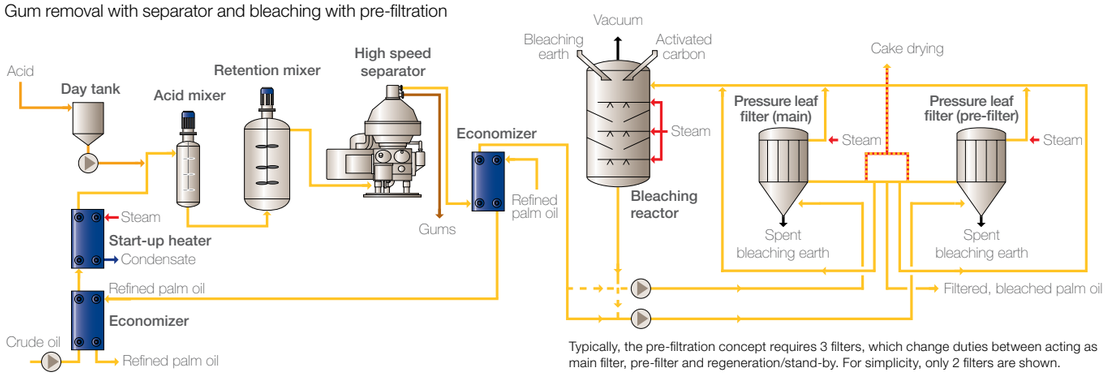
MBR – benefits
- Maximum BOD reduction and operation at high concentrations of mixed liquor
- Complete retention of biomass
- Small footprint
- Low maintenance requirements
- Automatic control of the whole system
- The membrane unit can be integrated in the bioreactor, or used to treat a side-stream from the bioreactors.

Patum Vegetable Oil

Since 1985 Patum Vegetable Oil, one of Thailand's largest producers of edible palm oil and biodiesel, has used Alfa Laval equipment to upgrade and extend its first physical refining plant for improved quality and reduced energy consumption. In 2012 a completely new 1,500 t/d refinery was put into operation, comprising the latest Alfa Laval innovations: Gums removal with high speed separator and pre-filtration prior to bleaching, plus all the newest features in continuous deodorization, such as flexible retention time, double scrubber, chilled water closed loop, VHE economizer (under vacuum and stripping) and Compabloc plate heat exchangers.

Refining - Degumming and bleaching

Gum removal with separator and bleaching with pre-filtration



Typically, the pre-filtration concept requires 3 filters, which change duties between acting as main filter, pre-filter and regeneration/stand-by. For simplicity, only 2 filters are shown.

Challenge: Reduce use of bleaching earth, oil loss, waste and MCPD
Traditional removal of gum, colour pigments and solid impurities from crude oil using acid and bleaching earth followed by filtration results in large amounts of spent bleaching earth containing a lot of non-recoverable oil.

Solution: Gum removal with a separator and pre-filtration
To minimize waste and oil loss, Alfa Laval recommends using an energy-efficient high-speed separator to remove precipitated gum before the bleacher.

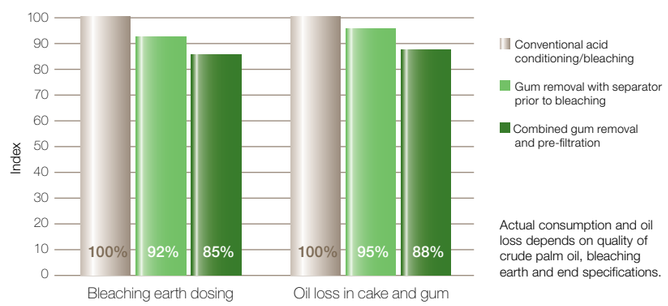
Benefits
- Up to 15% less bleaching earth
- Oil loss reduction
- Can handle a wide range of gums
- Significant reduction of MCPD.

The reduced gum load to the bleacher enables less dosing of bleaching earth, and further increases final oil quality. Gums can be mixed with spent bleaching earth or recycled upstream to the mill.

Pre-filtration of acid-treated oil through an already used filter before bleaching is normally not viable as filter blocking, mainly by gum, allows only a small fraction of the oil to be pre-filtered. Gum separation now makes it possible to pre-filter the full oil flow, further reducing the bleaching earth consumption.

Mitigation of MCPD formation
A positive side effect of wet degumming with a separator is significantly reduced content of chlorine compounds, that during deodorization can contribute to the formation of the undesired contaminants MCPD (monochloro-propanediol) compounds and esters thereof.

Performance of different bleaching modes



Actual consumption and oil loss depends on quality of crude palm oil, bleaching earth and end specifications.

Heat recovery

Challenge: Maximum heat recovery
Efficient economizing, utilizing heat from cooling one fluid to heat another fluid, benefits overall process economy and reduces the plant's carbon footprint due to reductions in the use of steam for heating, plus cooling water.
The refinery process configuration determines how the optimal economizing should be conducted, and which equipment to use.

Solution 1: VHE Economizer for cooling under vacuum
Some refiners prefer cooling under vacuum. Alfa Laval's patented Vacuum Heat Exchanger Economizer (VHE ECO) has for many years set the standard for economizing in deodorization, where the cooling is conducted while stripping the oil in a shallow vacuum tray.

Our conventional VHE ECO is a double deck construction which facilitates very shallow liquid height during the joint cooling/stripping. To meet the demand for cost-effective processing, we have designed a single deck version, suitable for palm oil economizing at high capacities.

Solution 2: Pressurized economizing
Some choose to conduct the economizing under pressure, a more cost-efficient solution than using vacuum. The duty in VHE ECO is partially or fully replaced by an economizer type where a hot pump provides pressure which is utilized to create efficient turbulence on the hot side, thus enhancing the heat transfer.

For this, Alfa Laval offers various types of heat exchangers including plate, spiral, fusion-bonded and compact heavy duty. Each equipment type has its own characteristics regarding efficiency, resistance to fouling, resistance to thermal fatigue etc. Our specialists advise you regarding the best choice for your specific application.

VHE Economizer with single deck. ▲ and double deck. ▼

CompaBloc compact heavy duty heat exchanger.

Spiral heat exchanger.

New trend in deodorization

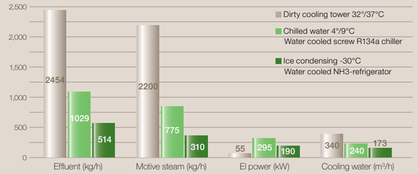
Partners in innovation

Since 1989 when Suksomboon, Thailand, decided to expand from plantation to downstream processing, Alfa Laval has been their chosen technical partner. Total cost of ownership, flexibility and our ability to implement their ideas were key to the owners. Today, the palm oil complex includes refining (900 t/d), dry fractionation and hydrogenation for edible oil, olein, hard stearin and biodiesel. They were the first to adopt our new deodorization concept with post-stripping (Dual-Strip) and an Iso-Mix rotary jet head for crystallizer cleaning.

Reduction of vacuum effluent

Steam consumption for the deodorizer's vacuum system and amount of vacuum effluent can be more than halved using chilled water. Ice condensing can further cut these by up to 85%.

Comparison of consumption and effluent for different vacuum solutions



Consumption figures for 1,000 t/day deodorizer. Vacuum system based on steam ejectors.
Data: Courtesy of Körting Hannover AG

Refining - Deodorization

Deodorization is a crucial part of all edible oil processing. Alfa Laval offers a variety of solutions for combined deacidification/deodorization in both continuous and semi-continuous mode with minimum stripping steam and the highest degree of heat recovery.

Challenge: Cost-effective continuous deacidification/deodorization
Removal of odours, pigments and volatile substances in a continuous deodorization process should be as gentle and energy-efficient as possible.

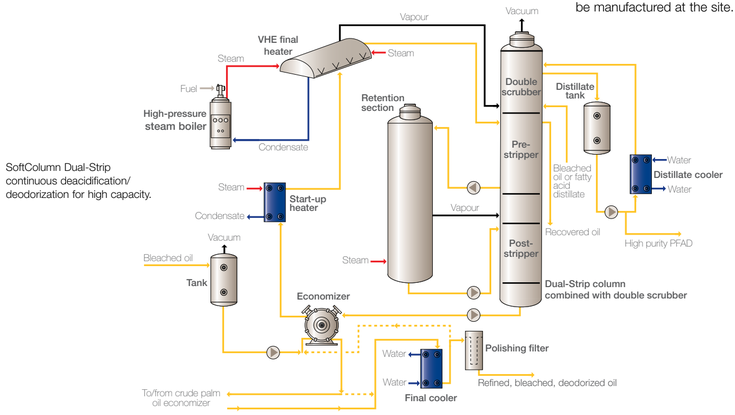
Alfa Laval's well-proven modular concepts for continuous deodorization, with heating and cooling under vacuum in separate vessels, offer a high degree of flexibility compared to all-in-one solutions. The structured packing based on counter-current thin-film technology ensures that stripping steam consumption and, thus, vacuum costs are minimized. It has therefore become the standard in the vegetable oil industry.

Solution 1:
Packed Column
This continuous deacidification/ deodorization solution offers high product quality while consuming a minimum of utilities. Alfa Laval was the first to introduce structured packaging technology as a standard part of the physical refining concept.

SoftColumn Dual-Strip benefits
- Enables production of oil with less FFA (free fatty acids) compared to standard deodorization technologies
- Lower energy consumption
- Improved oil quality.

The retention is conducted in stacked baffle trays with continuous overflow.

Solution 2:
SoftColumn for flexible operation
This flexible continuous deacidification/ deodorization solution addresses different end applications with minimum utilities consumption. Oil retention is conducted batch-wise with transfer between trays by Alfa Laval's patented Fast Draining Valve. The concept offers flexible retention time over a wide range, and is thus suitable for processing different oil types or oil for different applications. SoftColumn can handle 2-3 stock changes per day.



SoftColumn Dual-Strip continuous deacidification/ deodorization for high capacity.

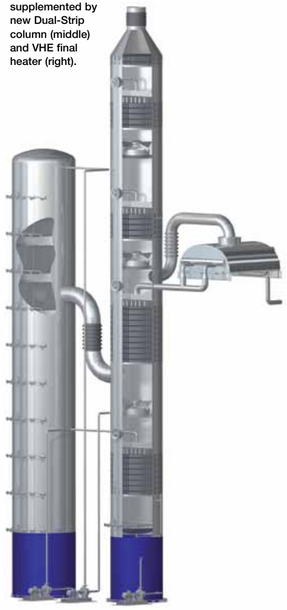
Solution 3:
SoftColumn Dual-Strip for high-capacity, mono-stock
Offering higher capacity with lower costs, our latest innovation SoftColumn Dual-Strip is a cost-effective continuous deodorization solution with post-stripping.

The Dual-Strip plant divides the stripping action into a pre-stripping section and a post-stripping section (with the retention section in between). The pre-stripping removes most of the volatiles in the feed before entering the retention section, while the post-stripping removes all volatiles produced during the retention section.

The Dual-Strip concept enables economizing under pressure as well as higher liquid height in the retention trays. These offer both capital and operational cost savings while maintaining high product quality.

The post-stripper also allows higher capacity in a certain diameter vessel. It is therefore especially suitable for extremely large capacities (more than 3,000 t/d), where the required vessel diameter (using single stripping) can no longer be transported but has to be manufactured at the site.

Any existing continuous deodorizer can be retrofitted to Alfa Laval's SoftColumn Dual-Strip process, reusing the old deodorizer as retention section (left), supplemented by new Dual-Strip column (middle) and VHE final heater (right).



Challenge: Physical refining with frequent stock changes
Minimizing cross-contamination between batches and achieving lowest possible operating costs.

Solution:
SoftFlex semi-continuous process
The patented Alfa Laval SoftFlex semi-continuous deacidification and deodorization technology comprises a structured packing section inside the batch-wise flow mode. Stripping steam injected to the other trays is reused in the structured packing, thus lowering the steam consumption by 30-40%.

Economizing has been improved by using our patented U-tube design for the heat transfer areas. It provides up to 30% higher heat transfer area in same space, resulting in less final heating requirement by high pressure steam.

Batch transfer between trays is done by the same unique Fast Draining Valve as is used in the SoftColumn design.

SoftFlex benefits
- Fast, automated stock changes with no loss of production time
- Minimum cross-contamination between batches
- Reduced energy consumption and lower fuel costs.

Reduction of vacuum effluent
The deodorizer's vacuum system in its standard configuration, i.e., a 4-stage steam ejector system served by tower cooling water, produces significant amounts of effluent slightly contaminated with organic matter. Alfa Laval offers a number of options, which can significantly reduce the amount of vacuum effluent.

Closed loop cooling
A closed loop cooling system can be installed, thus avoiding operating a "dirty" cooling tower.

Chilled water
Using chilled water as a substitute for tower water in combination with a closed loop cooling system will reduce the effluent production by about 60%. The colder water used for condensing reduces the compression required before condensing, which can be accomplished by a single steam ejector (2 ejectors in series are required for tower water).

Ice condensing
Freeze condensers can eliminate the need for compression of the process vapour before condensing.

Alfa Laval offers solutions where the process vapour is cooled and solidified either via an ammonia or glycol loop, chilled by refrigeration plant.

Beyond tocopherols

Natural palm oil E-vitamins, tocotrienols and tocopherols, typically used in dietary supplements, health and beauty products, have high market prices. Scientific studies show that tocotrienols, only available in high concentrates in palm oil, are far more potent antioxidants than tocopherols and have a beneficial effect on a variety of medical conditions.

Enriched product stream

Reap the added value from PFAD
Palm oil fatty acid distillate (PFAD) is enriched in unsaponifiable components such as tocotrienol, squalene and sterols. The ongoing hunt for these value adding products has increased refiners' interest in separating PFAD in the deodorization section to extract micronutrients as a source of additional revenue.
Alfa Laval offers several solutions to recover these in high concentrations.

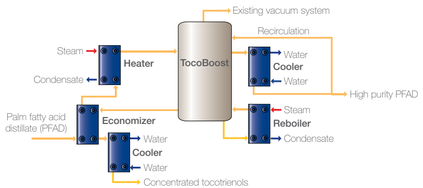
Double scrubbing for increased oil yield and high FFA purity
Today it is quite common to recover PFAD distillate using a double scrubbing system, which produces higher purity PFAD compared to a conventional single scrubber. It is also more efficient in preventing carryover of organic matter to the vacuum system.

Alfa Laval offers various scrubber types:

- "Hot wash bed": Once through washing (partial condensation) of the vapours before full condensing in a cold scrubber.
- "Full loop hot scrubber" circulating the high temperature distillate fraction to recover high value micronutrients as separate product streams.

Configuration and achievable concentration levels of micronutrients in the PFAD depend on the refiner's objective and scrubber configuration plus conditions in the oil deodorizing section.

Concentration of PFAD tocotrienols with TocoBoost

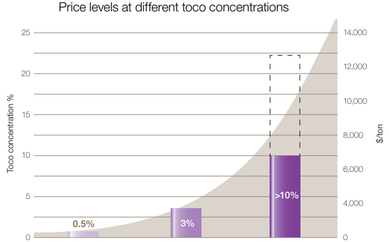


Concentration of tocotrienols with TocoBoost
To achieve highest concentrations of especially high value tocotrienols, Alfa Laval has developed the TocoBoost technology (patent pending). It combines a double scrubber with a separation section, and includes:

- Separation of glycerides from the unsaponifiable fraction
- Separation of tocotrienols from the fatty acid fraction.

Oleochemicals
We can also provide other distillation processes to turn PFAD into oleo-chemicals like C12/14, C16 and C18.

Price levels at different toco concentrations



World's largest refinery

When Wilmar International, the largest global processor of palm and lauric oils, chose Alfa Laval solutions for its Pelintung 6,000 t/d refinery in Indonesia, quality, safety, reliability and operating costs were in focus. In the bleaching and continuous deodorization plant spiral heat exchangers ensure maximum heat recovery and product yield. A double scrubber reduces oil losses in deacidification by about 50%.

Yield up, waste down

PT Royal in Indonesia, an international supplier of edible oils and fats, replaced their old inefficient refinery equipment with a new 500 t/d refinery for palm oil and palm kernel oil in 2008 with Alfa Laval bleaching and continuous deodorization plant. The results are higher yield, improved quality and a reduced wastage level. In 2010 they added dry fractionation to produce cooking oil.

Fats modification

Challenge: To add maximum value to the raw material
Many palm oil producers have extensive untapped resources in the form of under-exploited feed stock. Adding efficient fats modification processes can open new doors for producers to offer more products, reach new customer groups and harvest greater revenue.

This strengthens your company's capability to deal with the effects of seasonal demand and individual market fluctuations.

Solution: Dry fractionation, a direct, natural way to add value
Alfa Laval provides several complete flexible solutions for fats modification. One is fractionation, a direct, natural way to modify palm oil to ensure that it acquires greater value. Fractionation with gentle cooling of oils or fats in an accurately controlled process makes it possible to crystallize the hard fat content.

The Alfa Laval dry fractionation plant enables you to vary production rapidly and efficiently to meet changes in your customers' requirements and specifications. It consists of a crystallizer, filtration section and cooling water circuit (usually both evaporative cooling tower and a chilled water module).

Alfa Laval's dry fractionation pilot plant in Malaysia is used to customize a solution to suit customer requirements to different types of feedstock, and for R&D.

We design and specify the most suitable key components, such as crystallizers, membrane filters, pumps and instruments to ensure a reliable and efficient production. All the equipment is practical and easy to install, operate and maintain.

Process options include slurry type for palm oil, cake fractionation for palm kernel oil and oleic acid fractionation.

Efficient, flexible crystallization
Our crystallizers use best vessel engineering design and highest quality materials. We offer double coil, fin type, or vertical tube versions, depending on customer requirements in terms of fractionation task, batch size, cooling surface and layout.

Efficient crystallization and accurate process control ensure good separation of the liquid and stearin phases, resulting in greater yields and higher profitability.

The flexibility to expand is another feature of the system. The modular design makes it possible to increase production capacity to keep pace with demand, by adding more crystallizers and extending filter capacity.

Iso-Mix rotary jet heads for faster, cheaper crystallizer washing
The traditional way of melting left-over crystals inside the crystallizer by filling it with hot oil is very time and energy consuming.

Crystallizers can be cleaned in place much faster using the innovative Alfa Laval Iso-Mix rotary jet head technology. Installed inside the crystallizer unit, it enables all internal surfaces to be washed using hot oil to melt away crystals left over from the previous batch.

This allows most of the RBD oil from the refinery to be pre-cooled externally before feeding it into the crystallizer. This shortens the cycle time of each crystallizer considerably, thus increasing capacity by 10%. It also enables the cooling tower water circuit and the chilled water closed circuit to be kept fully separated, so coils will have a longer lifetime. And cooling costs can be reduced by approx. 15% due to lower temperature using external plate heat exchanger with tower cooling water before it is necessary to switch to expensive chilled water.

Other fats modification processes
- Hydrogenation, hardening of soft oils or fractions
- Post-refining: Post-bleaching and deodorization of hydrogenated oil and fats
- Chemical or enzymatic interesterification, an alternative to partial hydrogenation to modify oils and fats by rearranging the triglyceride molecules. It can be used to produce healthy fats without the undesired trans-fats.

Contact us to learn more about these.

Alfa Laval's Iso-Mix rotary jet heads can also be used for fast and efficient melting and washing of left-over crystals inside the fats modification system's crystallizer.

Example of a crystallizer for dry fractionation.

From fruit to food - and beyond

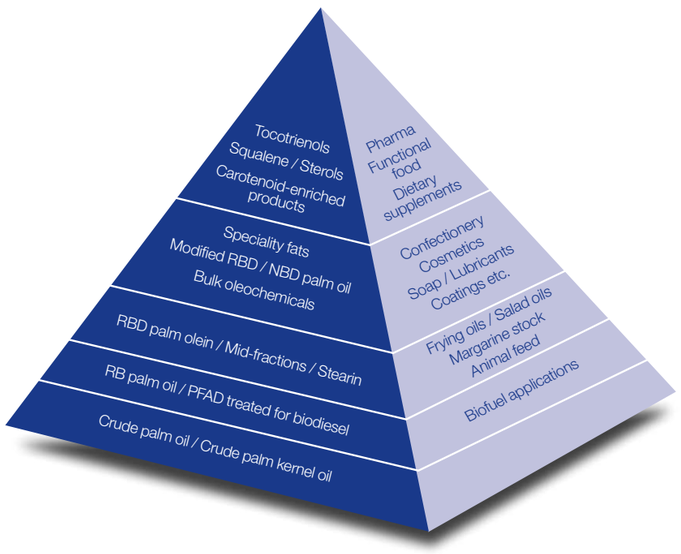
End-products

Discover new palm oil applications
Oil from palm fruit and kernels is a wonderful source of food and a variety of other essential everyday products that improve the quality of our lives. Its nutritional and health value plus other inherent properties have been recognized and exploited for centuries. New applications are still being discovered.

Collaboration between all players
Refined and modified palm oil and palm kernel oil can be further processed in many different ways and turned into a wide variety of end-products – for nutritional as well as other purposes.

Alfa Laval's dedicated palm oil teams see it as our mission to support the industry in making the most of the potential of this unique, natural raw material – in the most feasible, profitable and sustainable way. In close collaboration with upstream and downstream players as well as universities and scientists we continuously develop new, innovative processing solutions that pave the way for new applications and end-products.

Tap into our decades of experience from thousands of vegetable oil installations worldwide, and let us move up your value chain together.



Food and food ingredients
Margarine
Shortenings
Mayonnaise
Sauce/dressing
Frying/salad oil
Filling fats
Vegetable cheese
Vegetable whipped cream
Coffee creamer
Infant milk formulas (mother's milk substitute)
Ingredients in cocoa butter equivalents (CBE)
Cocoa butter substitutes (CBS)
Emulsifiers (ingredients in food and non-food)

Non-food
Health care
Pharmaceuticals
Cosmetics
Soap and detergents
Car tyres
Biofuel.

Continuous biodiesel plant

The state-owned petroleum company ALUR in Uruguay has purchased two Alfa Laval Ageratec transesterification plants: Stage 1 (B2) for 16,000 TPY and stage 2 (B5) for 55,000 TPY. The feedstock is RBD oil with a provision for re-commissioning to low grade animal fat.

Biofuel

Challenge:
To replace edible high-cost raw materials with alternative inedible low-cost feedstocks, while minimizing environmental footprint
Biodiesel is typically produced by conventional transesterification plants employing water wash technology. These depend heavily on high-cost edible feedstocks, leaving them vulnerable to the price-volatile spot market for edible oils while accumulating considerable costs for water recovery and biodiesel drying through distillation.

Solution 1:
Ageratec "virgin oil" transesterification technology for continuous biodiesel processing
An Alfa Laval Ageratec transesterification plant for biodiesel production is delivered as a compact prefabricated process on skids. It incorporates innovative approaches to total contamination, sterol glucosides, and filtration issues. Our patented biodiesel wash process using high-speed separators avoids energy intensive distillation, cutting energy demand and cost of distillation to around 50% of conventional water intensive transesterification technology.

Solution 2:
Ageratec "multi-feedstock" technology for biodiesel batch processing lines
Ageratec esterification batch plants make it possible to produce biodiesel with significantly less environmental impact, close to feedstock supply or diesel consumers. Intended for medium-scale production, each complete process line includes acid esterification, alkaline transesterification and our energy and cost saving wash process.

Solution 3:
Advanced Glycerol Treatment (AGT) pretreatment process for oleochemicals
The AGT process allows practically any inedible low-quality fats, oils and grease of vegetable or animal origin to become feedstock for producing biodiesel. The feedstock can be used inside an existing transesterification plant which previously required virgin oil for a working production set-up. Downstream, the producer can tap off the "biorefined" oil at different stages of production and upgrading.

An AGT system gives the freedom to select any appropriate output, and to sell the oil directly after upgrading. It delivers treated oil as mono- di- and triglycerides ready for mixing as heavy fuel oil. It can also be traded as an oleochemical, or forwarded to off-site biodiesel producers.

Ageratec continuous lines – benefits
- Directly applicable for traditional, refined feedstock
- Attractive alternative to today's elderly plant design
- Savings in project development/ site assembly

Ageratec batch processing lines - benefits
- Enables use of feedstocks with up to 10% FFA
- Front-end acid esterification for direct conversion of any free fatty acids (FFA) into methyl esters.
- Plant logistics free from water and effluent

AGT pretreatment process – benefits
- Adds significant value to existing "waste products"
- Enables the producer to move into new, high-value product segments available within the field of biorefining
- Reduces the environmental impact of plant operations.