Maximizing the value of modified fats

Alfa Laval processes for modifying edible oils and fats

Aiming at new horizons

If you're in the business of modifying oils into fats for the food industry, the key to success lies in providing your customers with high-quality products that meet their requirements perfectly – even at short notice.

Naturally, you also want to ensure that your processing operations remain safe while at the same time adding maximum value to your raw materials.

Alfa Laval provides you with the fats modification solutions you need to move up the value chain – safely and surely.

The benefits of fats modification

Fats modification processes open new doors so that you can offer more products, reach new customer groups and increase revenues.

There are also strategic advantages to be gained from modifying these fats. A move from the basic processing of bulk oils and fats enables you to focus on a wider market spread.

This in turn strengthens your company's ability to deal with the effects of seasonal demand, market fluctuations and the worldwide commoditization of basic agricultural products.

Opportunities abound

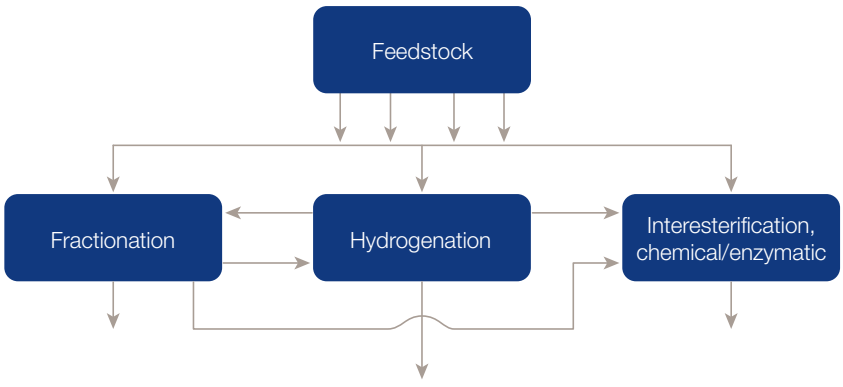
Installing Alfa Laval fats modification equipment provides you with a low-risk path into a world of new opportunities to:

- branch out into more products with higher value
- acquire new customers
- forge new types of customer relationships
- enter new markets
- move further up the value chain

The Alfa Laval approach provides flexible solutions that enable you to quickly, efficiently and safely vary production to meet changes in customer requirements and specifications.

Alternatives in fats modification

Depending on the products your customers are interested in and the raw materials you have available, you can choose between several different Alfa Laval solutions, or a combination of these.



Converting oils and fats naturally

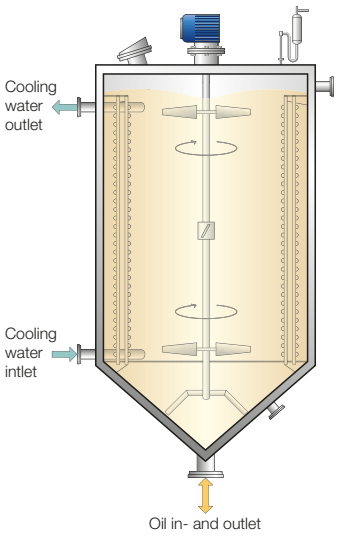
The natural way to modify oils and fats

If your feedstock stems from palm oil or animal fats, there is a direct, natural way to modify it to ensure that it acquires greater value. By separating the feedstock into liquid and solid fractions, or by combining different fractions, you can create products that match your customers' exact specifications.

Fractionation consists of gently cooling oils or fats in an accurately controlled process, making it possible to crystallize the hard fat content.

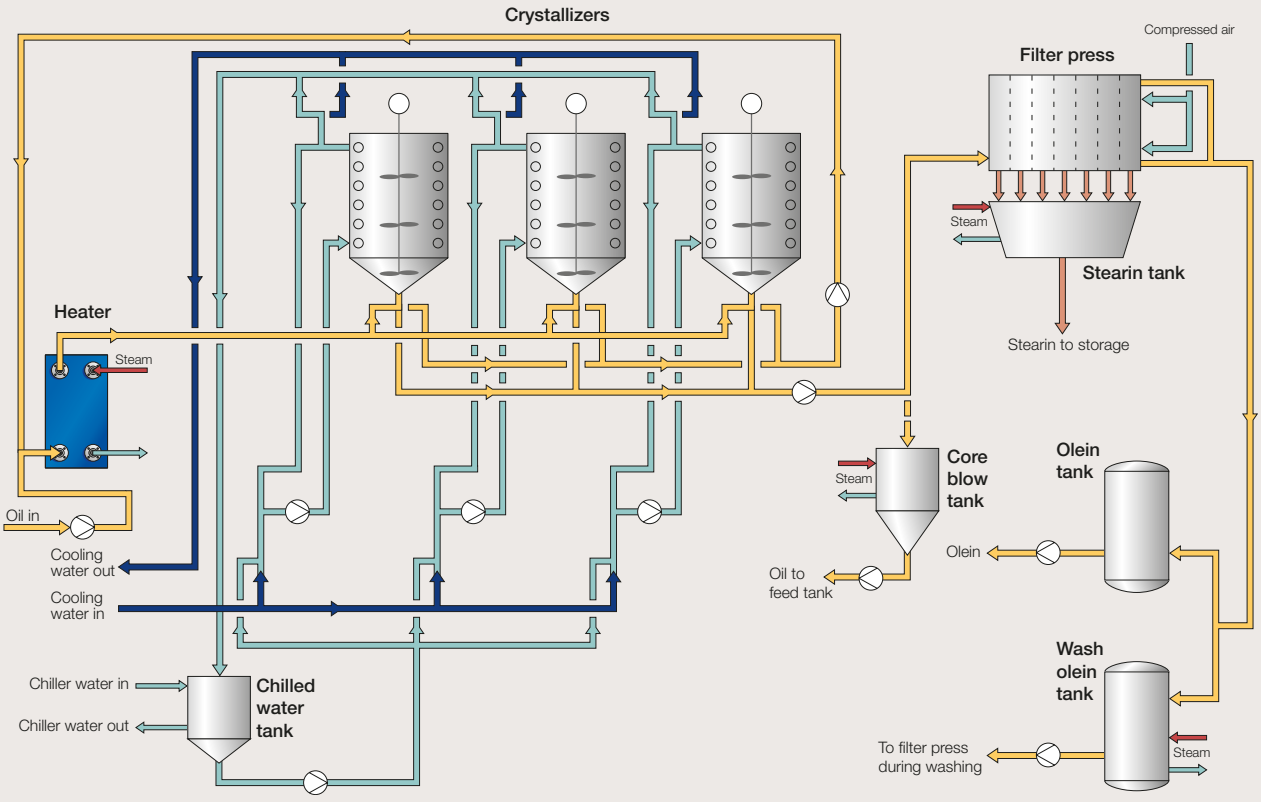
In dry fractionation, the fat is kept at a temperature at which it is in a partially liquid form. The crystals are then separated from the liquid fraction by membrane filtration. The result is two distinct products with different physical properties and melting points.

This can be achieved with absolutely no chemical modification, making this the "natural" way to produce hard fats.



Alfa Laval crystallizer

Fractionation



A schematic diagram of the dry fractionation process

Taking dry fractionation still further

The Alfa Laval dry fractionation plant at the palm oil refinery run by IOI Edible Oils features six crystallizers and one filter press. Here, dry fractionation is more than just a way of producing cooking oil. Advanced PLC systems have been added for efficient control and top-quality results.

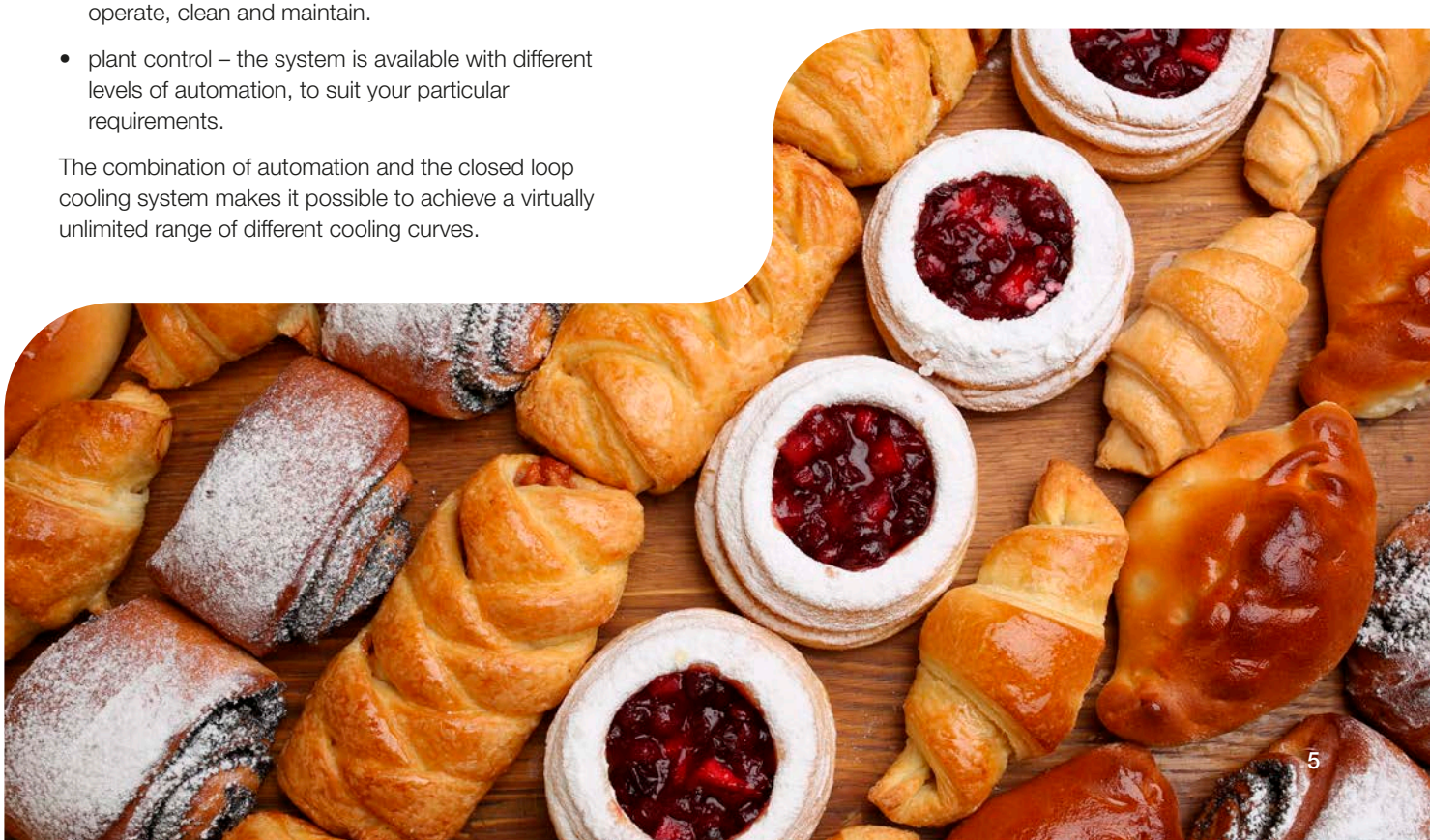
“Alfa Laval has simplified dry fractionation into a process that is easy for the operator to interface, and thus transformed the technology,” states Kenny Liew, Deputy Plant Manager for IOI Edible Oils Sdn Bhd in Malaysia.

The Alfa Laval advantage

Alfa Laval crystallization and filtration equipment for fats modification processes features:

- upward flexibility – the modular design makes it possible to increase production capacity to keep pace with demand, by adding more crystallizers and extending filter capacity.
- excellence in process and engineering solutions – by designing and specifying the most suitable key components, such as crystallizers, membrane filters, pumps and instruments, the Alfa Laval system ensures high process efficiency.
- highly effective crystallizer design – using the best vessel engineering design, construction materials, surface finishing, design of the cooling coils and agitation that produce crystallized slurry ideally suited for membrane filtration.
- high yields – efficient crystallization and accurate process control result in good separation of the liquid and solid phases as well as ensuring greater yields and higher profitability.
- practical design – Alfa Laval equipment is designed to be straightforward, practical and easy for you to install, operate, clean and maintain.
- plant control – the system is available with different levels of automation, to suit your particular requirements.

The combination of automation and the closed loop cooling system makes it possible to achieve a virtually unlimited range of different cooling curves.



Versatile, modular hydrogenation

The versatile way to modify fats

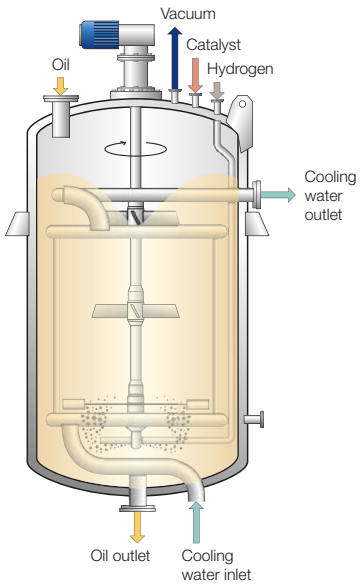
Oils and fats from virtually all kinds of raw materials and ingredients can be modified into hard fats by altering their molecular structure.

This is done by hydrogenation – the name given to the process in which hydrogen is chemically combined with unsaturated oils and fats, by making it link up with the double bonds of the unsaturated fatty acid chains.

Essentially, this process consists of bubbling hydrogen gas through the oils, normally at temperatures of 150–200°C (302–392°F), under pressure and in the presence of a catalyst. This adds the hydrogen atoms to the double bonds of unsaturated fatty acids, either to reduce them or to produce fully saturated fats.

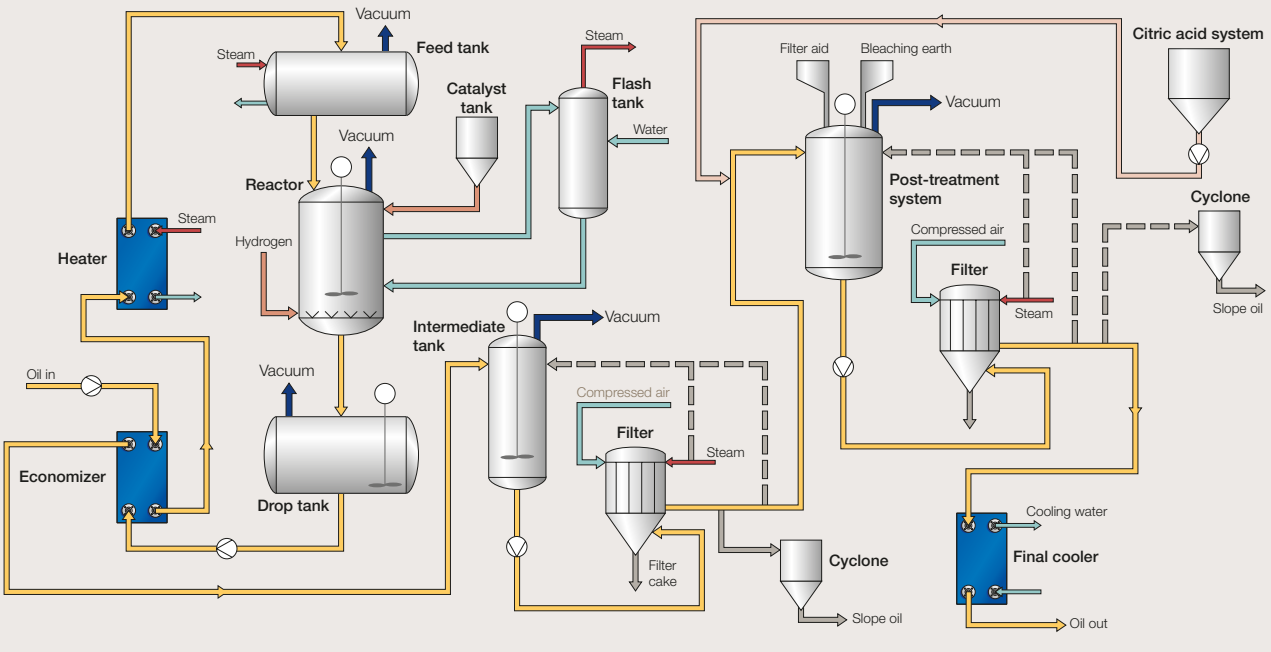
Hydrogenation raises the melting point of oils and fats and improves a range of other properties, including taste and shelf-life qualities.

The diagrams to the right and below show two systems based on filtration and continuous centrifugal separation that Alfa Laval provides for catalyst removal.



Alfa Laval reactor

Hydrogenatic



A schematic diagram of the hydrogenation process

Unlimited flexibility

The Alfa Laval hydrogenation plant supplied to CALSA features a feed tank, a drop tank and a dead-end reactor. Heat recovery is done by a highly efficient AlfaRex TM20 plate heat exchanger. Catalyst removal is undertaken in two steps, using direct filtration followed by a post-treatment system. The plant is fully automatic, controlled by a PLC unit.

"Alfa Laval supplied us with a highly efficient plant, with the lowest production costs in terms of energy, hydrogen and catalyst consumption. It gives us unlimited flexibility to produce any type of fats we want," states Mr. Alejandro Murillo, plant manager of CALSA – Cia Argentina de Levaduras S.A.I.C. – Argentina.

Low production costs

Alfa Laval hydrogenation equipment significantly reduces production costs by ensuring low production costs, full energy recovery, minimized hydrogen consumption, good catalyst distribution and contact with the oil, and a reduced temperature difference between oil and water.

- Low production costs. Highly efficient heat exchangers heat the incoming oil while simultaneously cooling the hydrogenated product, thereby maximizing heat recovery.
- Full exothermic energy recovery. Using a closed loop cooling system ensures maximum energy recovery from the exothermic reaction.
- Minimized hydrogen consumption. Special agitation techniques incorporate most hydrogen into the oil before it reaches the reactor head space. Vortices on the surface of the oil also force the hydrogen in the head space back into the oil. The result? Use of exactly the right hydrogen quantities.
- Good catalyst distribution and contact with the oil. Low speed and high flow agitation ensure good catalyst distribution and contact with the oil. The filtration rate is improved, as the catalyst is not converted to colloidal form.
- Reduced temperature difference between oil and water. The use of a closed loop cooling system and natural recirculation prevents the water hammer effect and improves temperature control.

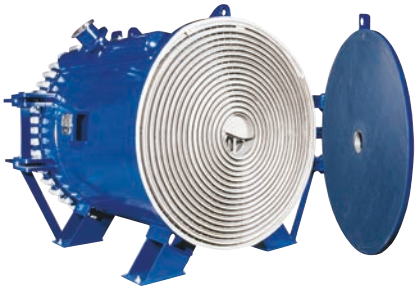
Greater flexibility

Alfa Laval hydrogenation equipment also lends a greater degree of versatility to your operations. A wide range of operating parameters makes it possible to produce saturated or partially hydrogenated fats with different specifications. These parameters include hydrogen flow rate and pressure, reaction temperature, degree of agitation and amount of catalyst.

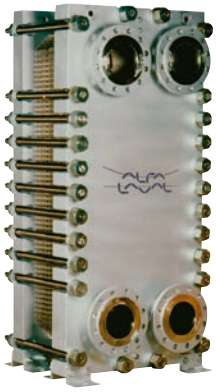
Hydrogenation solutions using Alfa Laval equipment also make it possible to vary batch size and plant capacity, according to specific requirements. Feed and drop tanks contribute to increasing production and heat recovery. In addition, the reduced oil volume in the heat exchangers makes stock changes easier and reduces contamination.

High degree of safety

What's more, the explosion-proof design of Alfa Laval hydrogenation equipment keeps the hydrogen within the reactor, ensuring plant safety. Special seals with leakage detectors ensure early detection, should any leaks occur.



Alfa Laval spiral heat exchanger



AlfaRex® economizer

Transforming edible oils and fats through interesterification

Want to combine an efficient, flexible production set-up with the ability to satisfy ever-changing customer demands? Interesterification can help.

By combining different oils and fats, interesterification makes it possible to produce hard fats from a wide range of raw materials – and in a way that conforms to modern market demands.

Traditional interesterification is carried out by using a chemical catalyst (normally sodium methylate) to bring about a regrouping of the position of the fatty acids on the basic glycerol molecule.

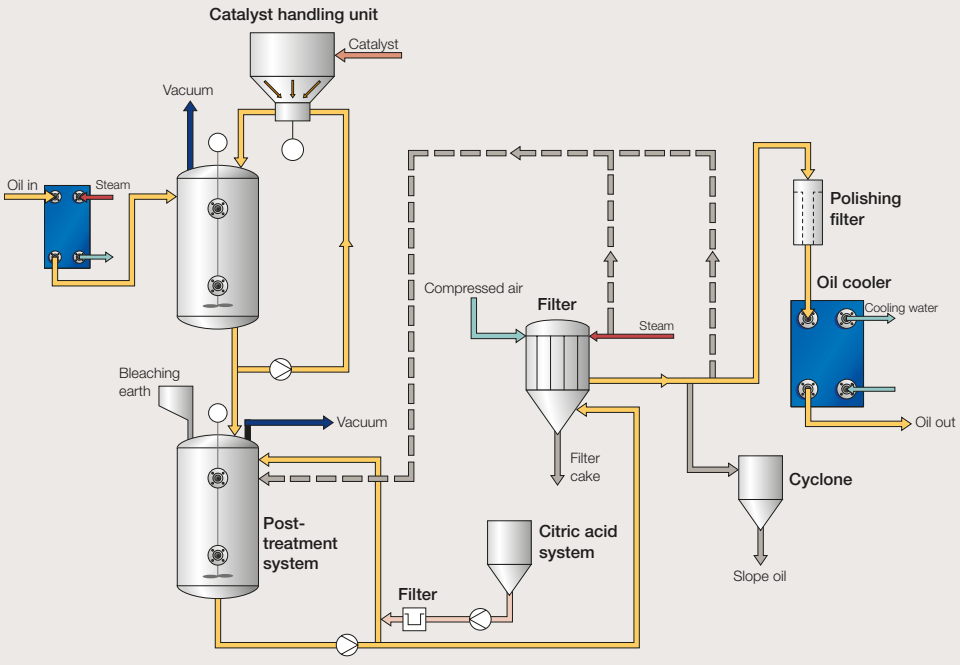
The mixture of oils and fats is pumped from the mixing tank to a steam heater and then to the reactor under vacuum conditions for drying. To improve drying efficiency, the oil is pumped through a recirculation section.

After drying the oil, a catalyst is introduced into the oil recirculation stream, using the special catalyst dosing device. When the catalyst reaction is completed, the oil is discharged to the post-treatment reactor. Here, the catalyst is deactivated with acid and the oil is treated using bleaching earth.

As an alternative, the catalyst can be deactivated with water in the washing tank. The soap generated in this process is removed using a disc stack centrifuge. The oil is then dried and sent to the post-treatment stage.

Interesterification does not affect the degree of saturation of the fat, nor the location of the cis-trans chemical bonds. It is largely done to control the consistency of the oil or fat at different temperatures, a parameter that is crucial for your customers in the food industry.

Interesterification



A schematic diagram of the interesterification process (catalyst deactivated with acid)

Advantages of interesterification

Alfa Laval interesterification equipment used in fats modification processes includes a specially designed catalyst handling system. The system includes:

- A hermetically sealed catalyst handling unit, which allows manipulation of the catalyst bags without direct contact between the product and the operator, thereby ensuring a safe, inert environment.
- A catalyst dosing unit ensures the use of accurate amounts of the catalyst, with no exposure to the atmosphere.
- A catalyst pre-mixer doses the catalyst in a blender where it is dissolved in the recirculation oil stream. This ensures the introduction of the catalyst powder to the oil occurs inside the vacuum reactor.
- A catalyst neutralizer, using either acid or water, to render the catalyst inactive.

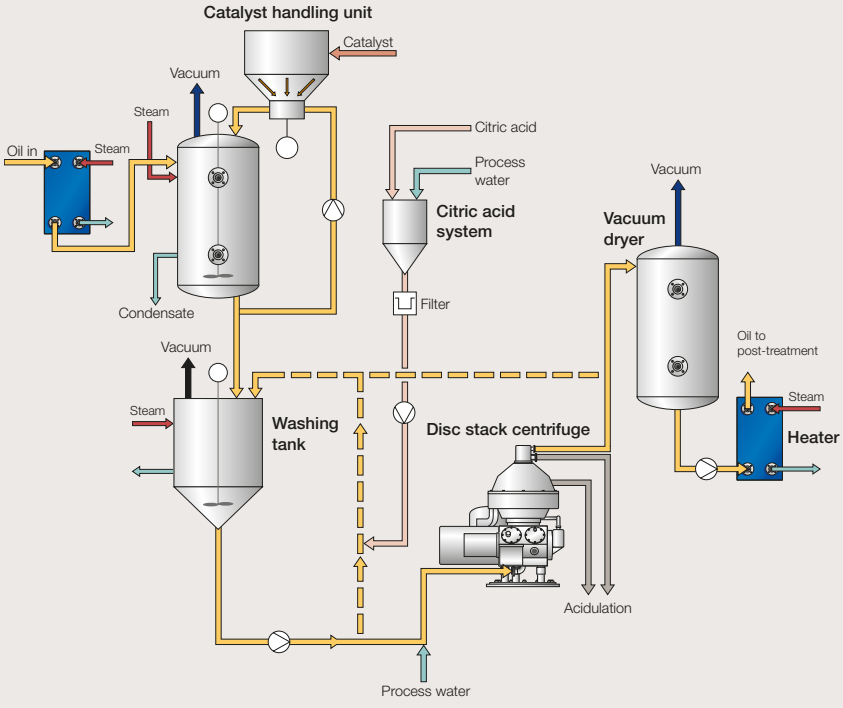
Other special Alfa Laval features include:

- Oil conditioning. Recirculating the hot oil to the reactor under vacuum conditions ensured that the oil has a low moisture content. This results in the best possible catalyst efficiency and consumption.
- Post-treatment equipment includes the Alfa Laval hermetically sealed earth transportation and dosing system and a post-treatment reactor with steam or mechanical agitation, designed for continuous or batch operation.

Because of the design of the components and the rigorous specifications used, Alfa Laval interesterification equipment keeps the consumption of energy and other utilities to a minimum, resulting in lower operating costs.

Alfa Laval disc stack centrifuge

Interesterification



A schematic diagram of the interesterification process (catalyst deactivated with water)

Expertise from a global a world leader in heat transfer, centrifugal separation and fluid handling

Process know-how

One of the key advantages of working with Alfa Laval to install, update and extend your fats modification systems is our extensive practical experience.

Alfa Laval's proven ability to design and configure a wide range of process variants to meet specific customer requirements can provide you with the benefits of a vast body of accumulated know-how.

Project implementation

Alfa Laval has a specialist group whose sole focus is the design and engineering of fats and oils projects. Our specialists have years of experience and an extensive, proven track record of plants designed, installed and in operation.

The process and engineering team also has constant access to the most recent technologies and solutions implemented by Alfa Laval all over the world. This means you benefit directly from Alfa Laval's renowned know-how in the fields of thermal engineering, separation technologies and fluid handling, and from the latest breakthroughs in other related industrial processes.

Engineering for automation

The automation of key plant operating processes – either wholly or in part – makes it possible to achieve new levels of flexibility when you need rapid, reliable resettings and adjustments to meet new specifications. Alfa Laval can provide you with the exact degree of automation you need to meet your particular requirements.

Alfa Laval provides a wide range of straightforward, easy-to-operate control and monitoring systems, which easily integrate with existing plant control systems.

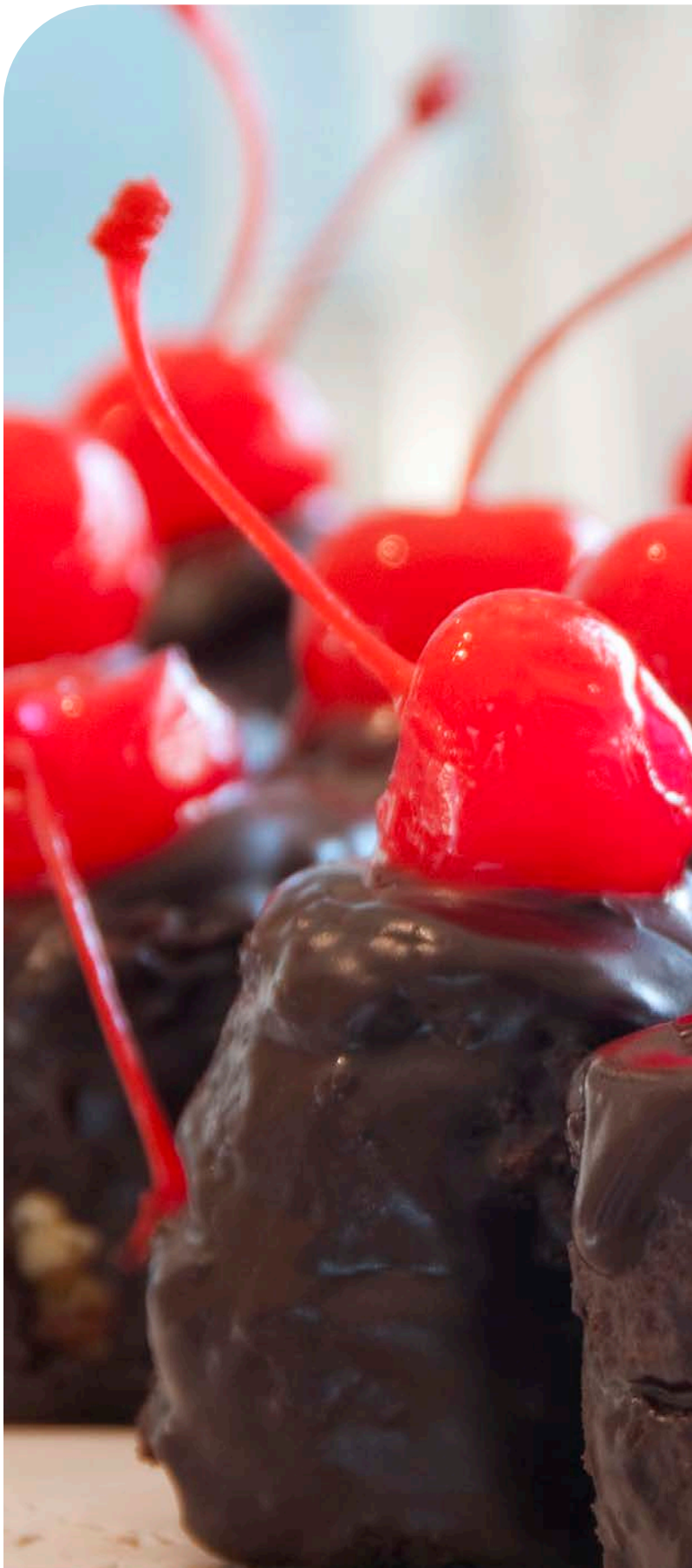
Engineering services

Alfa Laval provides a wide range of supplementary engineering services that help ensure that your new installation comes on line as quickly and efficiently as possible.

We can also provide you with considerable savings by ensuring full compliance with the relevant national and international regulations for design codes, safety procedures and best engineering practices.

Alfa Laval engineering services include:

- installation design in full accordance with international standards
- installation supervision
- commissioning and start-up
- operator training
- documentation
- operational, maintenance and service support.



This is Alfa Laval

Alfa Laval is active in the areas of Energy, Marine, and Food & Water, offering its expertise, products, and service to a wide range of industries in some 100 countries. The company is committed to optimizing processes, creating responsible growth, and driving progress – always going the extra mile to support customers in achieving their business goals and sustainability targets.

Alfa Laval's innovative technologies are dedicated to purifying, refining, and reusing materials, promoting more responsible use of natural resources. They contribute to improved energy efficiency and heat recovery, better water treatment, and reduced emissions. Thereby, Alfa Laval is not only accelerating success for its customers, but also for people and the planet. Making the world better, every day. It's all about *Advancing better*™.

How to contact Alfa Laval

Contact details for all countries are continually updated on our web site. Please visit www.alfalaval.com to access the information.

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