Margarine plant systems

About Alfa Laval

Our edible oil process line portfolio

– Comprehensive solutions

Crush and extract

CPO
Olive oil
Avocado oil

Clarify and water degum

Seed oil clarification
Water degumming (lecithin drying)

Degum/ neutralize/ dewax

Neutralization
Degumming (acid/enzymatic)
Dewaxing
Soapstock splitting

Bleach

Bleaching (absorption) to remove impurities

Deodorize

Deodorization (continuous or semi-continuous) to remove volatile components and thermally stabilize/bleach the oil

Modify

Modify by fractionation, interesterification or hydrogenation to produce liquid oils and fats with specific melting behaviours

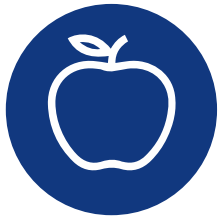
Margarine and shortening

Margarine and shortening lines

Industry trends

Industry trends and focus

– Shaping the future of margarine and shortening



Population increase

Significant rise in vegan and vegetarian population

Footprint in Asia, Africa and Europe

Increase in demand for plant-based food products

Industrial margarine market

More affordable, raw plant-based materials

Increased use of plant-based margarines

Demand for low-fat bakery and confectionery products

Health and wellness

More health-conscious consumers

More low-fat, low-calorie and trans fat-free products

More affordable, raw plant-based materials

Environmental footprint

Focus on image, legislation and utility cost

Water and energy savings

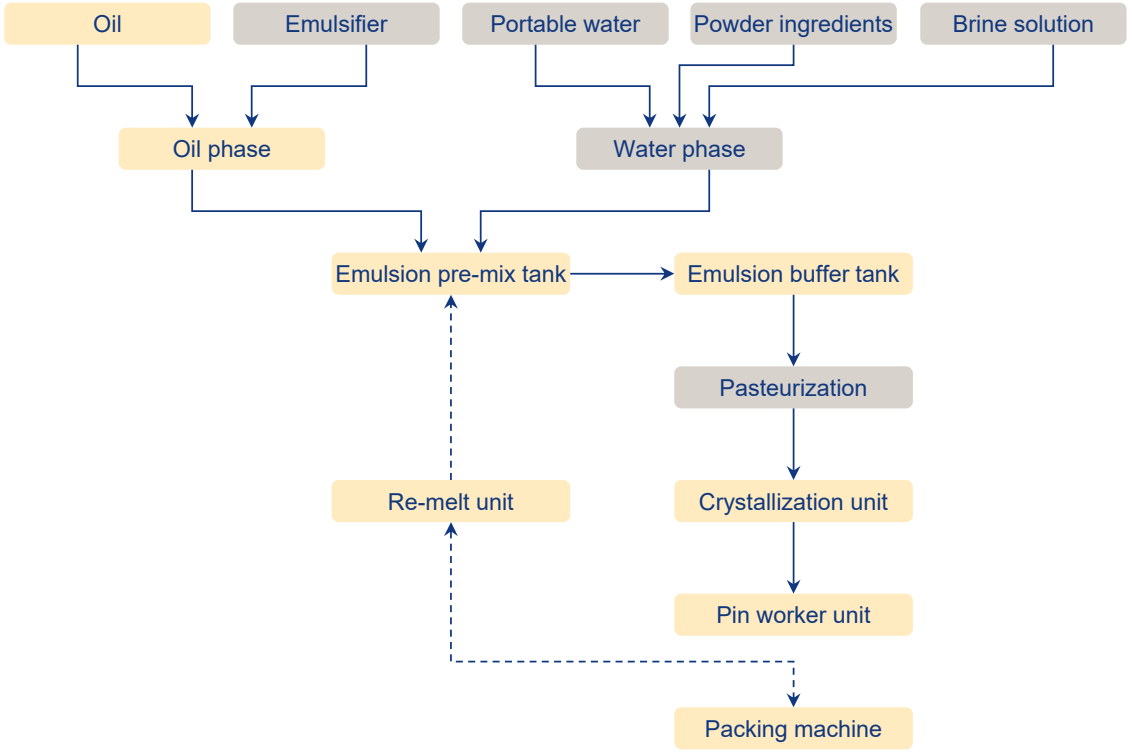
Continued investments in plant infrastructure

Introduction to margarine processing

Margarine plant systems

– What is margarine?

- A plant-based blend or stable water-in-oil emulsion
- Consists of 40-80% vegetable oil with the remainder being water with added salt, flavourings, colours and preservatives
- The blend may contain buttermilk or other dairy ingredients such as milk powder and whey powder
- Manufacturing processes vary according to the product formula and ingredients used



Margarine and edible fats

– Various products and applications

Margarine and edible fats

- Table margarine
- Low-fat margarine
- Industrial margarine
- Puff pastry margarine
- Anhydrous margarine
- Shortening product

Application

- Table consumption – cooking
- Industrial application – cakes and biscuits
- Industrial application – croissants
- Industrial application – puff pastry

Challenges in margarine production

Process challenges

– Margarine plant systems

- Thickeners tend to clump, making it difficult to mix the emulsion
- Long processing times are required for complete hydration of the oil
- Poor hydration leads to an unstable product with poor texture and mouthfeel
- Storage problems upon opening of a poorly hydrated product

A holistic approach

Our margarine process line portfolio

– From oil phase to crystallization

Modification

Modifies by fractionation, interesterification or hydrogenation to produce liquid oils and fats with specific melting behaviour

Margarine and shortening

Covers all production stages – from oil phase to crystallization

Oil phase and emulsifier preparation

Mixes emulsifier (mono- and diglycerides) with oil

Water phase preparation

Mixes water with solid/liquid ingredients

Emulsion preparation

Creates the emulsion by mixing the oil phase and water ingredient

Pasteurization

Heats the emulsion to kill pathogenic bacteria for food safety

Crystallization

Cools the emulsion under high-pressure conditions, turning the liquid into a solid and plasticizing it

A unique partnership

– Alfa Laval teams up with RONO

- RONO Maschinenbau GmbH – a company with long history in margarine and shortening technology
- Placed in Lübeck, Germany since 1958
- 3,200-m^2 production area and 700-m^2 office space
- Based on proven technologies, launched an improved scraped-surface heat exchanger in 2015
- Since 2018 in partnership with Alfa Laval
- A single point of contact for all your margarine processing needs

HP pump

Alfa Laval margarine plant systems

– In partnership with RONO

Oil phase and emulsifier preparation	Water preparation	Emulsion preparation	Pasteurization	Crystallization
Equipment  Hygienic fittings 	Agitators and mixers  Hygienic pumps 	Heat exchangers  Hygienic valves with control tops 	Pasteurizers  Hygienic pumps  Hygienic valves 	Scraped surface heat exchanger  Pin workers   Contherm for pre-cooling before crystallization 

Oil phase and emulsifier preparation

– Mixing emulsifier (mono- and diglycerides) with oil

Oil phase and emulsifier preparation

Mixes emulsifier (mono- and diglycerides) with oil

Centrifugal pumps

Transfers the oil phase and emulsifier from the storage tank to the weighing system and onward to the plate heat exchanger

Plate heat exchanger

Heats oil to 70°C

Emulsifier blending

Mixes emulsifiers, colouring and flavouring with oil

Emulsion preparation

Mixes the water phase and the oil phase

Water phase

– Mixing water with solid/liquid ingredients

Water phase

Mixes water with solid/liquid ingredients, water soluble

Centrifugal pump

Transfers water-ingredient solution

Plate heat exchanger

Heats the water before entry into the tank

Hybrid powder mixer

Blends powdered ingredients with hot water

Water and ingredients blending

Mixes emulsifiers, colouring and flavouring with water

Centrifugal pump

Transfers water phase to feed emulsion tank with liquid margarine

Emulsion preparation

– Creating the emulsion by mixing the oil phase and water ingredient

Emulsion preparation

Creates the emulsion by mixing the oil phase and emulsifier

Centrifugal pump

Transfers oil, emulsifier and water to the emulsion tank

Mixing with agitator in emulsion tank

Blends oil, emulsifier and water into an emulsion

Emulsion buffer tank

Mixes water with solid/liquid ingredients

Centrifugal pump

Transfers emulsion from the emulsion buffer tank to the pasteurization area

Pasteurization

– Heat processing the emulsion to eliminate bacteria and ensure food safety

Centrifugal pump

Transfers emulsion from emulsion feed tank to the pasteurizer unit

Skid-mounted pasteurizer

Heats emulsion to 85°C and cools it down to 50°C. Reduces the microbiological activity inside the product.

High pressure plunger pump

Transfers the emulsion in the high-pressure section to the crystallization area

Crystallization of margarine

– Cooling, solidifying and plasticizing the emulsion under scraping conditions

High pressure plunger pump

Transfers the emulsion in the high-pressure section, to the crystallizer

Scraped surface heat exchanger

Cools and crystallizes the emulsion under scraping under high-pressure conditions

Pin worker

Ensures the proper product plasticity, consistency and structure

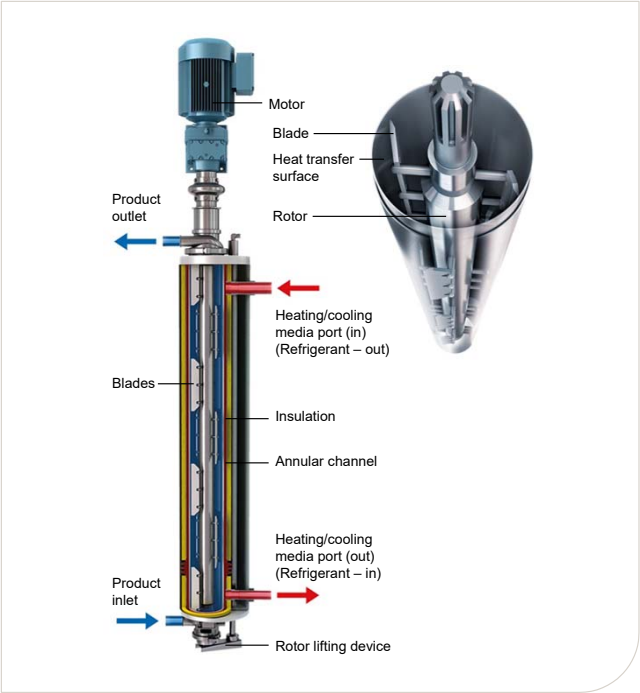
Continuous rework unit

Melts the excess margarine and un-packaged product

Contherm

– Application for margarine and shortening

- Enhances the performance of vegetable oils and fats pre-cooling
- Ensures the uniform thermal treatment of the product
- Prevents fat crystals from accumulating on surfaces
- Provides more uptime and less Cleaning-in-Place (CIP) downtime
- Increases the production capacity of downstream equipment



Margarine pre-cooling before crystallization section

– Contherm application between pasteurization and crystallization unit

Centrifugal pump

Transfers the oil, emulsifier and water to the pasteurizer

Pasteurization

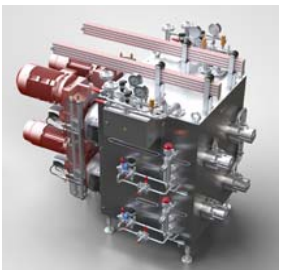
Reduces the microbiological activity inside the product

Contherm

Cools the emulsion during scraping

High pressure plunger pump

Transfers the emulsion in the high-pressure section to the crystallizer



Crystallizer

Cools and crystallizes the emulsion under high-pressure conditions

Cost-effective crystallizer

– Advantages of the Contherm for soft margarine and shortening

- Efficient treatment of soft vegetable oils and fats
- Uniform thermal treatment of the product
- Low investment cost and high performance
- Easy to operate and maintain
- Low operating cost

Shortening process

– Crystallization of shortening: cooling, solidifying and plasticizing under high-pressure conditions

Nitrogen dosing system

Introduces nitrogen into the product to prevent post-blooming in the packaged product

High-pressure plunger pump

Transfers shortening to crystallizer

Crystallizer

Cools and crystallizes the emulsion under high-pressure conditions

Pin worker

Ensures the proper product plasticity, consistency and structure

Homogenizing equipment

Ensures fine dispersion of the added nitrogen

Plasticator

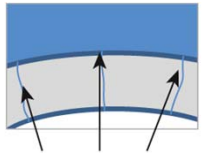
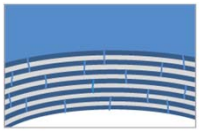
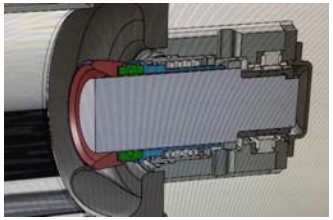
Kneads the product to ensure uniform product consistency. Can also be used for margarine processing

Margarine and shortening: Crystallizer with drop tank

– Recommended for use in countries with frequent power outages

- Highly flexible, modular crystallizer
- Recovers ammonia in case of electrical breakdown
- Prevents clogging inside the machine

Innovation in the crystallization process

Mutator shaft heating system	Six layers of chromium to protect the cooling cylinder	Ammonia control unit	Top-mounted maintenance crane
	**Old design** 1–2 chromium layers 		
For each water circuit through the mutator shaft, a flow meter controls the water flow rate through the shaft. If the flow rate falls below the design set point, a frequency converter increases the pump speed.	Water/CIP detergents start with corrosion via microcracks **New design** Six layers of chromium for enhanced cooling cylinder 	Radar ammonia control level  Outer bearing on the mutator shaft	Easy maintenance during replacement of the mutator shaft and chilling tube

Alfa Laval margarine and shortening

– Summary of benefits

- Efficient production of margarine, shortening, CBE and CBS
- Uniform thermal treatment of the product
- High performance
- Easy to operate and maintain
- Low operating costs
- Excellent product quality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