

EXTRACTION AND REFINING

FOR HIGH-QUALITY NATURAL OILS



Air Liquide Group

The world leader in gases, technologies and services for Industry and Health

Air Liquide is present in 80 countries with approximately 65,000 employees and serves more than 3 million customers and patients. Oxygen, nitrogen and hydrogen are essential small molecules for life, matter and energy. They embody Air Liquide's scientific territory and have been at the core of the company's activities since its creation in 1902.

Air Liquide's ambition is to lead its industry, deliver long term performance and contribute to sustainability.

Air Liquide Engineering & Construction

A technology partner of choice

Air Liquide Engineering & Construction builds the Group's production units (mainly air gas separation and hydrogen production units) and provides external customers with efficient, sustainable, customized technology and process solutions.

Our core expertise in industrial gas, energy conversion and gas purification, enables customers to optimize natural resources.

We cover the entire project life-cycle:

license engineering services / proprietary equipment, high-end engineering & design capabilities, project management & execution services. In addition we also offer efficient customer services through our worldwide set-up.

As a technology partner, customers benefit from our research and development to achieve energy transition goals.

Our full suite of technologies

- Liquefied Natural Gas
- Cryogenics
- Hydrogen
- Syngas
- Petrochemicals
- Natural Gas Treatment
- Sulfur
- Standard Plants
- **Oleochemicals**

15

Engineering centers and front end offices

3

Manufacturing centers

60

Proprietary technologies

1,600

Patents

Innovative design and expert execution

We deliver entire plants or single components

Air Liquide Engineering & Construction, through its proprietary Lurgi technologies, offers the solutions for extraction and refining tailored to your needs in terms of capacity, feedstock variety and mix. Our plants are easy to operate and integrate seamlessly with your existing equipment. They provide greater flexibility, as well as accommodating a wide range of feedstocks to produce a variety of high quality edible oils that are low in trans fatty acids.

We can combine extraction and refining technologies to create an end-to-end system.

All equipment that we provide is designed and manufactured to the highest standards, rendering it reliable and extremely cost-effective. Operating costs are reduced through lower equipment maintenance and optimal utilities consumption. In addition to improving your environmental footprint, the efficiency of our technologies allows you to maximize your output.

Our commitment is to helping you produce the purest edible oils at the lowest cost

Our project teams will help guide you in selecting the plant or processes that will enhance your business. Our expertise will ensure delivery, installation and operation within the shortest available time.

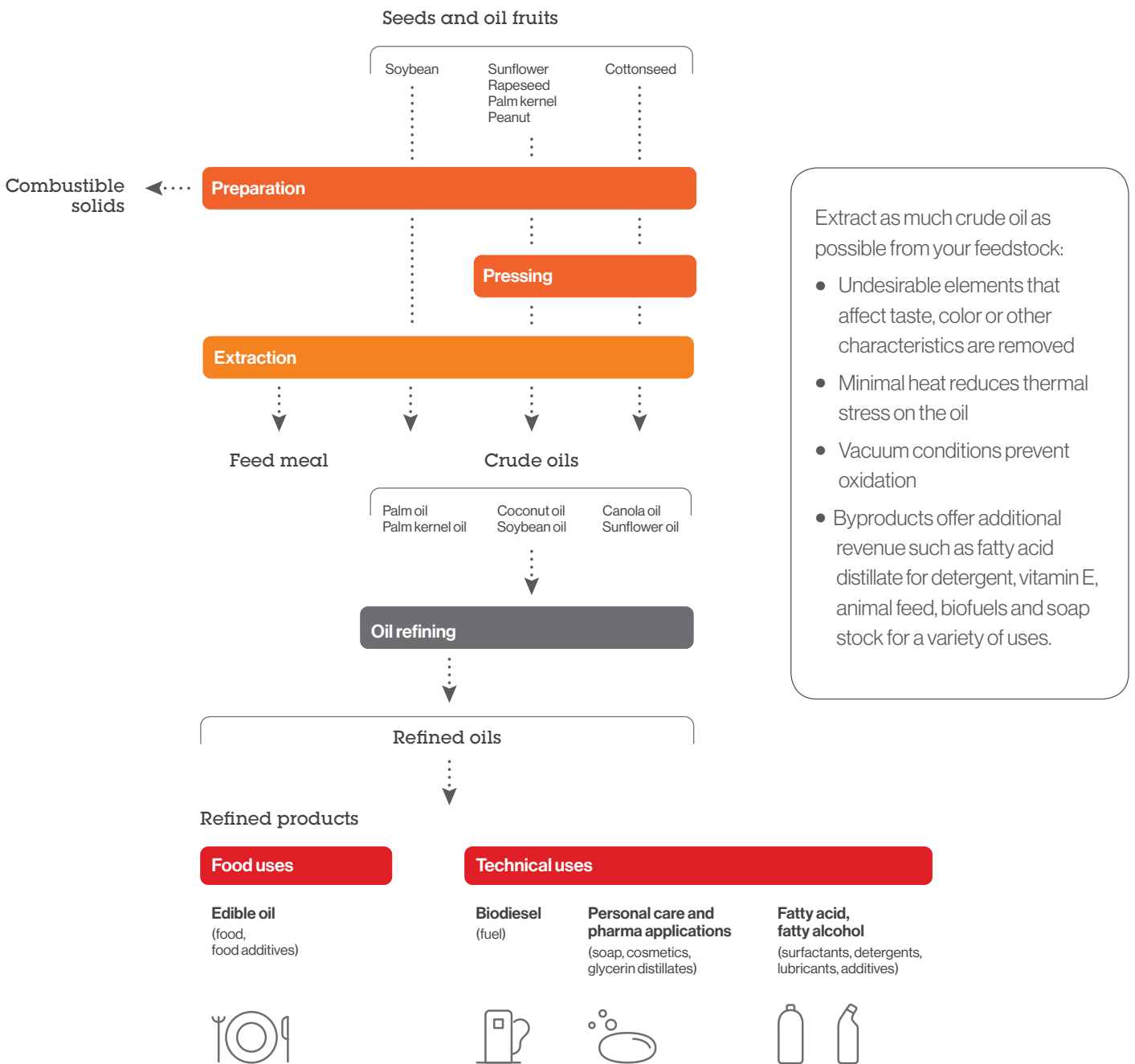
In 2007, Air Liquide acquired Lurgi Group and with it decades of development in oil and fats processing technologies. This is reflected in our extensive portfolio of proprietary technologies known for their efficiency and reliability.

Extraction & Refining Technologies

Natural oils

Flexible, adaptable, affordable technologies

Our cutting-edge technology lines for seed crushing, pressing and oil extraction, oil refining and downstream processing support diverse renewable natural oil-bearing feedstocks. These produce quality edible oils as well as those for personal care and pharmaceutical products, biodiesel and a variety of oleochemicals.



Extract as much crude oil as possible from your feedstock:

- Undesirable elements that affect taste, color or other characteristics are removed
- Minimal heat reduces thermal stress on the oil
- Vacuum conditions prevent oxidation
- Byproducts offer additional revenue such as fatty acid distillate for detergent, vitamin E, animal feed, biofuels and soap stock for a variety of uses.



State of the art

Depending on the feedstock and the desired final product, Lurgi extraction technology features adaptable parameters such as bed height, percolation rate and soaking time, for a maximized throughput. A single extractor can handle a variety of feedstocks.

Complete integration

We deliver individual process steps that integrate seamlessly into your existing equipment or complete plants.

Our extractors can be combined with a pre-pressing plant or an expander. They can be integrated into oil refining processes, as well.

You can go from raw product to refined end product through a single strand.

This technology was patented in 1949. We have built over 300 extraction plants worldwide in small, medium and large scale.

Extraction

Lurgi Multi-seed Sliding Cell Extractor

Superior equipment for superior results

The sliding Cell Extractor is at the heart of the extraction plant. It produces crude edible oils that can be used in food applications after refining. Based on seed crushing and solvent extraction, the process can be applied to a wide range of feedstocks, without modifying the internals of the extractor.

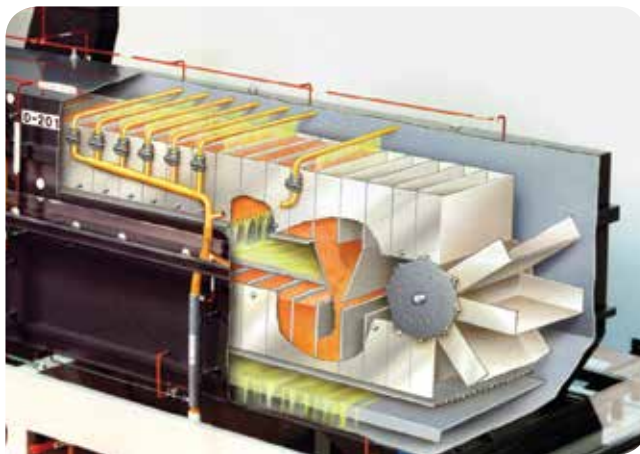
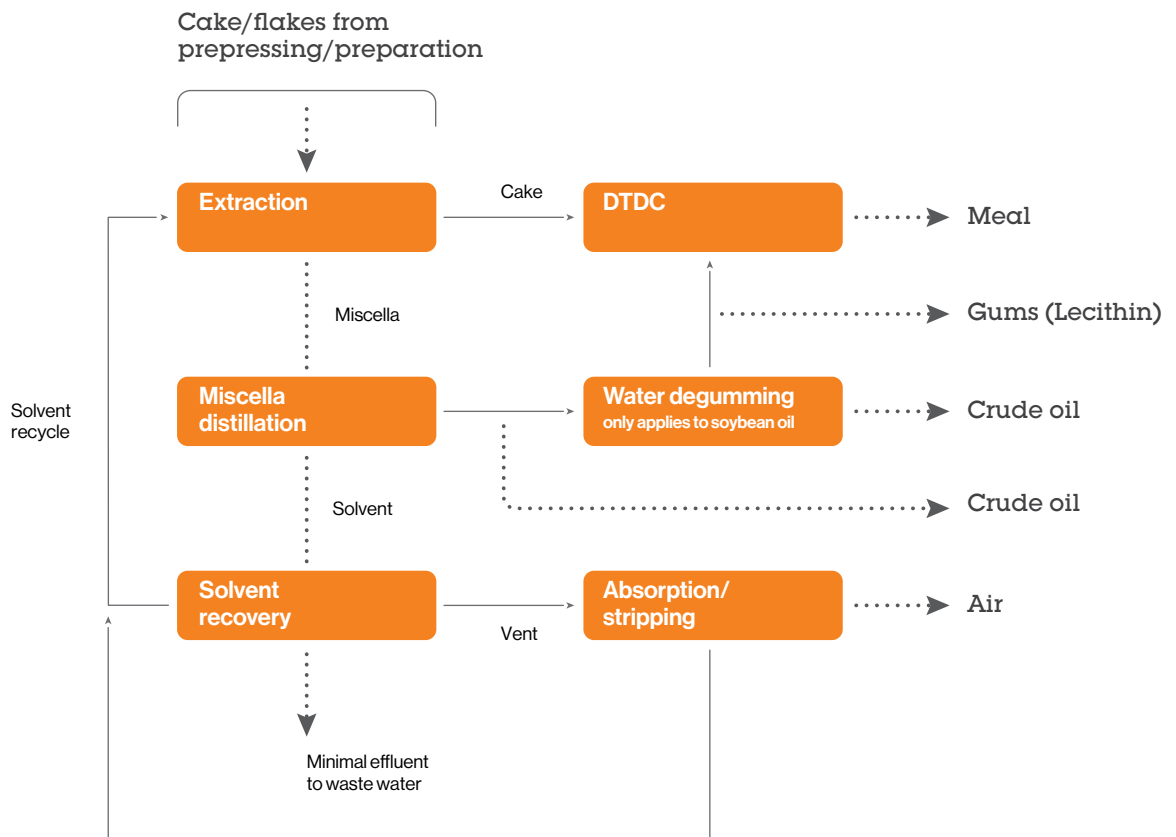
The Lurgi extractor has superior processing efficiency in oil extraction from all forms of flakes, expanded shape, cakes, leaving least possible oil residue. The drive sprocket and chain are designed with C45 material and operate at low speed with hydraulic pack. The equipment is thus almost maintenance-free.

The meal contained in enclosed buckets above the fixed screen plates provides full miscella soaking and percolation for a maximum extraction effect.

Our innovative proprietary solution offers these benefits

- Oil seeds move along a continuous series of cells on roller rails across upper and lower stationary screen plates.
- Low height of the shallow extractor bed ensures large contact area between solvent and flakes and optimum percolation.
- Complete counter-current operation of solvent or miscella and flakes.
- Double-bed improves extraction efficiency by re-distribution of meal during change of direction.
- Drainage zone design provides low solvent carry-over into extracted meal.
- Screen plate clogging eliminated with V-profile design.
- A desolventizer toaster unit can be integrated to remove excess solvent.

The unit is compact and easily transported and assembled.



Lurgi multi-seed Sliding Cell Extractor

Desolventizer Toaster Drier Cooler (DTDC) with Pre-Desolventising

The DTDC is Lurgi designed for superb energy transfer and high vapor velocity for efficient toasting.

This stripping effect removes meal hexane content to 200ppm or even less.

The DTDC is robust in design. The internal agitators go through heat treatment and maintain efficiency over time. This enhances meal swiping for optimized surface contact. All moving components are designed to maximize operating life.

A PRE-D stage, able to reduce solvent content in wet meal from 30 – 35% to 28% with indirect steam and flashing.

Steam saving up to 20% when compared with conventional DT – System.

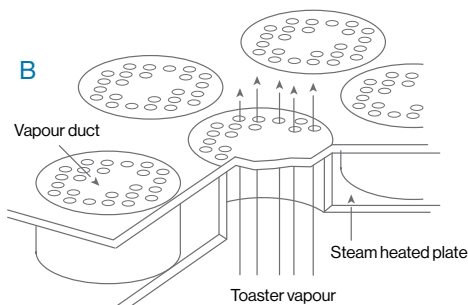
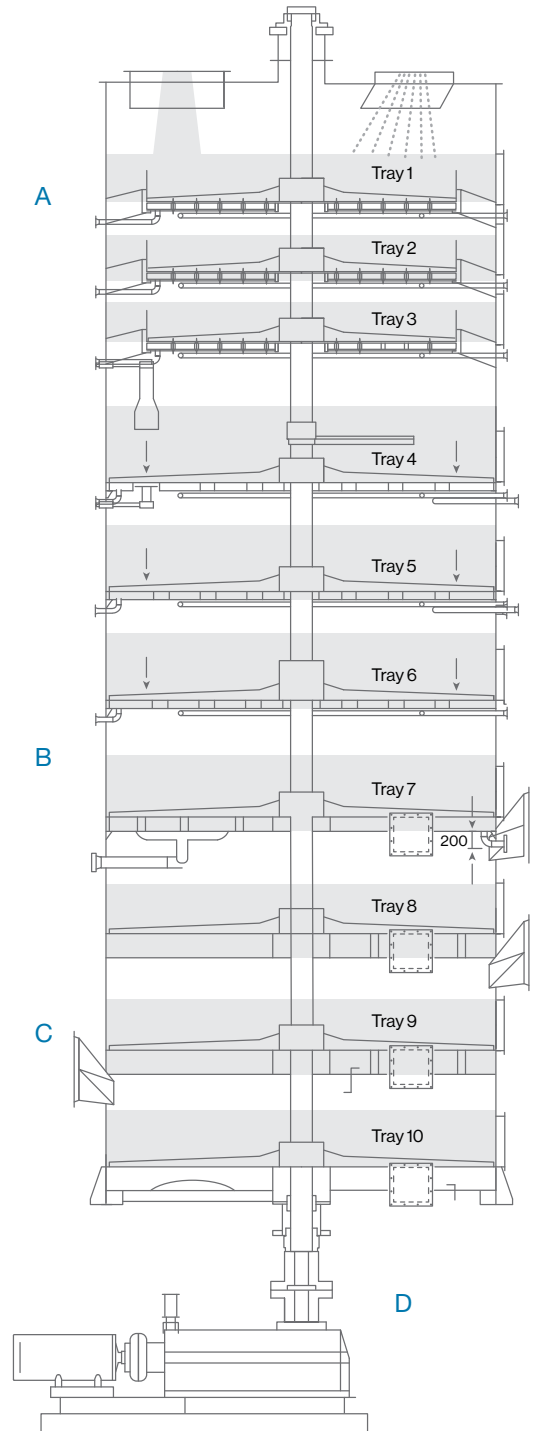
Reduce live steam load in Toasting Stage and optimize DT design.

B Effective steam stripping of hexane traces in meal with high velocity toaster vapor.

C Dryer/Cooler stage, high velocity air stream prevents meal short circuit and removes excess meal moistures and temperatures.

D Auxiliary drive motor with 4-stage reduction gearbox for longer life span and reduced electrical consumption.

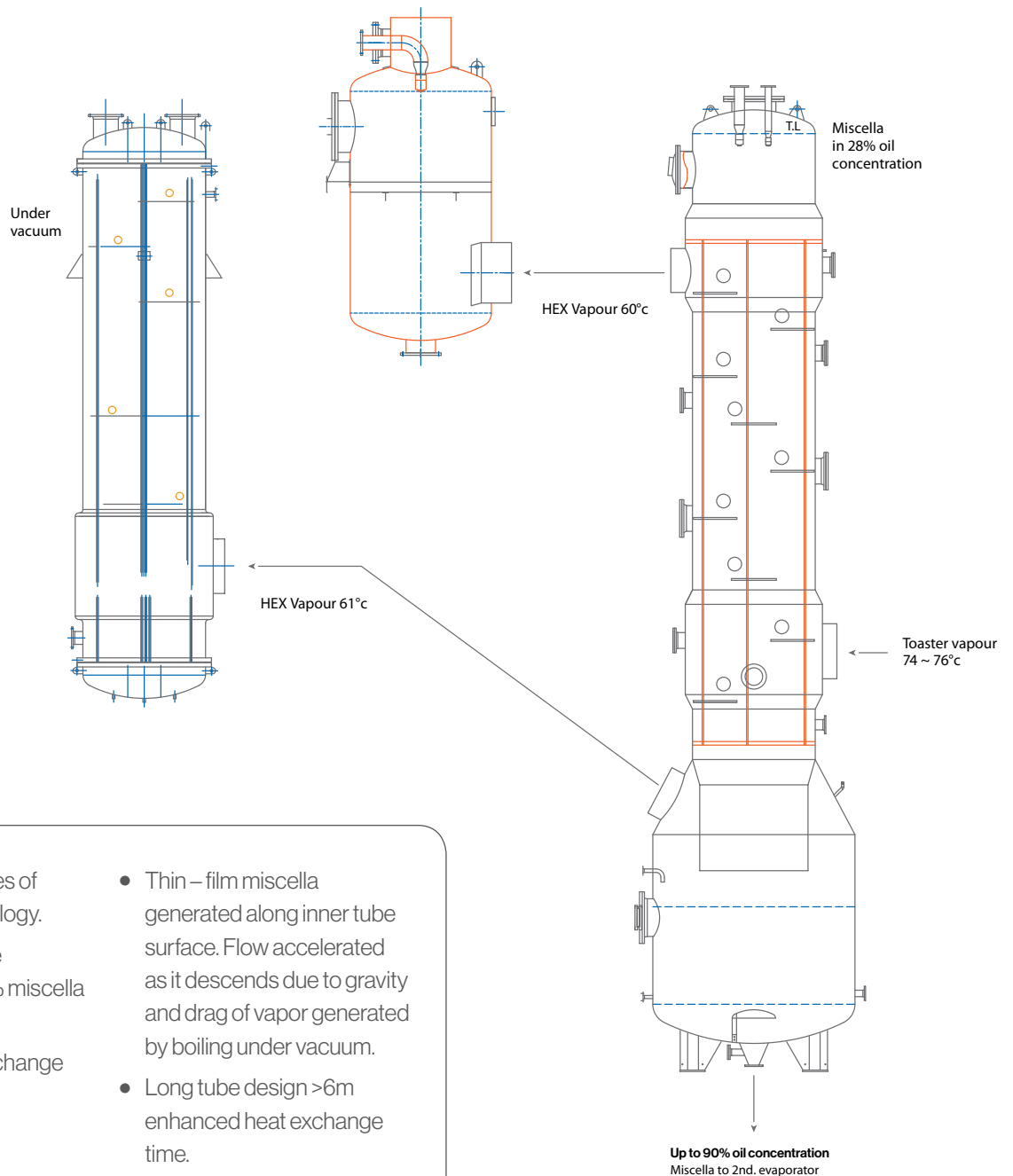
Extremely low maintenance cost.



Falling Film Evaporator

Lurgi know-how in designing Falling Film evaporator achieves up to 90% oil concentration.

This highly efficient evaporator reduces steam consumption in second stage evaporation and generates less water waste.



- Outstanding features of evaporation technology.
- Most efficient – able to achieve 86 - 90% miscella concentration.
- Maximized heat exchange and heat recovery.
- Thin – film miscella generated along inner tube surface. Flow accelerated as it descends due to gravity and drag of vapor generated by boiling under vacuum.
- Long tube design >6m enhanced heat exchange time.



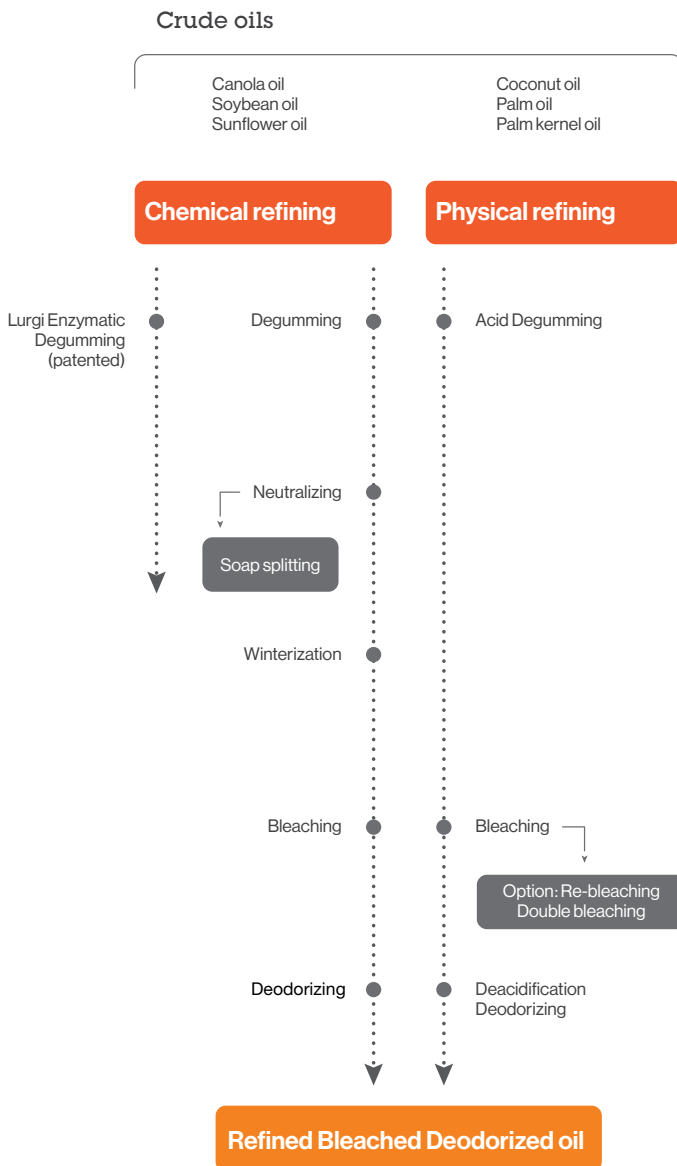
Refining

For stabilized oils at the highest purity

After extraction, the oil may contain undesired components that could have an effect on the taste, color or smell of the final product. The refining process is designed to effectively eliminate these components and create oil that is suitable for a variety of downstream applications.

Lurgi refining technologies consistently produce stabilized oils at highest purity. They are designed for a broad range of feedstocks and provide both chemical or physical refining capability. Single process steps can be configured to optimize your production of quality oils.

Our offering includes two routes for oil refinement: chemical refining for oils and fats with low ffa content, and physical refining for oils and fats with high ffa content.



Our refining technologies provide

- Continuous bleaching under vacuum to prevent oxidation using mild food-grade acid and natural soils inhibits oil degradation.
- Continuous winterization allows wax crystals to form and be easily separated, lowering the wax content of the oil. This offers easier filtration, lower viscosity and minimal oil loss prior to filtration.
- Continuous deodorizing under ideal vacuum conditions removes free fatty acids and undesirable odors and flavors.
- Options of an integrated vacuum system with chill water surface condensing or even ice condensing are energy saving and minimize waste.
- The deodorizing section processes single batches of oil in semi-continuous mode for ease of charging different kinds of feed oils without interrupting production.
- Continuous deacidification through carrier steam distillation removes unwanted free fatty acids. Ideal vacuum conditions ensure no oxidation for superior quality oils.
- Batch hydrogenation when you require different melting points through full or partial hydrogenation. This is an extremely efficient and cost effective technology that removes nickel catalyst. The filtration process sequence is fully automated.



Customer commitment

Evolving with you

Continually stepping up our game

Air Liquide Engineering & Construction, through its Lurgi extraction and refining technologies, provides customers with a range of plant options designed to maximize your efficiency, improve the quality of your product and help minimize your operating costs.

All of the components of our plants are manufactured to the highest standards and are backed by the reliability of a firm with over a century of experience behind it.

You help to make us better

Since acquiring Lurgi technologies in 2007, Air Liquide Engineering & Construction continues to build on the knowledge we gain from our customers.

The great strides we made in over a quarter century of extraction and refining technology, notably with our sliding cell extractor, arose from our customers' needs for flexibility, ease of operation and greater efficiency.

Execution capabilities

Thanks to our network of engineering and manufacturing centers, Air Liquide Engineering & Construction is able to offer effective project management and execution close to customers and vendors.

One of our key engineering centers specializing in Extraction and Refining is headquartered in Kuala Lumpur, Malaysia. JJ-Lurgi Engineering is a joint venture between Air Liquide Engineering & Construction and Jepsen & Jessen South East Asia. JJ-Lurgi together with its counterpart in Shanghai, China boasts over 25 years in designing, engineering and constructing process plants for customers worldwide and serving a rapidly growing in Asia/Pacific market.

We have delivered more than 300 extraction and refining facilities, ranging from 100 TPD to 5 000 TPD. Customers can rely on our multidisciplinary project teams, all of whom have direct knowledge of the markets they serve. We deliver the latest competitive extraction and refining technologies, that are reliable, safe and extremely efficient.

Our approach



End-to-end expertise

Ease of implementation and operation

The breadth of our experience with our clients means that our Lurgi technologies have evolved to cover every aspect of natural oil refining. Our units are designed to optimize your production system while minimizing your costs and offers zero waste steam generation with features like heat recovery and automated filtration.



Air Liquide Engineering & Construction extraction and refining technologies are the frontier of the industry.





● Engineering Centers and front-end offices ● Manufacturing centers



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