

# FATS & OILS TECHNOLOGY

**Fact sheet : N°2**

ITERG

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## CRUSHING OF OILSEEDS

**Crushing of oilseeds**

Industrial crushing of oilseeds is based on two major techniques, which are pressure and solvent extraction. The corresponding technologies used are traditional and have changed little: the so-called "rich" oil seeds (> 35%) are crushed by pressing and then extracted; the seeds classified as "low" in oil (< 35%, as in the case of soya beans for example) generally undergo direct extraction with hexane after preparation.

## OBTAINING VIRGIN OILS

Alongside this industrial sector, which accounts for more than 95% of French vegetable oil production, there is an artisanal production sector for the production and packaging of various virgin pressure oils. The players in this sector are generally small SMEs that have a low-capacity industrial pressure tool; virgin oils are produced by summary preparation of the seed without extensive heating, simple pressure and filtration or centrifugation; virgin sunflower, safflower, sesame oils, etc. are thus produced.without the use of processing aids, in accordance with the regulatory definition of virgin pressing or "cold pressing" oils.

As far as virgin olive oil is concerned, the pressing production process is adapted to the specificity of the raw material (oleaginous fruit, presence of water). The oils so named must have been obtained solely by mechanical processes, clarified only by physical (filtration) or mechanical (centrifugation) means and must not have undergone any chemical treatment or refining operation.



## REFINING CRUDE OILS

The purpose of refining crude oils is to separate various "impurities" or "undesirable" compounds from the noble material in order to obtain an oil of the quality required for good use and conservation and to allow its subsequent processing in the food industry.

# REFINING CRUDE OILS

The aim is to provide, on the one hand, to the consumer a refined oil that meets his expectations (clear, sparsely coloured, flat in taste and stable) and, on the other hand, to guarantee the industrial user an oil whose specifications comply with precise and complete specifications. Refining is defined by national regulations: its purpose is to maintain or improve the organoleptic characteristics and stability of edible fats and constitutes a lawful treatment of edible fats and oils, with the exception of oils sold under the name "virgin oil of ... ». To achieve this objective, various physicochemical operations are necessary, which are themselves defined by the regulations which specify the substances authorized (processing aids) for their use and, for some of them, a maximum limit of residue in refined fats. Refining typically consists of degumming or acid conditioning, chemical neutralization, decolorization, deodorization and, in some cases, refrigeration or "winterization".

Acid degumming or conditioning This operation Allows Elimination phospholipids, instability factors that tend to cloud the oil and induce discolouration when it is heated. For some oils, a first degumming (or degumming) can be carried out beforehand with water. Crude oil heated to 80°C receives an addition of about 3% water before passing through a rapid mixer followed by a slow contactor before centrifugation: this technique is used in particular for soybean oil.

The gums are recovered by centrifugation and can thus be recovered after drying; This produces the crude "lecithin". For crude oils less rich in phospholipids (rapeseed, sunflower, peanut), we do not seek to recover them specifically by centrifugation; in this case we are talking about a stage of conditioning the mucilage which is generally done by heating the oil to 60 - 80°C, adding 0.1 to 0.3% phosphoric acid at 75%, passing through a fast mixer and then through a slow contactor; The mixture is then sent to the neutralization stage. Phosphoric acid is by far the most industrially used acid at this stage.





**Alkaline Neutralization**

This step essentially removes free fatty acids by processing into soaps and separating, as well as various residual compounds (phospholipids, protein compounds, etc.). The traditional process consists of the following phases: addition of a soda solution, mixing, separation by centrifugation, water washes, separation and then vacuum drying.

The process generates neutralization pastes (which can be used in soap making, lipochemistry, etc.) and washing water that must be pre-treated before discharge. The quantity of soda to be used is calculated from the acidity of the oil, most often expressed in oleic or palmitic acidity; Thus, for example, for a ton of oleic acidity oil of 1% (average quality), about 10 kg of lye at 20° baumé is needed (i.e. a solution of soda of 166.7g / litre).

# REFINING CRUDE OILS

**Bleaching**

The main purpose of this operation is to remove the colored pigments contained in the oil. Decolouration involves an adsorption agent (bleaching earths1, silica2, with or without activated carbon3), bringing into play phenomena of a physical nature, even if certain chemical modifications may be associated with it. This agent not only plays a discolouring role by fixing the coloured pigments, but also has a "cleaning" effect by adsorption of various undesirable compounds present in the oil. The adsorption agent or mixture of agents is introduced (0.2 to 2%) into the decolorizer.

The oil heated to 90° / 110°C is stirred vigorously in a vacuum; the earth/oil contact time is around 30 minutes; After treatment, the oil is cooled and

Filtered. A filter aid (diatomaceous, celite or attapulgite) is advantageously used to build the filter cake and thus improve the filterability of the oil.



**Deodorizing**

This step is usually the final step in refining. It does not involve any processing aids and proceeds by simply injecting water vapour into the oil heated to a high temperature (180 / 240°C) and under a very high vacuum; By steam entrainment, the volatile compounds responsible for the oil's flavours (aldehydes, ketones, etc.) are eliminated as well as any pesticide and mycotoxin residues that may be present; At the end of this stage, the oil has a neutral taste; It is then packaged under nitrogen to protect it against oxidation.



**Winterization**

This operation concerns certain oils rich in waxes (between 400 and 1400 mg/kg) such as sunflower or grape seed . Waxes are esters of fatty alcohols and long-chain fatty acids that crystallize at room temperature and as such have disadvantages when using oils (cloudiness, deposits).

Winterization or dewaxing consists of causing the crystallization of these waxes by cooling the oil to around 5 - 10 °C and maturing the crystals. The next separation step is usually carried out by filtration in the presence of a filtration aid (about 0.2 to 1%), identical to that used in the decolorization step.

Dewaxing most often takes place between bleaching and deodorization. A pre-decising step can possibly be implemented at the neutralization level: the oil is then cooled to around 30°C, matured at this temperature and the fraction of the

The crystallized waxes are then separated at the centrifugation level, together with the neutralization pastes.