Technological Process of Obtaining Sunflower Oil

Note: Need to provide schematic diagram of manufacturing steps of sunflower oil
Also give practical yield of oil as per variety of sunflower seed

ABSTRACT

This chapter includes the main properties of olive oil, types of sunflower from which the oil is extracted, as well as the technological scheme for obtaining refined sunflower oil. The nutritional function of sunflower oil is enhanced by the presence of provitamins A, D, E, phosphatides as well as vitamins B4, B8, K, they also contain sterol, tocopherols. Energy capacity: 8.8 cal/g oil. It is excellent for food because it has fluidity, color, taste and pleasant smell.

Keywords: sunflower oil, technology, processing, properties

1. INTRODUCTION

The manufacture of vegetable oils is an important sub-branch of the food industry. This industry contributes to the exploitation of the agricultural potential of our country. The products obtained are intended for human consumption. The processing of vegetable oils has an old tradition in Romania. At the beginning of the 20th century, the production and processing of sunflower seeds began. Oil factories of medium capacity appear and develop in the first half of the 20th century.

1.1. Oily raw materials

The number of oily raw materials is very large and varied. Out of more than 100 oily plants, about 40 belonging to 11 botanical families are currently used on the world market. According to their origin, oily raw materials are grouped into:
- Seeds of cultivated oil plants including: sunflower, soybean, flax, castor, rapeseed, peanut, sesame, mustard, poppy, safflower, perilla.
- Seeds of textile-oil plants (mixed), a group in which we include cotton, hemp, flax.
- Seeds of non-oily, uncultivated plants or the so-called oily weeds in which they fall: wild rapeseed, primrose.
- Oily fruits of cultivated trees: olive, coconut, palm, walnut, cocoa, almond and others.
- Oily fruits of uncultivated trees: fir, fir, spruce, pine, chestnut.
- Oily by-products and waste: tobacco seeds, tomatoes, peppers, grapes, pumpkin, corn and wheat germs, rice bran, cherry pits, cherries, plums, oily waste from the volatile industry.

1.1.1. About the sunflower

The sunflower is an oily plant of great economic and food importance. It originates from Central America (Mexico) and was brought to Europe in the 16th century, being cultivated at first only as an ornamental plant. The plant represents one of the main sources of vegetable fats, used in human nutrition, respectively the most important source of oil for Romania. The main position (95% of the total production of these sectors) is occupied by sunflower oil.

1.1.2. Morphological structure of the sunflower seed

The actual seeds are made up of a more or less hard protective covering called the integument or shell (pericarp) (which protects them from mechanical and biochemical actions), the endosperm (core or albumen) and the embryo of the future plant.

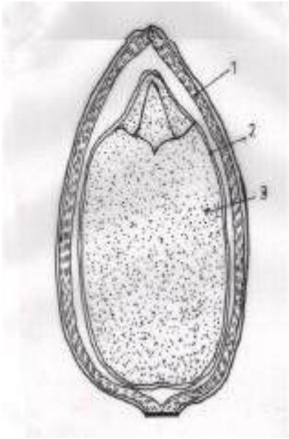

Fig. 1. The morphological structure of the sunflower seed 1-shell; 2- integument; 3- core.

The integument, as a protective part of the seed, consists of several layers of lignified cells. It can be of different colors, thick or thin, smooth or wrinkled, reticulated, ribbed, etc. In some seeds, the integument shows different formations based on which the respective species can be easily identified.

The endosperm or albumen constitutes the seed's reserve of nutrients and forms its core. The seeds that contain endosperm are called albuminous and belong to plants in the families: Euphorbiaceae, Gramineae, Papaveraceae, Solanaceae.

The seeds without endosperm are called exalbuminate and belong to the plants of the families Curcubitaceae, Fagaceae and Leguminosae.

In these, the endosperm is assimilated by the embryo at the time of seed formation. There are also intermediate or partially albuminized seeds that have a smaller amount of endosperm in the vicinity of the integument, belonging to plants from the Cruciferae, Linaceae, Rosaceae families.

In some seeds, such as sunflower, the endosperm exists for a very short time after the formation of the seed and then resorbs. These are called albumen-femeraid seeds.

The embryo contains the vegetative organs of the future plant: the root, the stalk, the cotyledons and the bud, which remain dormant until the seed germinates. In albuminized seeds, the embryo is generally small in relation to the size of the seed, while in exalbuminized seeds the embryo is large.

Table 1. The chemical composition of the sunflower

The raw material	Water %	Oil %	Protein substances %	Non-nitrogenous extractive substances %	Cellulose %	Ash %
Sunflower	9-11	36-39	17.5-20	9-15	20-25	2.5-3
Core of sunflower	7-9	55-60	26-29	5-14	2-4	3-4
Flower pods sun	13-15	0.5-1	1.5-4.5	26-34	53-64	1.8-2.1

Table 2. The main organoleptic properties of sunflower oil

Appearance	Color	Taste and smell
At ambient temperature it is clear, without suspensions and without sediment	yellow, yellow to reddish yellow in the unrefined	pleasant, specific, tasteless or foreign smell (rancid, bitter, etc.)

Table 3. The main physical and chemical properties of sunflower oil

	Refined oil	Unrefined oil
Free acidity in acid oleic % max	0.1-0.4	2.0
Water and volatile substances max %	0.08-0.15	0.3

Unsaponifiable substances max %	1.0	1
Soap % max	0.03-0.07	lack
Iodine index	119-135	119-135
Saponification index	186-198	186-194

2. Stages of the technological process for obtaining sunflower oil

2.1. Reception of raw materials

It represents the first stage of the technological process of obtaining oil. It is done both quantitatively and qualitatively.

2.2. Storage of raw materials

Storage is done for a period of at least 60 days. Seed warehouses must be provided with:
- a garage line for unloading seeds from wagons and trucks
- mechanical installations for unloading and handling seeds, as well as with the necessary installations for drying, airing and purifying them, in order to protect the seeds from degradation during storage.

The warehouses used in oil factories can be divided according to their construction into three groups, namely:
- mechanized barns
- warehouses with floors
- cell silos.

Fig. 2. Metal silos with conical bottoms for sunflower storage

2.3. Cleaning sunflower seeds

During storage, raw materials can undergo degradation processes caused by enzymes existing in them, by different living organisms or by a series of chemical transformation processes. These degradation processes, which lead to quantitative and qualitative losses, are more accentuated if the seed mass contains impurities or is wet. Impurities existing in the seed mass can be mineral (soil, dust, stones, nails, screws) and organic (straw, chaff or weed seeds or other cultivated plants, dry, carbonized seeds or fragments).

Like any living organism, seeds breathe during storage. The intensity of respiration depends on the temperature and humidity of the seed mass. The increase in temperature favorably influences breathing, up to 40 °C, after which it decreases, until the absence of breathing. The humidity at which breathing intensifies is called critical humidity, which has values of 6-7% for sunflowers. If the humidity increases above these values, the intensity of respiration increases and the germination phase can be reached, when the seeds are dried out by consuming the oil and proteins and become unusable. As a result of the more intense breathing, which dries out the seeds, there is also the production of heat, which can reach very high values, in areas with impurities or moisture in the seed mass, reaching the heating of the seeds, an undesirable phenomenon, which leads to the separation of the oils from the seeds, to their degradation.

To avoid these unwanted effects:

- the initial cleaning or cleaning, before storage, which removes about 50% of the initial impurities;
- post-cleaning, after which the content of impurities is reduced to 0.3-0.4%

Most seed cleaners separate the impurities based on the size differences between them and the seeds (sieving), based on the differences in aerodynamic properties (pneumatic separation), and based on the magnetic properties of the ferrous impurities (magnetic separation).

In the country's oil companies, the Sagenta-type vibro-vacuum and the Buhler-type pre-cleaner are used for seed pre-cleaning, and for post-cleaning, the MIAG post-cleaner and the tarer.

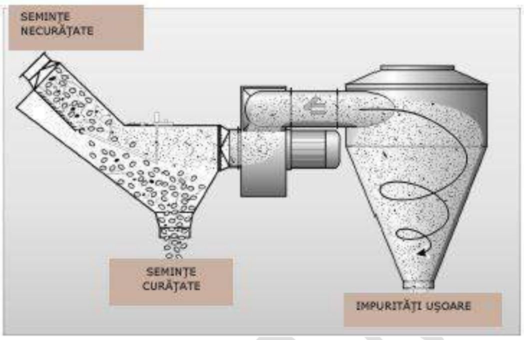

Fig. 3. Impurity separator based on KOM suction

2.4. Dry

The purpose of drying the seeds is to slow down the chemical, hydrolytic and biochemical processes that take place during storage and to avoid their germination and heating. In the drying process, water is transported from the inside of the seeds to their outer surface, from where it is taken up with the help of a drying agent. The temperature of the seed mass must not exceed 70 °C. The transport of water from inside the seed to the surface is a complex phenomenon to which several processes such as diffusion and capillary flows contribute, in different proportions depending on the nature of the seeds. An important factor in seed drying is the heat transfer mode. Industrially, heat transmission is used by convection, conduction or simultaneously by both methods. In oil factories, drying is usually applied to at most one third of the raw materials and has a predominantly technological character.

The drying operation is carried out with the help of the following machines: rotary dryers, drying column, etc.

Fig. 4. Dryer for barley, rapeseed, wheat, sunflower, soybean, corn with mobile dryer "Farm Fans C2140A", drying capacity up to 35 tons/hour, depending on humidity.

2.5. Peeling

From the morpho-anatomical point of view, oilseeds are composed of the shell, which has a high cellulose content and constitutes an unwanted material both in the processing process and in the composition of the processing residues. That is why, whenever possible, it is necessary to remove the skin through the peeling or decorking operation.
Peeling favorably influences the development of the technological process of obtaining crude oil as follows:
-increases the daily processing capacity of the used installations;
-the wear and tear of machines, especially of rollers and presses, is reduced;
-oil losses in scrap are reduced; Of course, peeling also has some disadvantages:
- oil losses in the core driven with the shell;
- additional installations are needed to perform this operation;
- an extra energy consumption.

In order for this operation to be carried out properly, it is necessary to leave a certain percentage of shell in the core (approximately 8% for sunflower), which ensures optimal conditions for pressing and extraction. In general, after separating the shell from the core, a percentage of the core always remains in the shell, around 0.5% in sunflowers.

The peeling process is practically carried out in 2 intended phases, namely:
-separation and detachment of the shell from the core;
- separating the peels from the resulting mixture.
In the case of sunflower seeds, this process is carried out by pounding. Peeling by hitting is practically done with the help of the breaking drum.

Hitting can be divided into 2 phases:
-phase I-a- when the seed is touched by the paddle and it deforms or cracks depending on the rheological properties of the shell and core;
-phase II-a- when, due to the impact, the seeds are projected onto the wavy surface of the breaking drum where they suffer a second impact that favors peeling.
Separators (Vulcan type) or breaking drums are used in oil factories.

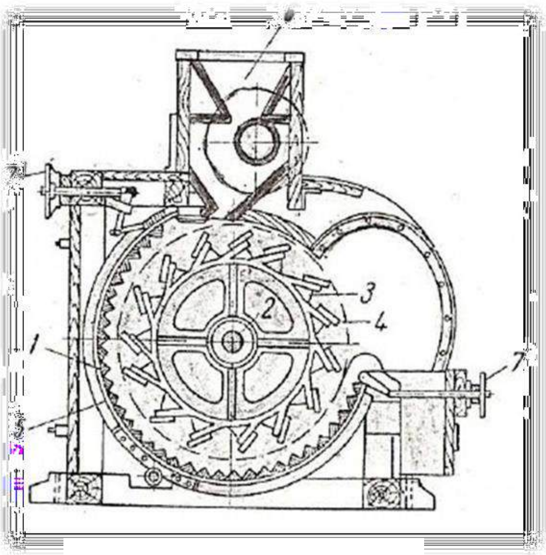

Figure 5. The breaking drum
Component parts: 1-cylindrical surface; 2-axle; 3-rosettes; 4-pallets; 5-break screen; 6-grainer; 7-mechanism

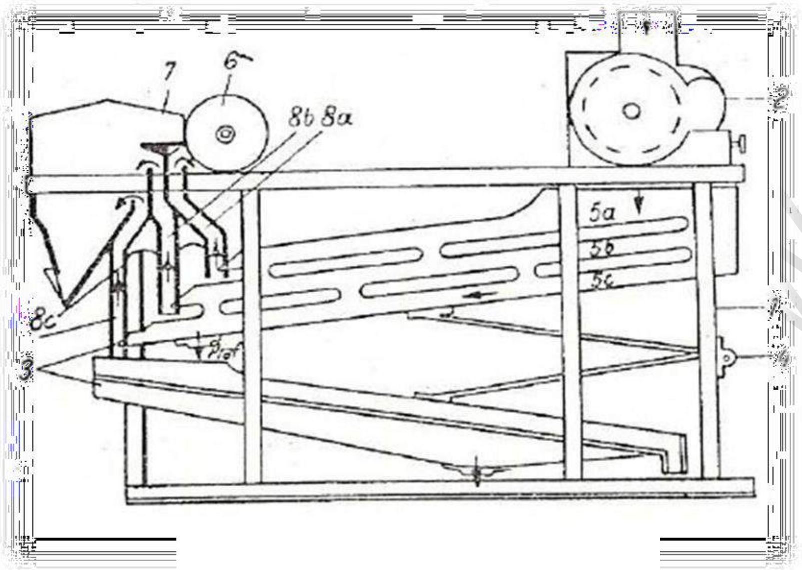

Figure 6. Vulcan type shell separator
1-support frame; 2-breaking drum; 3-frame with sieve; 4-axle with eccentric; 5-site; 6- fan; 7- suction chamber; 8 suction channels

2.6. Grinding sunflower seeds

It is an important operation in the preparation process for the extraction of oil, thereby breaking the membranes and breaking up the structure of the cellular oleoplasm that contains oil. From open cells the oil can be easily extracted by pressing, while from closed cells the oil can only be recovered by extractives with solvents, but not in this integral way.

The humidity of the seeds and the oil content influence the grinding process. If the seeds have a normal humidity, the grinding is done without difficulties, and the grinding is friable and powdery. And in the case of increased seed humidity, they become plastic, grinding is difficult, and the grinding is sticky, making pressing and extraction difficult, thus increasing oil losses in the scrap. If the seeds have a high oil content, a larger amount of oil is separated during grinding that can no longer be fully absorbed, resulting in a sticky grind and loss of oil in the meal.

The oil can be extracted from the ground seeds by pressing and extraction with solvents (for sunflower seeds, very rich in oil).

In the oil factories, the oleaginous raw materials, the press cakes and, if necessary, the scrap resulting from extractives are subjected to grinding. For this purpose, crushers, rollers and hammer mills are used.

Hammer mills, used in the oil industry especially for grinding scrap, have the advantage of being more robust, small in size and high productivity, compared to crushers.

They also present some disadvantages, such as:

-careful adjustment of the distance between the hammers and the sieve according to the humidity of the material;

- operation with high wear and tear requiring careful and permanent supervision. For the sunflower brooch intended for extraction, a passage through
crusher and 2 passes through rollers to obtain a specific grinding surface of 1.1 - 1.6m^2/Kg.

Fig. 7. Hammer mill HM1

Technical specifications:

Model		**Hammer mill HM1**
Size (BXHXT)	mm	570 x 900 x 990
Weight	kg	600
Motor	kW	5.5
Feed particle size(maxim)	mm	50
Final particle size	mm	2-30
Amount of material passed	kg/h	1000

2.7 Hydrothermal treatment (roasting)

The purpose of the hydrothermal treatment or roasting is to modify the physico-chemical properties of the grinding components to obtain a maximum pressing yield.

This is felt more acutely with raw materials that have an oil content of more than 25%, where it is not possible to recover the oil only by extraction with solvents, and prior pressing is also necessary. Roasting before extraction is aimed at obtaining a plasticity in order to be processed by the flattening rollers into fine, porous, stable flakes, which do not crumble in the extractor and have an internal structure favorable to solvent extraction.

The hydrothermal treatment is performed in 2 phases:

-wetting the grind to an optimal humidity specific to the raw material used;
- heating and drying of the grind to a humidity that determines an optimal cellular structure and technical parameters

After wetting, it forms two phases: the solid (gel) phase, made up of proteins with a pronounced hydrophilic character, and the liquid phase, made up of oil and water.

Due to the heating, there is a decrease in the surface tension of the oil and its viscosity, being easily released when pressed from the grinding capillaries.

Optimum roasting conditions and technical parameters in the case of sunflower:

-steam pressure: 4-5 kgf/cm^2
- roasting time: 40-45 min
-moisture of grinding -initial: 8-9 %
-final when leaving the roaster: 5-6 %
-final temperature leaving the roaster: 115-120 °C
-grinding layer thickness: 260 cm

These parameters must be controlled and maintained within optimal limits.

Roasting is carried out in compartmentalized, multi-level cylindrical roasters, the most common being those with 5-6 compartments.

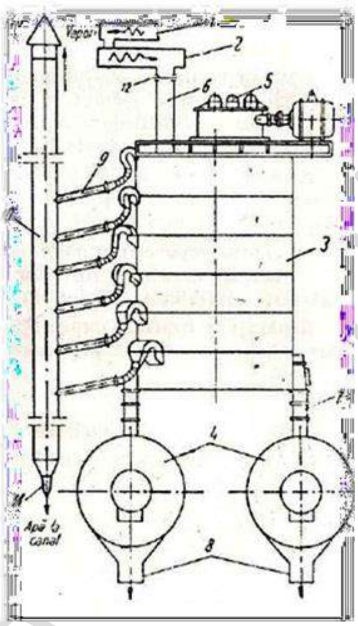

Fig. 8. Frying-pressing equipment

1-feed auger, 2-inactivation auger, 3-fryer, 4-mechanical presses, 5-reducer, 6- feed spout, 7- fried ground drain tube, 8- pin discharge, 9- suction tubes, 10- steam exhaust pipe, 11- condensate drain, 12- supply adjustment register

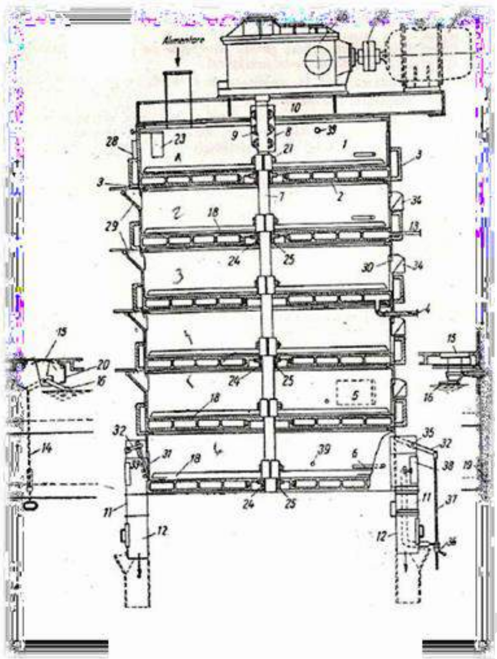

Fig. 9. Toaster 6 compartments

1-roaster compartments, 2-compartment bottom, 3-mantle, 4-connection, 5-inspection connection, 6-thermometer housing, 7-main axis, 8-coupling, 9-circular grooves, 10-frame, 11-tube discharge, 12-feeding funnel, 13-connection, 14-rod, 15-folding valve, 16-float, 17-lever, 18-paddles, 19-corner, 20-support, 21-bolts, 22-electric motor, 23- level indicator, 24-bronze bearings, 25-cast iron plugs, 26-reducer, 27-elastic sleeve, 28-needle, 29-slots, 30-ventilation holes, 31-unloading hole, 32-lever , 33-register, 34-holes, 35-spindle, 36-butterfly, 37-rod, 38-control door, 39-perforated pipes

2.8. Pressing

Pressing the fried oleaginous meal is the technological operation of separating the oil from it, with the help of presses, resulting in crude press oil and brochettes. By pressing, the oil can be separated up to 80-85%, the rest of the oil being later separated by extraction with solvents. For this reason, in the oil factories in our country, only raw materials with more than 30% oil are subjected to pressing. The other raw materials, with a lower oil content, are directly subjected to solvent extraction.

The duration of pressing must ensure the outflow of as much oil as possible, under the given conditions. It depends on the physico-chemical characteristics of the grinding, on the constructive and functional characteristics of the press and on the thickness of the brochne at the exit from the press. The duration of pressing can vary between 40 and 200 seconds.

During pressing, the grind undergoes a series of changes, the most important of which are:

- humidity reduction: by 0.3-1.2% due to heating by transforming into heat the mechanical energy consumed to overcome friction;
- the passage of part of the phosphatides from the gel phase into oil;
- the dissolution of natural pigments in the oil, which leads to a change in its color;
- the content of stable oxidized compounds increases, this being accompanied by a reduction in the iodine index.

This operation is carried out with the help of presses, which according to their construction can be hydraulic or mechanical. Currently, mechanical presses have a number of advantages over hydraulic ones.

Fig. 10. Cold pressed oil press

Product details
1. Oil press: PU 20 - with 1 head
2. Yield: maximum 38-42 liters of crude oil per 100 kg of sunflower seeds (depending on the oil content in the seed)
3. Productivity: maximum 20 kg seeds / hour 3. Drive: 220/380V- 50 Hz – 2.2 kW
4. Dimensions: 800x400x1200mm
5. Weight: approx. 130 kg.

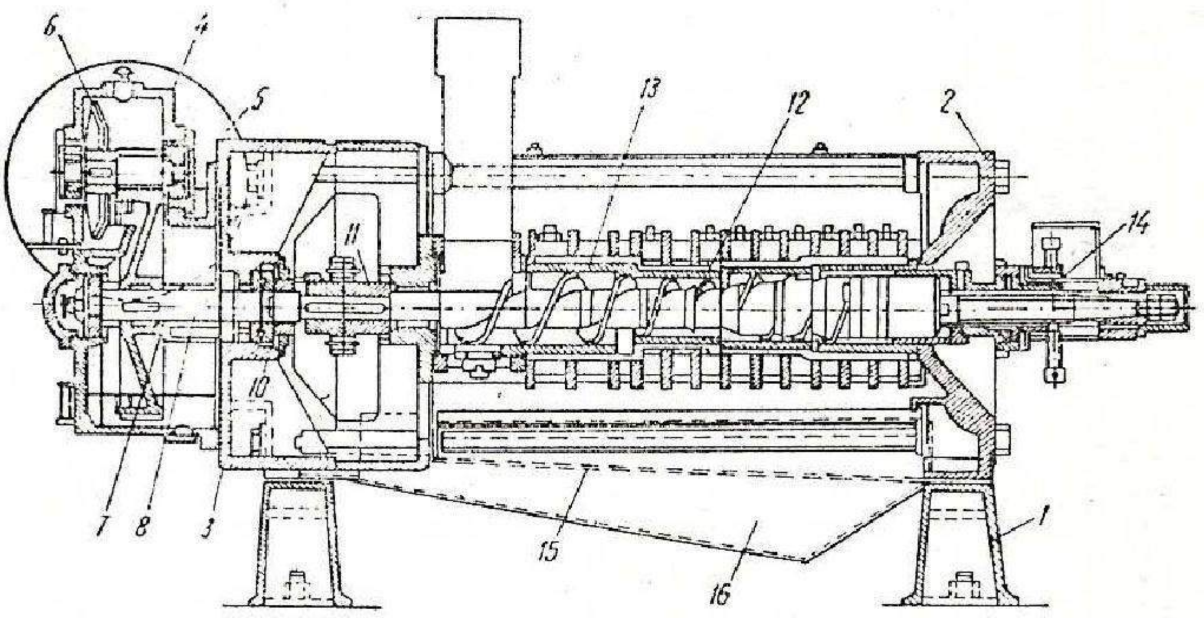

Figure 11. Mechanical screw press

Component parts:
1-cast iron supports, 2, 3 – vertical supports, 4-reducer, 5-drive wheel, 6, 7- gears, 8, 9-axle, 10-thrust bearing, 11-couplings, 12-axle with helical screw, 13-pressing chamber, 14-adjusting device, 15-slanted sheet metal plate, 16-collector chute

2.9 Solvent extraction and solvent recovery

1. Solvent extraction of oil

Through extraction with solvents, the grind, which was previously subjected to some technological preparation operations, is degreased. For extraction, the oily material is mixed with the solvent, during which the oil together with the solvent forms the mixture, and what remains after extraction, i.e. the degreased material, represents the scrap.

Solvent extraction is applied to the sunflower brooch. If the sunflower brochen has an oil content of 18-22%, it is prepared, before extraction, by frying and glazing. If the brochen's oil content is 13-14%, it is prepared only by grinding.

As solvents more often used are those from the group of aliphatic hydrocarbons, of which in our country we mention extraction gasoline.

Practically, the stages of extraction with solvents are the following:

1. Moistening of the grinding particle with solvent and entrainment of the free oil to the surface of the particle;
2. Solvent penetration inside the particle and equalization of solvent concentrations;
3. Movement of oil from the inside to the outside;
4. The passage of oil from the surface of the particle into the boundary layer of diffusion that surrounds the particle;
5. Transport of oil by convection from the outer surface of the diffusion layer into the stirring current.

In modern factories, three methods of continuous extraction are used, namely:
- the immersion method
- repeated spraying method
- the mixed method

"De Smet" belt extractors, the rotary extractor with fixed sieve (Carusel type), the rotary extractor with folding sieve (Rotocel type), basket extractor, etc. are used in oil companies.

The parameters at which the extraction is carried out in a continuously operating installation vary depending on the nature of the raw material, its processing method, the type of installation used. On average, the most important parameters have the following values:
- moisture of grinding (sequins)... ..6-9%
- the duration of the extraction. ..15-20 hours
- the temperature of the solvent at the entrance to the extractor...50-55°C
- the height of the material layer. 0.5-1.5m
- the concentration of the movement. ..18-30%
- solvent in scrap at discharge 30%
- depression in the extractor. ..3-12mm H_2O

Solvent recovery

As a result of the technological process of oil extraction both in the mixture, in addition to the oil, as well as in the scrap, significant amounts of solvent remain that must be recovered. At the exit from the extractor, the mixture has an oil concentration that varies between 14 and 35%, depending on the installation used. For the recovery of the solvent from the mixture, the different volatility of the components in this mixture is used as a basic principle. In practice, this is achieved by distilling the mixture, which involves heating it to the boiling temperature of gasoline, when it evaporates, being recovered later. There were concerns to protect the quality of the oil, possibly degraded by distillation. This can be practically achieved by reducing the distillation time and reducing the distillation temperature.

Solvent recovery from the mixture is carried out in two phases, namely pre-distillation and final distillation.

Pre-distillation: it is carried out in multi-tube heat exchangers, called economizers and evaporators. In saving and the first evaporator, the mixture, is concentrated from 25% to 55-60% oil, at a residual pressure of 400-450mmHg. In the second evaporator the mixture is concentrated to about 96% because the residual pressure is about 200mmHg.

Final distillation: is the solvent recovery operation and is carried out at a temperature of 95-110 °C and a residual pressure of 60 mmHg.

Solvent recovery from scrap: after extraction, in oil-exhausted grinding, i.e. in scrap, a large amount of solvent remains, retained in the capillaries of the particles and on their surface, varying between 25 and 50%. Because the solvent present in the scrap is mostly composed of light fractions, it can be removed by heating the scrap. The other part of the solvent, composed of heavy fractions, can be removed by introducing superheated steam directly into the installation. The recovery of the solvent from the scrap in continuous operation takes place in screw dryers or in toasters.

2.10 Refining

Crude vegetable oils, obtained by pressing or extraction, contain a quantity of 1-4% foreign substances from natural triglycerides called accompanying substances. The accompanying substances include mucilages, free fatty acids, dyes, waxes, odorous substances. They are found in oils in different forms, namely as insoluble particles dispersed in oil, substances soluble in oil and colloidal solutions or suspensions. The accompanying substances have a series of effects on the oils, namely: they change the taste and smell, transmit the color, determine a series of undesirable processes during processing and negatively influence the stability of the oils during storage.

To improve the quality of the oils, the accompanying substances must be removed. This is done during the refining operation. Depending on the destination and quality of the oil, physical, chemical, physico-chemical refining methods are used.

The main operations in the refining of edible oils are: demucilagination, neutralization, washing, drying, discoloration, dewaxing (winding) and deodorization.

2.11 **Demucilage**

If seeds are processed before technological maturity, oils with a high mucilage content are obtained, which are difficult to process during refining. Also, if the oils are obtained by extraction, their content in mucilages is higher than when pressed. Mucelages have a complex composition represented mainly by phosphatides, albuminoids, carbohydrates, resins, stearins, etc. By demucilaging, a high-quality oil is obtained, losses during refining are reduced, an instability factor is eliminated and a very valuable product "lecithin" is obtained, which is used in the food industry because it has the ability to stabilize emulsions and increases its nutritional value of the products.
Mucilage removal can be done by hydration, in the case of edible oils, and by acid treatment for technical oils. Hydration is based on the fact that phospholipids, albuminoids and their compounds, in the form of mucilage, in the presence of water. To activate the hydration, you can use citric acid, 10% solution in a quantity of 1% compared to crude oil or concentrated phosphoric acid. 80% in a quantity of 0.05-2% relative to oil. It is very important that the temperature should be between 60-75°C.
Mucilage separation is done by centrifugation using centrifugal separators with plates, tubular supercentrifuges and others.

2.12 **Neutralization of oils**

In order to obtain edible oils, the elimination of free acidity, i.e. neutralization, is absolutely mandatory. The maximum limit of free acidity was established by regulations. In sunflower oil, the free acidity is a maximum of 0.1-0.35%. The removal of free fatty acids from the oil can be done by several methods, namely:
- alkaline neutralization;
- neutralization by distillation;
- neutralization by esterification.

The use of one or another of these methods depends on the free acidity of the oils, the most used being alkaline neutralization. For this purpose, alkaline solutions are used. NaOH is frequently used and following its reaction with free fatty acids, refining soap is formed.
The machines used to make the lye-oil mixture, in the continuously operating refining installations in our country, are the Sharples paddle mixer and the Alfa De Laval disk mixer.

2.13 Oil washing

The washing of oils as well as the preparation of lye is done with softened water, because using water with high hardness increases the soap content in the refined oil due to the formation of calcium soap, soluble in oil but insoluble in water. That's why whenever the water hardness exceeds 5 germ degrees, it needs to be decalcified.
Then, due to the hardness of the water, there are deposits on the devices that are very difficult to remove. In this phase the oil temperature must be maintained between 85-90°C.

2.14 **Oil drying**

After washing, the oil contains between 0.1 and 0.5% water as well as traces of soap. Cooled to ambient temperature, the washed oil becomes cloudy because the solubility of water in the oil decreases and the amount of free fatty acids increases. To eliminate these shortcomings, the oil is dried by the discontinuous or continuous process. As a rule, vertical cylindrical dryers are used in which the oil is introduced by spraying, and there is a vacuum (10-40 mmHg) inside. The water content of the dry oil is a maximum of 0.05%.

2.15 Discoloration of oils

The oil intended for consumption must be clear, shiny and slightly colored. The color of the oil is given by natural pigments that are found in small quantities, but very important for the quality of the oil. Sunflower oil has a yellow-orange color due to carotene and xanthophyll. Apart from these natural pigments, secondary pigments also appear in the oils.
Different procedures are used to decolorize oils, grouped into: decolorization by adsorption and chemical decolorization.
In practice, decolorization is achieved by treatment with adsorbents, using decolorizing earths activated with mineral acids to which decolorizing charcoal is sometimes added. For edible oils, the optimal decolorization temperature is around 80-100°C, and the contact time is 15-20 minutes for installations with discontinuous operation and a few minutes for decolorization in continuous flow. The yield of oil discoloration depends on the amount of agent which varies within very wide limits 0.25-5%, depending on the nature of the oil and the bleaching effect to be obtained. 5-10% activated carbon is added to the more intensely colored oils. Likewise, for edible oils, smaller quantities are used, respectively 0.5-1.5 bleached earth.
The factories in our country use the "De Smet" installation, the improved version, which has the advantage of a small consumption of bleaching earth and small oil losses.

2.16 Winterization (defrosting)

Dewaxing is the operation by which the waxes and di- and tri-saturated glycerides of fatty acids are removed from the oil, which at temperatures below 15-20°C solidify and produce a turbidity, which influences the quality of the oil. In sunflower oils, the wax content depends on peeling and separating the skins from the core. Through winterization, between 0.5 and 0.8% waxes are separated from this oil. Winterization can be performed either before or after deodorization and consists in the crystallization of waxes and solid glycerides, followed by their separation by filtration. Crystallization can be performed in two ways:
- in short time
- lasting, about 38-72 hours

The reduction of the crystallization time can be achieved by introducing crystallization germs. So the fermentation consists in cooling the oils in order to precipitate the glycerides and waxes followed by their removal by filtration.
In the winterization installations with continuous operation, the winterization proceeds as follows: a pre-cooling to 20-22°C is performed followed by a cooling to 5-7°C. Then the crystallization germs are introduced and mixed for 4 hours, after which the oil is reheated to 12-16°C, considered the optimal filtration temperature.

2.17 Deodorizing

It is the last phase of refining and aims to remove substances that produce unpleasant, specific smell and taste. These substances come both from the raw material, as substances accompanying the glycerides, and from the chemical transformations that take place during storage and processing. Thus, if the hydrothermal treatment was done improperly, a burning smell appears in the oil. If the washing is inadequate, the oil gets a soapy taste, and if the bleaching time is too long, the smell and taste of earth appear.
Deodorization is achieved by combining the effect of three technological parameters, namely: temperature, pressure and water vapor. The temperature of the injection steam must be 30-35°C above the oil temperature. The residual pressure in the device is 2-3 mmHg. The oil is heated to bring it to working temperature and to compensate for losses. In installations with continuous operation, deodorization is carried out at temperatures of 200-230°C. At a temperature of 200°C, deodorization takes 1-2 hours, and at 230°C, the duration is 0.5-1 hour.
The effectiveness of this operation also depends on ensuring an effective contact between the oil mass and the driving steam. This is achieved in two ways: by bubbling the steam in the oil mass, by finely dispersing the oil and its flow in a thin film, on surfaces in direct contact with the steam.

2.18. Storage of vegetable oils
2.18.1. Oil storage in tanks

When storing oils, especially in the case of refined oils, it must be taken into account that they are sensitive to the influence of light, air and humidity. A proper storage must protect the oils from the action of these factors.
The most suitable tank construction material is stainless steel for large tanks and layered polyester for small capacity tanks. The introduction and evacuation of the oil is done through pipes, dimensioned according to the required flow rates. Two connections are usually provided for oil discharge: one located at the lowest level, for emptying the tank, the other at a certain height, to allow the current discharge of the oil without entrainment of the sediment layer at the bottom of the tank. An indirect steam coil is mounted inside the tank to heat the oil in winter.
Periodically, the tanks are cleaned of the sludge collected at the bottom. The amount of sludge is higher in tanks where crude oil has been stored. There are also washing installations with a jet of detergent solutions.

2.18.2. Storage of packaged oils

Edible oils delivered in retail packaging (glass bottles), placed in compartmentalized crates, are handled on pallets. In modern warehouses, pallets are stacked in 2-3 rows. Oil barrels are placed in a row or crushed using special pallets. The storage rooms must be cool, dark, clean and free of foreign smells. In warehouses, the products are placed in batches, according to the date of packaging, so that their delivery and consumption are done within the terms established by the standards:
-bottled sunflower oil: maximum 4 months;
-sunflower oil in barrels: maximum 6 months.

2.19. Packaging of vegetable oils

2.19.1. Bottling of edible oils

Edible oils are bottled in 1-liter and ½-liter glass containers, 1-liter and ½-liter PET bottles, 5-10-liter PET or metal cans. If the technological process was well conducted and the refined oil meets the required quality conditions, it shows good stability over time. Depending on the duration and storage conditions, a well-refined oil can oxidize if: atmospheric oxygen is present, light and UV radiation are present and the storage temperature is high (>30°C).

2.19.2. Packing oil in barrels

Edible oils intended for industrial and collective consumption are packed in metal barrels with a capacity of about 200 l. Similarly, part of the technical oils are delivered. The barrels go through the following process: cleaning, visual inspection, weighing "empty", filling, weighing "full" and marking. Hydrogenated vegetable oils can also be packed in barrels. They can be poured in a fluid state, in wooden or tin barrels, according to the usual procedure. In a paste state, they can be loaded into open wooden barrels, to which the bottom is applied after filling, or into steel barrels with removable lids.

2.19.3. Shipment of oils in tankers

Tanks intended for transporting vegetable oils must be clean, odorless and free of impurities and rusty parts. Particular attention must be paid to tanks when loading edible oil. In this case, the cleaning of the tanks is done by steaming, washing with weak alkali solutions, then with water and, finally, by wiping the interior with a filter cloth soaked in oil. Tanks are filled by pumping the oils in the tanks. The unloading of tanks at the beneficiaries is usually done by free flow in buried tanks.

2. Conclusions

I chose this theme, because I considered that the sunflower is a valued honey plant, an oily plant of great economic and food importance. It ranks third among herbaceous oleic ferrous plants.

The basic idea of this chapter consists in the fact that oil is one of the food products indispensables to life. There is no one who has not used the oil ever.

The nutritional function of sunflower oil is enhanced by the presence of provitamins A, D, E, phosphatides as well as vitamins B4, B8, K, they also contain sterol, tocopherols. Energy capacity: 8.8 cal/g oil.

It is excellent for food because it has fluidity, color, taste and pleasant smell.

They are used in the food industry (bakery, pastry, chocolate preparation, sausages). Olive oil is healthier than sunflower oil.

For Romanians, the most important thing when they buy is the price, because oil is considered a basic product. Rapeseed and soybean oils are perceived as low-quality oils, with an unpleasant taste and smell, so the sunflower and vegetable oils remain valid (sunflower-rapeseed, soybean combination). In other countries, the population is more attentive to healthy products and preferences are directed towards olive, pumpkin, palm oil.

In the happiest case, Romanians buy olive oil when there are promotions in supermarkets, to use it in salads, not at all for actual cooking. The lack of interest in this food can be

explained by the fact that most Romanians cannot afford to use olive oil frequently. Added to this are the less healthy consumption habits, oriented towards quantity and not quality, as well as the large areas cultivated with sunflowers.
Sunflower is one of the most profitable agricultural crops.

Reference

1. Rodica G., 2000, Tehnologii în industria alimentară (parteaI), Ministerul Educaţiei Naţionale-Universitatea ”Transilvania” din Braşov

2. Gheorghe B., Dumitru P., 1980, Tehnologia uleiurilor vegetale, Editura tehnica Bucureşti

3. Manualul inginerului din industria alimentară, 1968, Editura tehnică Bucureşti

4. Rodica G, 2005, Tehnologii în industria alimentară, Editura Universităţii Transilvania Braşov

5. http://www.agrocov.ro/ro/culturi-floarea-soarelui/

6. http://www.bizoo.ro/firma/stimel/vanzare/2120133/Presa-ulei-cu-presare-la-rece

7.http://www.bizoo.ro/firma/tcemobiledryers/vanzare/621618/Inchiriere-uscator-mobil-de-cereale-si-plante-oleaginoase

8.http://chimie-biologie.ubm.ro/Cursuri%20on-line/MIHALY%20COZMUTA%20ANCA/ALIMENTE%20CU%20DESTINATIE%20SPECIALA-FUNCTIONALE/Tehnologii%20ale%20produselor%20de%20origine%20vegetala/Ulei%20de%20floarea%20soarelui.ppt

9.http://www.clubafaceri.ro/41240/silozuri-metalice-cu-fund-conic-pentru-depozitare-cereale-(-porumb,-grau,-floarea--soarelui,-etc)-1040547.html

10. http://extractive.wikispaces.com/file/view/Fabricarea+uleiului+de+floarea-soarelui.pdf

11. http://www.scribd.com/doc/55465416/Industria-Produselor-Oleaginoase

12.http://www.scribd.com/doc/60934431/12/Structura-anatomic%C4%83-a-semin%C5%A3elor-oleaginoase

13. http://www.scribd.com/doc/58323717/Fabric-Area-Uleiului-de-Floarea-Soarelui

14. http://www.sepadin.ro/mori-laborator-mori-cu-ciocane-SIEBTECHNIK

15. http://taifuns.blogspot.com/2009/03/consumam-mult-ulei-de-floarea-soarelui.html

16. Stanciu I., Study concerning the rheological behavior of sunflower oil, Journal of Science and Arts, 2013;4(25): 355-360

17. Stanciu I., Application of new models in rheological behavior study sunflower oil, American Chemical Science Journal, 2014;4(4)(July-August): 537-545

18. Stanciu I., The Study Rheological Behavior for Sunflower Oil, International Research Journal of Pure and Applied Chemistry, 2014; 4(5):531-540

19. Stanciu I., 2014, Regression Models that Describe Sunflower Oil Dynamic Viscosity of Temperature Absolute, International Journal of Scientific Research, 3(4), 53-54

20. Stanciu I., The Relationship Dynamic Viscosity on Inverse Temperature Squared for Sunflower Oil, Indian Journal of Scientific Research, 2014;8(1):210-213

21. Stanciu I., New Mathematical Relationship of Dependence Dynamic Viscosity of Absolute Temperature for Sunflower Oil, Indian Journal of Applied Research, 2014;4(9): 48-50

22. Stanciu I., Methods of Determination Viscosity Index of Sunflower Oil, International Journal of Scientific Research, 2014;3(11): 55-56

23. Stanciu I., The Effect Temperature and Shear Rate on the Rheological Behavior for Sunflower Oil, Paripex – Indian Journal of Research, 2014; 3(10): 14-16

24. Stanciu I., New relationship to describe the rheology of sunflower oil, Ovidius University Annals of Chemistry, 2014;1(25): 28-31