**Lipids**

These are greasy organic compounds which are soluble in organic solvents but insoluble in water. They are esters of long chain fatty acids and alcohols or closely related derivatives.

**R-OH + HOOC-R ester RCOOR**

Alcohol fatty acid Lipids (ester)

**Examples**

Examples are fixed oils, fats & waxes.

1. **Fixed oil**

These are esters of higher fatty acids such as oleic acid, palmitic acid, stearic acid and linoleic acid with glycerol which are liquid at room temperature e.g. olive oil, almond oil, peanut oil, sunflower oil etc.

**Properties of Fixed oils**

* They are obtained from various plants or animals.
* They are called fixed oils because they leave greasy mark on paper and cannot be distilled without being decomposed.
* They form soap with alkalies.
* They are odorless and tasteless.
* They are insoluble in water and soluble in organic solvents.
* They are non-volatile.
* They yield glycerol and fatty acids on hydrolysis.
* When they are heated strongly, they undergo decomposition with the production of Acrid vapors. This is due to formation of Acrolein.

1. **Fats**

These are esters of fatty acids with glycerol which are solid at room temperature. They are also called triglycerides because three fatty acids are attached to them e.g. Lanolin (wool fat), theobroma (Cocoa butter) etc.

**Difference b/w Fats & Fixed oil**

|  |  |
| --- | --- |
| **Fats** | **Fixed oils** |
| 1. They are solid at room temperature. 2. They contain relatively higher proportion of solid glycerides. 3. They contain saturated glycerides e.g. glyceryl stearate. 4. Their specific gravity is more. 5. Example are Wool fat, Theobrama | 1. They are liquid at room temperature. 2. They contain relatively higher proportion of liquid glycerides. 3. They contain unsaturated glycerides e.g. glyceryl oleate. 4. Their specific gravity is less. 5. Examples are Coconut oil, Corn oil, Peanut oil etc. |

1. **Waxes**

These are esters of fatty acids with long chain alcohols other than glycerol e.g. Bees wax (solid wax), Jojoba oil (liquid wax) and paraffin wax.

**Difference between Volatile oil and Fixed oil**

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| --- | --- |
| **Volatile oil** | **Fixed oil** |
| 1. Volatile oil is odours principle found in various plants parts because they evaporate at Room Temperature so called ethereal or volatile oil. 2. Volatile oils leave no spot after evaporation. 3. They cannot be saponified. 4. Volatile oil can’t be rancified like fixed oil. 5. These consist of isoprenoid units. 6. They are mixture of eleoptenes and stereoptenes. 7. These have characteristic odor and taste. 8. They are obtained by distillation. 9. e.g. clove oil, peppermint oil, cinnamon oil | 1. These are esters of higher fatty acids such as oleic acid and palmitic acid with glycerol which are liquid at room temperature. 2. They leave spot after evaporation. 3. They can be sponified. 4. Fixed oil can be rancified. 5. They consist of fatty acids. 6. They are esters of fatty acids with glycerol. 7. These are odorless and tasteless. 8. They are obtained by extraction (soxhlet’s apparatus) 9. e.g. corn oil, mustard oil, sunflower oil |

**IMPORTANCE OF FIXED OILS**

Fixed oils are important products used pharmaceutically, industrially and nutritionally.

* **Pharmaceutical uses**
* **As vehicle**

Peanut oil and Sesame oil are used as solvents in the preparation of certain IM injections.

* **As Stimulant, Cathartic & Purgative**

Castor oil

* **As Emollient**

In ointments, creams, lotions e.g. almond oil

* **Industrial uses**

They are used in the manufacturing of detergents, cosmetics, varnishes, paints, soaps, textiles and leather industry.

* **Nutritional uses**

Fixed oil like oil with high contents of unsaturated fatty acids is suggested in diet to reduce high blood cholesterol level (Hypercholestremia) e.g. canola oil

**OCCURRENCE**

Vegetable oil and fats may occur in various parts of plant but seeds contain larger quantities of fats and fixed oil than other parts so seeds are usual source of fixed oils.

**METHODS OF OBTAINING FIXED OILS**

There are three methods by which fixed oils are obtained.

* By direct compression of plants or animal tissues.
* The material is first grinded and then subjected to heat when necessary. The first expression is called “Virgin”.
* By the use of Soxhlet apparatus & using a suitable solvent. This is process of **extraction**.

**ANALYSIS OF FIXED OIL/IDENTIFICATION TEST FOR FIXED OILS**

Fixed oil can be identified by their physical properties such as melting point, refractive index and specific gravity. Apart from physical properties, a number of chemical tests are carried out on fixed oils to determine their identity, quality and purity.

* **Saponification test**

It is the number of milligrams of NaOH or KOH required saponifying 1 gram of oil or fat.

* **Iodine value**

It is the measure of degree of unsaturation of fats or fixed oils. It is the number of milligrams of iodine absorbed by 100 grams of fats or fixed oils.

* **Acid value**

It is the measure of free fatty acids present in oils or fats. It is the number of milligrams of KOH required to neutralize free fatty acids in 1 gram of oils.

**Other tests include**

* **Refractive index**
* **Melting point**
* **Specific gravity etc.**

**CLASSIFICATION OF FIXED OILS**

Fixed oils are classified into 3 groups on the basis of their ability to absorb O2 from air.

* **Drying fixed oils**

When they are exposed to air, they undergo oxidation and form tough, hard film e.g. linseed oil used in paints and varnishes.

* **Non-drying fixed oils**

They do not oxidize, don’t form tough film and not used in paints and varnishes e.g. Olive oil.

* **Semi-drying fixed oils**

They are oxidized very little and form a thin film e.g. cotton seed oil

**DRUGS CONTAINING FIXED OILS**

1. **Cotton seeds oil**

**Botanical origin**: *Gossypium hirsutum / Gossypium harbaceum*

**Part used:** Oil obtained from seeds

**Preparation**

There are three methods by which fixed oils are obtained.

* By direct compression of plants or animal tissues
* The material is first grinded and then subjected to heat when necessary. The first expression is called “Virgin”.
* By the use of Soxhlet apparatus & using a suitable solvent. This is process of extraction.

**Properties**

* It is pale yellow in color.
* It has unpleasant taste.
* It form soap with alkali.
* It is insoluble in water and soluble in organic solvents.
* It is obtained from seeds by expression.
* Cotton seed oil is valued on the bases of acidity or acid number.
* Refined oil is pale yellow in color, nearly odorless.
* Crude oil is amber red or black in color.
* Saponification no. is 192-200.
* Iodine no. is 100-115.
* Specific gravity is 0.92.

**Constituents**

It contains glycerides (fatty acids + glycerol) which have fatty acids like stearic acid, linoleic acid, oleic acid and palmitic acid.

**Uses**

* Used as Nutritive
* Used as Emollient
* Used as Vehicle
* Used in preparation vegetable oil and soap
* Used as lubricant
* Used as cathartic
* Used in cooking oil

**Toxic effects**

Nausea, Vomiting, Headache, Dizziness, Backache

1. **Castor oil**

**Botanical origin:** *Ricinus communis*

**Family:** Euphorbiaceae

**Part used:** Oil obtained from seeds

**Preparation:**

* Castor oil is obtained from castor seeds.
* The oil is obtained by two ways; either after the removal of the seed coat or with the seed coat.
* Seed coats are removed by crushing the seeds under the grooved rollers and then they are subjected to a current of air to blow the testas.
* The kernels are fed in oil expellers and at room temperature they are expressed with 1 to 2 tons pressure per square inch till about 30% oil is obtained.
* The oil is filtered, steamed 80–100°C to facilitate the coagulation and precipitation of poisonous principle ricin, proteins and enzyme lipase present in it.
* The acid no. is less than 4 and iodine no. is b/w 81-91.
* It is miscible with alcohol, ether and chloroform.

**Constituents**

* It contains glycerides (fatty acids + glycerol) which have fatty acids like stearic acid, linoleic acid, oleic acid and palmitic acid.
* It also contain fixed oil, protein (globulin, albumin, ricin).
* The oil contains ricinoleic acid (responsible for purgative action).

**Uses**

* Used as Nutritive
* Used as Emollient
* Used as Vehicle
* Used in preparation of vegetable oil and soap
* Used as purgative
* Also used in preparation of hair oil, lip sticks, lubricants, paints and varnishes.

**Toxic effects**

Nausea, Vomiting, Headache, Dizziness, Backache

1. **Olive oil**

**Botanical origin:** *Olea europaea*

**Family:** Oleaceae.

**Part used:** Oil obtained by expression of ripe fruits

**Preparation:**

* The fruits are collected.
* After grinding, the pulp is introduced into coarse, grass baskets, and placed in a screw press.
* The oil coming out is collected into tubes containing water and the upper layer is skimmed off. The product is called as Virgin oil obtained by gently pressing the peeled pulp freed from the endocarp.
* The marc is then treated with water and again expressed to yield second grade of edible oil.
* Finally, the pulp is mixed with hot water and pressed again for technical oil.
* The pulp may be extracted with carbon disulphide to obtain ‘Sulphur’ olive oil of inferior quality. The yield is from 15 to 40%. If the fruit is not fully mature, the yield of the oil is poor and its taste is bitter.

**Constituents**

Olive oil contains mixed glycerides of oleic acid (56–85%), palmitic (7–20%), linoleic (3–20%), stearic (1–5%), arachidic (0.9%), palmitoleic (3%), linolenic acids

**Uses**

* Used as Nutritive
* Used as Emollient
* Used as Vehicle
* Used in preparation vegetable oil and soap
* Used as purgative
* Used as Laxative
* Used to protect against colon cancer.

**Toxic effects**

Nausea, Vomiting, Headache, Dizziness, Backache

1. **Peanut/Arachis oil**

**Botanical origin:** *Arachis hypogaea*

**Part used:** Arachis oil is obtained by expression of shelled and skinned  
seeds of *Arachis hypogaea* Linn.

**Preparation:**

* Fruits are dug out by raking the plants from the soil.
* The seeds are separated by machine and expressed in a hydraulic press at ordinary temperature.
* The remaining oil of cakes is removed by solvent extraction.
* The two oil fractions are combined and purified.

**Characteristics:**

* Peanut oil is a non-drying oil.
* It is a colorless to pale yellow in color.
* Acid value is 0.08.
* Saponification no. is 188-195.
* Iodine no. is 84-102.
* It becomes rancid upon prolong exposure to air.

**Constituents**

* The important constituents of the glycerides of Arachis oil are the fatty acids palmitic (8.3%), stearic (3.1%), oleic (56%), linoleic (26%), arachidic (24%), eicosenoic, behenic (3.1%), and lignoceric (1.1%) acids.
* The yellow colour of oil is due to the presence of carotenoid pigments, chiefly β-carotene and lutein.

**Uses**

* Used as Nutritive
* Used as Emollient
* Used in preparation of vegetable oil and soap
* Used in ink formation
* Used as parenteral vehicle in pharmaceutical industry.
* Used in manufacture of margarine, soap, liniments etc.

**Toxic effects**

Nausea, Vomiting, Headache, Dizziness, Backache

1. **Corn oil**

**Botanical origin:** *Zea mays*

**Part used:** Corn oil is a fixed oil obtained by expression of embryos of *Zea mays*

**Preparation**

* It is obtained from embryo of *Zea mays*.
* After separation of starch and glutin the embryos are expressed for oil.
* Purified corn oil is a clear light yellow oily liquid with characteristic odor and taste.

**Constituents**

* Dried corn embryo yields around 20% of fixed oil.
* The fatty acid composition of corn oil indicates the presence of palmitic (8–13%); stearic (1–4.5%); oleic (24–33%); linoleic (55–62%); linolenic (0.5–1.5%) and arachidic (0.5%) acids.

**Uses**

* Used as Nutritive
* Used as Emollient
* Used as Vehicle
* Used in preparation vegetable oil and soap
* Used as purgative
* Used as edible oil
* Used for decreasing high blood cholesterol level
* Used as solvent for injections

**Toxic effects**

Nausea, Vomiting, Headache, Dizziness, Backache

1. **Almond oil**

**Botanical origin:** *Prunus amygdalus*

**Family:** Rosaceae

**Part used:** Almond oil is obtained by expression from seeds

**Preparation**

* Almond oil is obtained by grinding the seeds and expressing them in canvas bags between slightly heated iron plates.
* The oil is clarified by subsidence and filtration.
* It is a pale yellow liquid with a slight odor and bland nutty taste.
* Bitter almonds, after maceration on hydrolysis of amygdalin yield a volatile oil that is used as a flavoring agent.
* Sweet almonds are extensively used as a food, but bitter almonds are not suitable for this purpose.  
  Essential or volatile oil of almonds is obtained from the cake left after expressing bitter almonds. This is macerated with water for some hours to allow hydrolysis of amygdalin to take place.
* The benzaldehyde and hydrocyanic acid are then separated by steam distillation.
* Bitter almond is bitter due to amygdalin.

**Constituents**

* Almond oil consists of a mixture of glycerides of oleic (62–86%), linoleic (17%), palmitic (5%) and myristic (1%) acids.
* Bitter almond oil contains benzaldehyde and 2–4% of hydrocyanic acid.

**Uses**

* Used as Nutritive
* Used as Emollient
* Used as Vehicle
* Used in preparation vegetable oil and soap
* Used as purgative
* Used as demulcent & emollient
* Used in lotions
* Used as mild laxative
* Used as a flavoring agent.

**Toxic effects**

Nausea, Vomiting, Headache, Dizziness, Backache