

DEPOSITS OF ESSENTIAL OILS IN PLANTS

PLANT EPIDERMIS

Its structure is important for the extraction of raw materials having surface deposition of essential oil. It is formed by one, rarely two or more rows of tightly to each other cells. It protects the plant from desiccation, mechanical damage, bacterial and fungal infections. At the same time it performs increased permeability for the purposes of respiration, photosynthesis and aspiration. The outer surface of the epidermis is covered by a layer called the cuticle. It represents a thin and continuous membrane over the entire outer surface of the epidermis, which has excellent permeability for a number of substances, including water lipophilic substances. Permeability of the cuticle in different plants is not directly related to its thickness. With increasing of leaves its thickness and permeability increases too. Simultaneously, the permeability is improved by increasing temperature. Cuticle is partially permeable for essential oils. Going through it they enter the surface of the plant where evaporate, which felt its flavor. The speed of movement of substances through the cuticle depends on their molecular weight as those with higher mass move slower. The dynamics of the formation of essential oils may not always coincide with that of their release into the atmosphere through the cuticle. Therefore, in certain parts of the day cuticle sometimes swell to a hemispherical shape, sometimes shrinks without changing significantly its thickness. Increasing the volume of sub- cuticle space is by means of distortion of the cuticle. In some plants its rupture and leakage of essential oil initially and then its regeneration is observed. In epidermis wax is delayed, which is involved in both the cuticle and its surface.

DEPOSITION OF ESSENTIAL OILS

Essential oils for different types of plants are deposited in their various tissues, which can be divided into internal and external exogenous endogenous tissue separation.

1. Exogenous receptacles

In plants with exogenous receptacles latter are not covered with any additional tissue. Their essential oil may evaporate directly into the atmosphere and its flavor can be felt without further tearing of the tissue. Such materials do not require further fragmentation before extraction due to direct contact of the receptacle with the solvent. This type of receptacles are found in flowers, leaves and stems of

plants. Exogenous receptacles are found in the form of glandular hairs (trichome) and specialized glandular fields called osmofori.

1.1. Glandular hairs - these are the epidermis appendages, specialized for the separation of essential oils, slimy substances, resins and aqueous solutions of various salts. In some cases the entire hair is composed of glandular cells, and in others only the final cell is glandular. Glandular hairs usually emit secretions in the space between the shell and cuticle. After accumulating a large amount of mucus cuticle splits up and pour out the secret to the atmosphere. Then sometimes the cuticle is restored and re-collected swabs, other times it degenerates after a single discharge.

1.1.1. Labiatic glands - found mainly in plants of the family Labiatae wearing its name. Each hair is placed on a single epidermal cell, above which is another secretory cell. Between 8 and 16 pieces (most often 8) oblong, perpendicular secretory cells are placed on it. Back to the top they are drifting apart, thus forming a cavity between them. This cavity and the secretory cells are coated with highly inflated cuticle, which closes the cavity top. In thus formed cavity essential oil is secreted. Viewed from above this labiatic arranged hair looks like a circle - cuticle, which entered eight-cells jack - secretory cells with a circle in the middle - the cavity with essential oils. This type of gland is found in mint, lavender, basil, oregano, melissa, marjoram, savory, thyme, sage, rosemary, hyssop, etc.

1.1.2. Composite glands - found mainly in plants of the family Compositae wearing its name. Their base is also an epidermal cell on which several small core secretory cells in one or two lines are placed, forming the handle of the hair. Over this handle a cluster of larger cells in two or three lines forming the body of the hair is available. The entire body is covered with cuticle. Essential oil in this type of hair is excreted in the cells themselves, not in a special cavity, as in labiatic. This determines their weaker activity compared with labiatic. This type of gland is found in chamomile, tarragon, pyrethrum, tarragon, etc.

1.1.3. Large multicellular trichomes - consist of a long handle, made up of several glandular cells, one above another, and unicellular spherical head, which accumulate essential oil. Top is covered with cuticle. In case of intensive accumulation of essential oil in the head, its cuticle swell and deform. Appears in geranium in three different forms, etc.

1.1.4. Small multicellular trichomes - consist of one core, secretory cell, forming the handle of trichome and placed over her head oblong or tapering, which may be constructed of one, two or more cells.

1.1.5. Scaly glands - are constructed from short secretory cells arranged in a circle like labiatic. They lack the formation of cavities. The essential oil is collected in the cells and cuticle is stretched over them. This type of glands are small and slightly active. Occur in the leaves of walnut.

1.1.6. Lupulin glands - consists of numerous rounded cells, arranged in the form of a plate. Above

them is strongly convex cuticle, and between it and the rounded cells formed a large chamber filled with essential oil. This type of gland is located at the base of the colored leaves of cone clusters of hops.

1.1.7. Essential oils endocrine glands - similar to the labiatic and difference of being on a par with epidermal tissue without going over it. They also have 8 oblong secretory cells, but they produce essential oil in a chamber beneath them in the internal tissues of the body where they are. They accordingly missing and convex surface of the cuticle. Since over secretory cells lacking other tissue they relate to exogenous receptacles. This type of gland is found in St. John's wort.

1.1.8. Thyroid - Like the endocrine glands that are located on one level with the epidermis, and are buried in it. They consist of two groups of cells - secretory elongated shape arranged in a circle and releasing the essential oil and the second group of rounded cells located in the circle of secretory and accumulate essential oil. This type of glands found in leaves of birch.

1.2. Osmophoric - these are specialized fields glandular secreting essential oil. Located in petals or other parts of the color. They are composed of several layers of cells in some depth from which glandular are only those of the epidermis. The latter are covered with cuticle, which in turn is recovered with wax coating or impregnated with wax as a matter of color preserver. These epidermal cells viewed from above, are rectangular with blunt corners. Viewed from the side are rectangular or irregular amoeboid shape, while filled with essential oil swell out and acquire a conical shape. Layers below the epidermis are rich of storage substances. Discharge takes place in a short time and is linked to consumption of large quantities of storage substances. In this tissue essential oil is not delayed in all cells, a group of several cells. Between them remain free of oil cells that connect the inner tissue to the environment in the transmission of light, heat, etc. This type of gland is found in flowers of rose, violet, lily of the valley, lilac, jasmine, acacia, etc.

2. Endogenous receptacles

In materials with endogenous receptacles they are located inside the tissue, without direct outlet to the atmosphere and thus preserving the integrity of their flavor can not be felt. For this purpose it is necessary to prevent mechanical rupture to allow the contents of the receptacles to pour into the atmosphere. Such materials require grinding before extraction to reduce the path of penetration of solvent into the tissue. This type of receptacles are found in seeds, fruits and roots. Endogenous receptacles occur as secretory cells, secretory receptacles, divided on lizigenic and schizogenic, and large aromatic chambers.

2.1. Secretory cells - are scattered singly among cells and tissues contain various substances - oils,

tannins, mucilage, etc. There are such as spherical shape, elongated tubes or branched. Essential oil secretory cells are usually larger than neighboring cells, often their cell envelopes are harden and after forming the essential oil die. This cell type is found in rhizomes of iris, cinnamon, pepper, ginger, valerian, garlic, etc.

2.2. Secretory receptacles - formed in all parts of the plant species in form of round voids and channels in schizogenic or lizigenic way.

2.2.1. Schizogenic receptacles - is formed by secretory cells are retreating away and between them form a gap, which are collected separately from these secretions. This type of receptacles is paved by the secretory cells forming around the so-called glandular epithelium. In some species there are schizogenic channels. This type of receptacles occurs in fruit of coriander, aniseed, fennel, cumin, cloves, etc.

2.2.2. Lizigenic receptacles - is formed by dissolving the secretory cells. The secret, which fills them, formed before to dissolve the cells. Originally generally dissolve only a few cells, but then this process is carried and the neighbors. Therefore lizigenic receptacles are usually surrounded by more or less damaged cells. This type of receptacles is found in the bay leaf.

2.3. Large aromatic chambers - occur in all parts of the plant. They can be found in palisade parenchyma and sponge of leaves, while different species of plants and shifted to either. The dimensions of the chamber are greater than those of other cells. They are surrounded by two rows of secretory cells, such as those of outer row are always oblong in shape and interact with palisade and sponge parenchyma. Internal order cells, elongated or other shape surrounding the essential oil chamber. The chamber can be in spherical or irregular form, as it builds essential oil. The chambers are separated from the environment through the upper or lower epidermal cell layer. Occur in the leaves of St. John's wort, myrtle, rue, etc.

Large chambers occur in the peel of citrus fruits. Their cavity is spherical in shape and is also considerably larger than other cells. Outside is surrounded by a row elongated secretory cells.

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