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маг. К.А. Сасновская
Науч. рук. канд. пед. наук. А.М. Романова
(кафедра межкультурных коммуникаций и технического перевода)

THE MAIN BIOLOGICALLY ACTIVE SUBSTANCES OF PLANTS, THEIR CHARACTERISTICS AND APPLICATION

The flora is rich and diverse. Plants containing biologically active substances that can be used for medicinal purposes are called medicinal plants. Due to its wide distribution, availability and valuable properties, medicinal plants have been used since ancient times. At present, despite the great achievements in the field of drug synthesis, the use of medicinal plants is not only reduced, but also significantly increases. The pharmacological effect of medicinal products from plants depends on the content of biologically active substances in them, which have a diverse composition and belong to different classes of chemical compounds. Biologically active substances include: alkaloids, glycosides, tannins, coumarins, terpenoids, carbohydrates and etc. They are usually found in plants in small quantities and their accumulation in different organs of the plant is not the same.

Alkaloids are the important secondary metabolites are formed by a large variety of entities, including plants, animals, fungi, and bacteria. Alkaloids are low-molecular-weight structures and form approximately 20% of plant-based secondary metabolites. Alkaloids have antiproliferative, antibacterial, antioxidant potential, which can be used for the development of drugs, these are powerful poisons. It is well known that Socrates was poisoned by hemlock poison [1].

Carbohydrates are the primary fuel for our muscles and the brain. Eating a high carbohydrate diet will ensure maintenance of muscle and liver glycogen (storage forms of carbohydrate), improve performance and delay fatigue. Carbohydrates are a group of polyhydroxy aldehydes, ketones or acids or their derivatives, together with linear and cyclic polyols.

Compounds that yield one or more sugars upon hydrolysis are known as **glycosides**. A glycoside is composed of two moieties: sugar portion (glycone) and non-sugar portion (aglycone or genin). For example, the hydrolysis of salicin produces a glucose unit and salicyl alcohol. There are two major classes of isoprenoid glycosides: saponins and cardiac glycosides. Steroidal saponins are used in the commercial production of sex hormones for clinical use. For example, progesterone is derived from diosgenin [1].

Terpenoids are found in all parts of higher plants and occur in mosses, liverworts, algae and lichens. Terpenoids of insect and microbial origins have also been found. Many monoterpenes are the constituents of plant volatile oils or essential oils. These compounds are particularly important as flavouring agents in pharmaceutical, confectionery and perfume products. Tetraterpenes are represented by the carotenoids and their analogues, e.g. b-carotene, an orange colour pigment of carrots, lycopene, a characteristic pigment in ripe tomato fruit and capsanthin, the brilliant red pigment of peppers Carotenoids are found abundantly in plants, and have been used as colouring agents for foods, drinks, confectionery and drugs. The vitamin A group of compounds are important metabolites of carotenoids, e.g. vitamin A1 (retinol).

Phytosterols or plant sterols are steroid alcohols that occur naturally in plants. Example: b-sitosterol. Phytosterols found in plants have many applications as food additives and in medicine and cosmetics.

Phenylpropanoids are widespread in higher plants, especially in the plants that produce essential oils, for example, Tolu balsam yields a high concentration of cinnamic acid esters, cinnamon produces cinnamaldehyde, fennel is a good source of eugenol and star anise produces high amounts of anethole.

Lignans with antitumor activity, compounds that stimulate the central nervous system, and hepatoprotectors are of the greatest practical interest. Some lignans have estrogenic activity. Lignans are also antioxidants. Lignans can be found in red wine, whole grains, greens (cruciferous vegetables), but they are especially abundant in sesame seeds and flaxseeds. Flaxseed is the most concentrated source of lignans.

Many **coumarins** are used in sunscreen preparations for the protection against the sunlight, because these compounds absorb short-wave UV radiation (280 – 315 nm), which is harmful for human skin, but transmits the long-wave UV radiation (315 – 400 nm) that provides the brown suntan. A number of coumarins also possess antifungal and antibacterial properties.

Most **flavonoids** are potent antioxidant compounds. Several flavonoids possess anti-inflammatory, antihepatotoxic, antitumour, antimicrobial and antiviral properties. The antioxidant properties of flavonoids present in fresh fruits and vegetables are thought to contribute to their preventative effect against cancer and heart diseases. Rutin is probably the most studied of all flavonoids, and is included in various multivitamin preparations.

Tannins are often present in unripe fruits, but disappear during ripening. It is believed that tannins may provide plants with protection against microbial attacks. Tannins of plant origin (for example, from oak bark) are used in medicine as astringents. They have a characteristic astringent taste, and are also used in the food industry. Tannins are used for gastrointestinal disorders, heavy metal poisoning. Tannins are not toxic and many of them have P-vitamin activity.

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Студ. А.Д. Сохибова
Науч. рук. канд. пед. наук А.М. Романова
(кафедра межкультурных коммуникаций и технического перевода)

HOW POLLUTION IS CHANGING THE OCEAN'S CHEMISTRY

When carbon dioxide (CO2) is absorbed by seawater, chemical reactions occur that reduce seawater pH, carbonate ion concentration, and saturation states of biologically important calcium carbonate minerals. These chemical reactions are termed "ocean acidification" or "OA" for short. Calcium carbonate minerals are the building blocks for the skeletons and shells of many marine organisms. In areas where most life now congregates in the ocean, the seawater is supersaturated with respect to calcium carbonate minerals. This means there are abundant building blocks for calcifying organisms to build their skeletons and shells. However, continued ocean acidification is causing many parts of the ocean to become unsaturated with these minerals, which is likely to affect the ability of some organisms to produce and maintain their shells [1].

Since the beginning of the Industrial Revolution, the pH of surface ocean waters has fallen by 0.1 pH units. Since the pH scale, like the Richter scale, is logarithmic, this change represents approximately a 30 percent increase in acididy. Future predictions indicate that the oceans will continue to absorb carbon dioxide, further increasing ocean acidity. Estimates of future carbon dioxide levels, based on business as usual emission scenarios, indicate that by the end of this century the surface waters of the ocean could have acidity levels nearly 150 percent higher, resulting in a pH that the oceans haven't experienced for more than 20 million years.

The Biological Impacts. Ocean acidification is expected to impact ocean species to varying degrees. Photosynthetic algae may benefit from