

FLAVONOIDS - BIOLOGICALLY ACTIVE SUBSTANCES

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Abstract: *This article describes flavonoids, which are biologically active substances, their classification and biological significance.*

Keywords: *flavonoid, heterocycle, aglycone, glycosides.*

Аннотация: *В данной статье описаны флавоноиды, являющиеся биологически активными веществами, их классификация и биологическое значение.*

Ключевые слова: *флавоноид, гетероцикл, агликон, гликозиды.*

Flavonoids (from lat. flavus - yellow, lat. suf. - op-, greek. eidos - view) - phenolic compounds containing in their structure a fragment of diphenylpropane (C₆-C₃-C₆) and which are most often derivatives of 2-phenylchroman (flavan) or 2-phenylchromone (flavon). The term "flavonoid" was proposed in 1949 by the English scientist Geissman more than a century after the isolation of the first flavonoid quercetin (Quercus) not only for flavones - yellow substances, but also for other compounds of a flavonoid nature that have a different color - white or colorless (flavanones), orange (aurons, chalcones), red, crimson, blue (anthocyanins).

The chemical classification of flavonoids is based on three main features: the degree of oxidation of the C ring or propane fragment; heterocycle size (C); the position of the side phenyl.

The variety of flavonoids is also due to the peculiarities of the structure of functional groups and their location in the aglycone. Flavonoids are found both in free form, including in the form of methoxylated derivatives, and in the form of glycosides. Currently, all known flavonoid glycosides are divided into three groups. The first (main) group is represented by O-glycosides, in which sugars

are linked to the aglycone by a hemiacetal bond through an oxygen atom. O-glycosides, depending on the amount of sugars, position and order of attachment, are divided into monosides, biosides, diglycosides. Monosides are simpler compounds; biosides can differ in the sequence and order of sugar compounds, the size of oxide cycles and the configuration of glycosidic bonds, becoming more complex biosides can turn into triosides and oligosides, while the sugars in these compounds can be combined into straight or branched chains. Diglycosides contain sugars at two carbon atoms. The second group is represented by C-glycosides, or glycoflavonoids. They, in turn, are subdivided into C-monoglycosides, C-O-diglycosides, C-O-biosides. In glycoflavonoids, the carbohydrate substituents are linked to the aglycone through a carbon atom at the 6- and 8-positions. The third group of flavonoids includes complex compounds. They are acylated glycosides and, depending on the position of the acyl substituent, are divided into depsinoid-type glycosides and glycosides with an ester bond in sugar substituents. In depsinoids, aglycones are usually associated with aromatic acids (benzoic, p-hydroxybenzoic, protocatechuic, p-hydroxycinnamic, caffeic, ferulic, etc.)

In its pure form, flavanoids are crystalline compounds with a specific melting point, which are light yellow, yellow or yellowish green (flavones, flavonols), orange or orange-red (aurons), red or blue (anthocyanins). Quite often there are also colorless flavonoids - isoflavones, catechins, flavanones, flavanonols. Aglycones of flavonoids, as a rule, dissolve in ethyl ether, acetone, alcohols and are practically insoluble in water. Many methoxylated flavonoids (eg pinostrobin) dissolve in chloroform. Glycosides of flavonoids containing 1-2 sugars in a molecule (monosides, biosides, diglycosides), as a rule, are highly soluble in ethyl and methyl alcohols, aqueous alcohols (especially in 70% ethyl alcohol), n-butanol, and partially in acetone, ethyl acetate, but do not dissolve in chloroform and diethyl ether.

Flavonoid glycosides containing 3 or more monosaccharide residues in a molecule are readily soluble in water, partially in aqueous alcohols, but do not dissolve in strong alcohols, in chloroform and diethyl ether. Flavanoid aglycones and glycosides are odorless, but some of them have a bitter taste. For example, bitter substances. It is believed that their bitter taste is due to the structure of the carbohydrate component of neohesperidosis. Flavonoid glycosides have optical activity, which is used to determine the quality indicators of some standard samples (datiscin, rutin, hyperoside, etc.). One of the characteristic features of flavonoid glycosides is the ability to acid and enzymatic hydrolysis. The rate of hydrolysis and the conditions for its implementation are different depending on the structure of flavonoids. So, flavonol-3-glycosides are easily hydrolyzed when heated with weak solutions of mineral acids (0.1-2%), and 7-O-glycosides of flavones (cynaroside) are hydrolyzed under harsh conditions - when heated for 2 hours from 5-10 % mineral acids. On the contrary, 5-O-glycosides are hydrolyzed instantly even by weak acids, and without heating (tricin-5-O-glucoside). Flavonoids are subject to enzymatic hydrolysis, for example, glucosides (with a few exceptions) are quite easily cleaved by 3-glucosidase.

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