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Manufacture of All Kinds of Auto loom Fabrics and Natural Dye Fabrics.

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Betalains



The red color of beets comes from betalain pigments.

Betalains are a class of red and yellow indole-derived pigments found in plants of the Caryophyllales. They are most often noticeable in the petals of flowers, but may color the fruits, leaves, stems, and roots of plants that contain them.

Description



Swiss chard, showing one plant expressing yellow betaxanthins and another expressing red betacyanins.

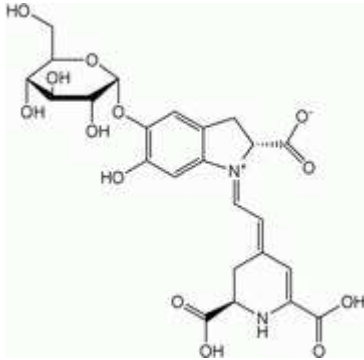
The name "betalain" comes from the Latin name of the common beet (*Beta vulgaris*), from which betalains were first extracted. The deep red color of beets, bougainvillea, amaranth, and many cacti results from the presence of betalain pigments.^[1] The particular shades of red to purple are distinctive and unlike that of anthocyanin pigments found in most plants. Betalains may occur in any part of the plant, including the petals of flowers, fruits, leaves, stems, and roots.

There are two categories of betalains:

- **Betacyanins** include the reddish to violet betalain pigments.
- **Betaxanthins** are those betalain pigments which appear yellow to orange.

Plant physiologists are uncertain of the function that betalains serve in those plants which possess them, but there is some preliminary evidence that they may have fungicidal properties.

Chemistry



Chemical structure of betanin.

It was once thought that betalains were related to anthocyanins, the reddish pigments found in most plants. Both betalains and anthocyanins are water-soluble pigments found in the vacuoles of plant cells. However, betalains are structurally and chemically unlike anthocyanins. For example, betalains contain nitrogen whereas anthocyanins do not.

It is now known that betalains are aromatic indole derivatives synthesized from tyrosine. They are not related chemically to the anthocyanins and are not even flavonoids. Each betalain is a glycoside, and consists of a sugar and a colored portion. Their synthesis is promoted by light.

The most heavily studied betalain is betanin, also called beetroot red after the fact that it may be extracted from red beet roots. Betanin is a glucoside, and hydrolyzes into the sugar glucose and betanidin.^[1] It is used as a food coloring agent, and the color is sensitive to pH. Other betalains known to occur in beets are isobetainin, probetainin, and neobetainin.

Other important betacyanins are amaranthine and isoamaranthine, isolated from species of *Amaranthus*.

Taxonomic significance



Flowers of the cactus *Mammillaria sp.* contain betalains.

Betalain pigments occur only in the Caryophyllales and some Basidiomycota (mushrooms). Where they occur in plants, they sometimes coexist with anthoxanthins (yellow to orange flavonoids), but never occur in plant species with anthocyanins.

Among the flowering plant order Caryophyllales, most members produce betalains and lack anthocyanins. Of all the families in the Caryophyllales, only the Caryophyllaceae (carnation family) and Molluginaceae produce anthocyanins instead of betalains. The limited distribution of betalains among plants is a synapomorphy for the Caryophyllales, though their production has been lost in two families.

Recently, betalain-like compounds have been discovered in carnivorous plants that were not previously considered related to the Caryophyllales, but which have been added to that order under the APG II system. Betalains are now known from species of *Drosera* (sundew) and *Nepenthes*.^[citation needed]

Economic uses



Inflorescences of *Amaranthus caudatus* (love-lies-bleeding) contain large quantities of betacyanins.

Betanin is commercially used as a natural food dye. It can cause beeturia (red urine and faeces) in some people who are unable to break it down. The interest of the food industry in betalains has grown since they were identified as natural antioxidants which may have positive health effects in humans.

The 'Hopi Red Dye' amaranth produces red flowers which the Hopi Amerindians used as the source of a deep red dye.