

## Reference Substances for Herbal Products

# Anthocyanins & Anthocyanidins

As one of the leading manufacturers internationally, PhytoLab offers over 1,100 extensively documented herbal reference substances of all classes of natural compounds. Our portfolio currently includes a total of 20 anthocyanins and 5 anthocyanidins.

Anthocyanins are water-soluble secondary plant metabolites that can occur in all parts of higher plants, including leaves, stems, roots, flowers and fruits. The name derives from the Greek: words *άνθος* (anthos) = flower and *κυανός* (kyanos) = blue). Depending on pH-value, anthocyanins may also appear orange, red and purple. In nature, anthocyanins are responsible for making bright-colored flowers and fruits attractive to pollinators or animals. Anthocyanins also act as a “sunscreen” and protect cells from damage due to exposure to UV-light. They may also act as antioxidants in the cell vacuoles. The antioxidant properties have been confirmed in vitro, although this effect is most likely limited in vivo due to low bioavailability of the intact anthocyanins. However, anthocyanin metabolites may have an indirect effect.

Plants rich in anthocyanins are e.g. blueberry, cranberry, and bilberry (*Vaccinium sp.*); raspberry and blackberry (*Rubus sp.*); blackcurrant (*Ribes nigrum*); cherry and plum (*Prunus sp.*); chokeberry (*Aronia sp.*); elderberry (*Sambucus sp.*); strawberry (*Fragaria sp.*); grape (*Vitis sp.*); eggplant (*Solanum melongena*); black soybean (*Glycine max* L. Merr.). Some less known anthocyanin-containing varieties of common foodstuffs exist, e.g. purple potatoes (*Solanum tuberosum*), purple corn (*Zea mays*) or purple carrots (*Daucus carota*).

### Currently available phyproof® anthocyanins & anthocyanidins

| Reference Substance         | Product # | Reference Substance          | Product # |
|-----------------------------|-----------|------------------------------|-----------|
| Cyanidin                    | 80022     | Delphinidin 3-sambubioside   | 82249     |
| Cyanidin 3-arabinoside      | 89614     | Malvidin                     | 80083     |
| Cyanidin 3,5-diglucoside    | 89615     | Malvidin 3,5-diglucoside     | 89727     |
| Cyanidin 3-galactoside      | 89463     | Malvidin 3-galactoside       | 80600     |
| Cyanidin 3-glucoside        | 89616     | Malvidin 3-glucoside         | 89728     |
| Cyanidin 3-rutinoside       | 80577     | Pelargonidin                 | 80084     |
| Cyanidin 3-sambubioside     | 89617     | Pelargonidin 3,5-diglucoside | 80334     |
| Cyanidin 3-sophoroside      | 80579     | Pelargonidin 3-glucoside     | 89753     |
| Delphinidin                 | 89625     | Peonidin                     | 80085     |
| Delphinidin 3,5-diglucoside | 89626     | Peonidin 3,5-diglucoside     | 80335     |
| Delphinidin 3-galactoside   | 89506     | Peonidin 3-glucoside         | 89754     |
| Delphinidin 3-glucoside     | 89627     | Petunidin 3-glucoside        | 89755     |
| Delphinidin 3-rutinoside    | 80735     |                              |           |



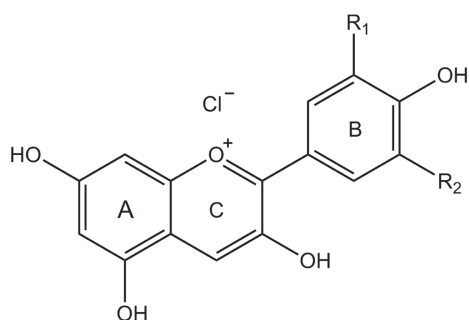
Anthocyanins belong to the class of natural compounds known as flavonoids. Their 15-carbon skeleton consists of two phenyl rings and one heterocyclic ring containing a positively charged oxygen atom. In nature, usually carboxylate anions of water-soluble acids would act as counter ions, while the pure compounds are most frequently isolated as chloride salts. The most common anthocyanins exhibit hydroxyl functions in positions 3, 5, 7 and 4'. The anthocyanidins are the aglycones of the anthocyanins, which most often bear a sugar moiety bound to position 3. Structural variation is usually achieved by the substitution pattern in the B-ring and differences in the glycosidic profile.

In **European Pharmacopoeia**, a specification for total content of anthocyanins, calculated as cyanidin 3-glucoside, is given in the monographs for **fresh bilberry fruit** and **fresh bilberry fruit dry extract, refined and standardised**. The latter monograph also specifies a maximum limit for anthocyanidins, calculated as cyanidin, and requests a certain chromatographic profile to confirm identity. A minimum content of procyanidins, expressed as cyanidin, is given in the monograph on **hawthorn berries**.

In **United States Pharmacopoeia**, the dietary supplements monograph on **powdered bilberry extract** specifies a minimum content of anthocyanins, calculated as cyanidin 3-glucoside, and a maximum limit for anthocyanidins, calculated as cyanidin. Requirements on chromatographic profiles including peak intensities of various anthocyanins are given.

For a reliable quantitative analysis of anthocyanins & anthocyanidins well characterized reference substances are essential. Currently we offer 25 anthocyanins & anthocyanidins, all of them supplied together with a comprehensive certificate of analysis. Due to the positive charge of the molecule the counter ion has to be taken into account. For all anthocyanins & anthocyanidins characterized as primary reference substances, chloride was determined quantitatively and considered as an impurity in the calculation of the absolute content, which therefore refers to the pure anthocyanin or anthocyanidin only. For up-to-date information on prices and specifications please contact us or visit our webshop at <http://phyproof.phytolab.de>.

### Structure of common anthocyanidins



| Anthocyanidin | R <sub>1</sub>   | R <sub>2</sub>   |
|---------------|------------------|------------------|
| Cyanidin      | OH               | H                |
| Delphinidin   | OH               | OH               |
| Malvidin      | OCH <sub>3</sub> | OCH <sub>3</sub> |
| Pelargonidin  | H                | H                |
| Peonidin      | OCH <sub>3</sub> | H                |
| Petunidin     | OH               | OCH <sub>3</sub> |

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