

Periodic Graphics

A collaboration between C&EN and
Andy Brunning, author of the popular
graphics blog *Compound Interest*

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To see more of
Bunning's work, go to
compoundchem.com.
To see all of C&EN's
Periodic Graphics, visit
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The chemistry of hydrangea color changes

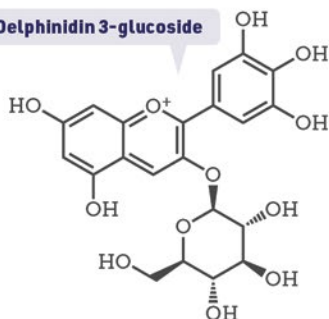
PERIODIC
GRAPHICS

Hydrangeas change color depending on soil acidity. Here we take a look at the science behind their varying colors and how you can fine-tune their hues with soil additives.

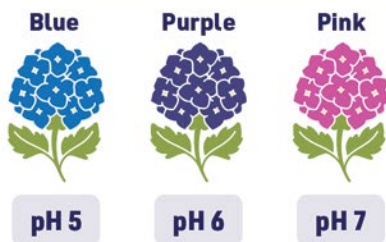
Hydrangea hues

As with many other plants, the main pigments contributing to color in hydrangeas are anthocyanins. Delphinidin 3-glucoside, which produces a pink-red color, is the primary anthocyanin in hydrangeas.

Delphinidin 3-glucoside



The color of hydrangeas' petallike structures, called sepals, is sensitive to soil acidity. This sensitivity is unique to hydrangeas. The soil's pH can create blue, purple, or pink sepals.



pH, aluminum, and hydrangea color

Hydrangeas' varying shades depend on the presence or absence of aluminum ions in the soil. Aluminum in the soil usually takes the form of silicates or oxides. Lower soil pH can release aluminum ions.

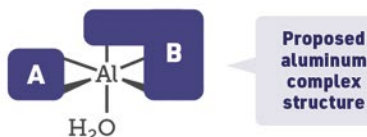


Above pH 5.5



At or below pH 5.5

In hydrangea sepals, aluminum ions form a complex with delphinidin 3-glucoside and phenolic copigments, making the sepals blue. When the complex is absent, the anthocyanin colors the sepals pink. A mix of the complexed and unbound anthocyanins results in purple.



Proposed
aluminum
complex
structure

A Delphinidin 3-glucoside

B 3-O-caffeoylquinic acid or
5-O-caffeoylquinic acid or
5-O-p-coumaroylquinic acid



Changing hydrangea color

You can tune your soil's pH to change the color of hydrangeas.



To make blue

Reduce soil pH by adding sulfur or aluminum sulfate.



To make pink

Increase soil pH by adding lime (calcium oxides and hydroxides).

It takes weeks for soil pH changes to alter hydrangeas' colors.