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 Brunning's work, go to **compoundchem.com.** To see all of C&EN's Periodic Graphics, visit **cenm.ag/periodicgraphics.**

BAKING SODA VERSUS BAKING POWDER

Baking soda and baking powder are two common ingredients in baked goods. Here we take a look at what these leavening agents are made of and how they help your cookies, muffins, and cakes rise.

WHAT ARE RAISING AGENTS?

Carbon dioxide makes doughs and batters rise during baking. The gas can be produced by yeast, other microorganisms, or chemical raising agents.

BAKING SODA

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Sodium bicarbonate

$NaHCO_3$

Heat or acidity breaks down sodium bicarbonate to release carbon dioxide. If a dough or batter is acidic enough, no acid needs to be added with the baking soda.

$NaHCO_3 + HX \longrightarrow CO_2 + NaX + H_2O$
(acid) (neutral salt)

$2NaHCO_3 \xrightarrow{heat} CO_2 + Na_2CO_3 + H_2O$

Baking soda is alkaline—too much causes bitter flavors in baked products.

Potassium bicarbonate — Used to reduce sodium content of baked goods.

Ammonium bicarbonate — Produces carbon dioxide and ammonia gases. Used in crisp cookies and crackers.

BAKING POWDER

BAKING POWDER

Sodium bicarbonate

Acid or acidic salt

Most baking powders are double acting, releasing gas during both mixing and baking.

During mixing

A soluble acid reacts with the baking soda.

During baking

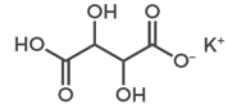
A less soluble acid reacts with the baking soda.

Different acid ingredients affect gas production differently.

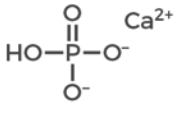
BAKING POWDER ACIDS

Cream of tartar (potassium bitartrate) is a soluble acid and reacts during mixing.

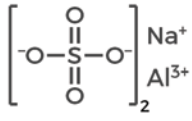
Potassium bitartrate



Double-acting baking powders often combine monocalcium phosphate, which reacts with baking soda during mixing, with sodium aluminum sulfate, which reacts during baking. Some other baking powders use pyrophosphate salts, whose different granulations can vary their reaction times.



Monocalcium phosphate



Sodium aluminum sulfate

PERIODIC GRAPHICS