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Baking Chemistry: Differences in Uses among Chemical Leaveners

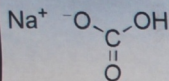
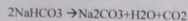
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Baking Soda: Sodium Bicarbonate (NaHCO_3)



A leavening agent which reacts, when combined with an acid such as buttermilk, yogurt or molasses producing carbon dioxide bubbles which cause a dough to rise.

Since it reacts with water, baking soda should be mixed thoroughly with dry ingredients before adding liquids. This will insure even leavening.

Results (Assuming recipe calls for only Baking Soda): As expected, delicious cookies

No chemical agent to induce leavening.

Results: dense, hard, brittle, and unevenly baked cookies

BAKING CHEMISTRY: DIFFERENCES IN USES AMONG CHEMICAL LEAVENERS: BAKING SODA, BAKING POWDER, AND CREAM OF TARTAR

Diana Christopher - Great Harvest Bread Company and Parkland College

As the holiday season rapidly approaches, many holiday bakers may notice some interesting discrepancies between recipes. Some call for baking powder, others call for baking soda. Others still call for cream of tartar—each of these three substances are leavening agents so what is the difference, if any, among the three and can they be substituted for each-other?

First things first, what is a "leavening agent"? A leavening agent is a substance that allows for the release of carbon dioxide, which in turn allows the baked good to rise.

There are two classifications of leavening agents; biological (yeast) and chemical (baking soda, baking powder, and cream of tartar)—in this instance, we will only be looking at the three chemical leaveners.

CASE:

We explore the results of varying the leavener in a chocolate chip cookie recipe that calls for baking soda and compare with expected results.

CONCLUSION:

Can they always be substituted for one another? Short answer, no. However, with some extra effort (and in certain instances), one can produce a reaction that properly leavens properly.

Substitution Situations

You cannot make your own baking soda from baking powder, since the main component of baking powder is baking soda

If a recipe calls for baking powder and you don't have any on-hand, you can make your own (single acting) baking powder by mixing:
1/4 teaspoon of baking soda, 1/2 teaspoon of cream of tartar, and 1/4 teaspoon of cornstarch (equivalent to 1 teaspoon on baking powder)

Cream of Tartar is it's own entity and as such, you are better off purchasing if needed rather than trying to make your own

Baking Powder:



A leavening agent made of three components; an acid, a base, and a filler. A common mixture includes cream of tartar (acid), baking soda (base) and cornstarch (filler) [$\text{NaHCO}_3 + \text{KC}_4\text{H}_5\text{O}_6 + \text{corn starch}$]. When combined with a liquid, carbon dioxide gas bubbles are released causing dough to rise.

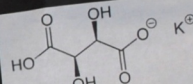
Baking powder is available in 2 varieties, single-acting and double-acting. Single acting baking powder bubbles only when it gets wet. Double-acting baking powder reacts twice—once when it reacts with liquids during mixing, and again when it's exposed to higher temperatures in the oven.

Results: (Assuming recipe calls for baking soda): The cookies appear to be okay, but upon further inspection it is determined to be dry, hard, and crumbly

Cookie Recipe Used

- 2 1/4 cups all-purpose flour
- 1 teaspoon baking soda
- 1 teaspoon salt
- 1 cup (2 sticks) butter, softened
- 3/4 cup granulated sugar
- 3/4 cup packed brown sugar
- 1 teaspoon vanilla extract
- 2 large eggs
- 2 cups (12-oz. pkg.) NESTLÉ® TOLL HOUSE® Chocolate Morsels

Cream of Tartar i.e. Potassium bitartrate ($\text{KC}_4\text{H}_5\text{O}_6$)



When used on it's own, cream of tartar provides more of a stabilizing affect for baked goods (seen a lot in angel food recipes to provide structure to the sugar and egg whites).

Precursor to baking soda and byproduct of the winemaking process



Results (Assuming recipe calls for only Baking Soda): A hard brittle cookie

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