Baking powder is a dry chemical raising agent used to increase the volume and lighten the texture of baked goods such as muffins, cakes, scones and North American biscuits. Baking powder works by releasing carbon dioxide gas into a batter or dough through an acid-base reaction, causing bubbles in the wet mixture to expand and thus leavening the mixture. It is used instead of yeast for end-products where fermentation flavors would be undesirable[1] or where the batter lacks the elastic structure to hold gas bubbles for more than a few minutes.[2] Because carbon dioxide is released at a faster rate through the acid-base reaction than through fermentation, breads made by chemical leavening are called quick breads.

Most commercially-available baking powders are made up of an alkaline component (typically baking soda, also known as sodium bicarbonate), one or more acid salts, and an inert starch (cornstarch in most cases, though potato starch may also be used). Baking soda is the source of the carbon dioxide,[3] and the acid-base reaction is more accurately described as an acid-activated decomposition of baking soda, which can be generically represented as[4]

$$NaHCO_3 + H^+ \rightarrow Na^+ + CO_2 + H_2O$$

The inert starch serves several functions in baking powder. Primarily it is used to absorb moisture, and thus prolong shelf life by keeping the powder's alkaline and acidic components from reacting prematurely. A dry powder also flows and mixes more easily. Finally, the added bulk allows for more accurate measurements.[5]

The acid in a baking powder can be either fast-acting or slow-acting.[6] A fast-acting acid reacts in a wet mixture with baking soda at room temperature, and a slow-acting acid will not react until heated in an oven. Baking powders that contain both fast- and slow-acting acids are double acting; those that contain only one acid are single acting. By providing a second rise in the oven, double-acting baking powders increase the reliability of baked goods by rendering the time elapsed between mixing and baking less critical, and this is the type most widely available to consumers today. Common low-temperature acid salts include cream of tartar and monocalcium phosphate (also called calcium acid phosphate). High-temperature acid salts include sodium aluminum sulfate, sodium aluminum phosphate, and sodium acid pyrophosphate.[7]

Generally (in countries where the cup is used as a standard measure in cookery) one teaspoon (5ml) of baking powder is used to raise a mixture of one cup (200-250ml) of flour, one cup of liquid, and one egg. However, if the mixture is acidic, baking powder's additional acids will remain unconsumed in the chemical reaction and often lend an unpleasant chemical taste to food. High acidity can be caused by ingredients like buttermilk, lemon, yoghurt, citrus, or honey. When excessive acidity is present, some of the baking powder is replaced with baking soda. For example, one cup of flour, one egg, and one cup of buttermilk requires only ½ teaspoon of baking powder—the remaining leavening is caused by buttermilk acids reacting with ¼ teaspoon of baking soda.[citation needed]

The opposite is sometimes true, too. In baking powders that contain sodium acid

pyrophosphate, excess alkaline substances can sometimes deprotonate the acid in two steps instead of the one that normally occurs, resulting in an offensive bitter taste to baked goods. Calcium compounds and aluminum compounds do not have that problem though, since calcium compounds that deprotonate twice are insoluble and aluminum compounds do not deprotonate in that fashion.

Moisture and heat can cause baking powder to lose its effectiveness over time, and commercial varieties have a somewhat arbitrary expiration date printed on the container. Regardless of the expiration date, the effectiveness can be tested by placing a teaspoon of the powder into a small container of hot water. If it fizzes energetically, it's still active and usable.[13]
[edit] Substituting in recipes

Baking powder is generally just baking soda mixed with an acid, and a number of kitchen acids may be mixed with baking soda to simulate commercial blends of baking powder. Vinegar (dilute acetic acid), especially white vinegar, is also a common acidifier in baking; for example, many heirloom chocolate cake recipes call for a tablespoon or two of vinegar.[14] Where a recipe already uses buttermilk or yogurt, baking soda can be used without cream of tartar (or with less). Alternatively, lemon juice can be substituted for some of the liquid in the recipe, to provide the required acidity to activate the baking soda. In China, a small amount of powdered coal may be added to baking soda to simulate baking powder.[15]

In times past, when chemically manufactured baking soda was not available, ash water was used instead, especially in confectionery. Wood ash is also weakly alkaline. To prepare ash water, one used a fistful of ash from the fireplace in a big pot of water. Ash from solid woods, such as the olive tree, is preferred, whereas resinous woods, like pine, cannot be used. The ash water is given a boil, then left overnight to settle. The water is then filtered through a cloth and is ready to use. Many traditional recipes call for ash water instead of baking soda, because of some unique qualities: for example, ash water dripped on hot vegetable oils congeals into a gel-like mixture.

Source