

Baking powder 101: Rising to the occasion



This article by Karla Pretorius-Verneel, Synercore's senior R&D technologist in baking, unpacks the world of baking powder – a key ingredient for achieving those light and fluffy baked goods.

Baking powder is a well-known raising agent used in a wide variety of baked goods including cakes and muffins and the development thereof has been recorded as early as 1843 in England, and 1850 in America. It is typically used in confectionery baked items where the flavour of yeast and fermentation is undesirable. Baking powder can be defined as a dry chemical leavening agent which typically consists of three main components including a base (sodium bicarbonate; NaHCO_3), an acid (such as cream of tartar) and starch which acts as a buffer to prevent premature reaction between the base and acid components (corn starch most commonly used).

THE SCIENCE BEHIND THE RISE

When baking powder is added to a recipe, the main object is for liberation of carbon dioxide (CO_2). The CO_2 produced is subsequently entrapped in a batter or dough to create a desired voluminous, fluffy texture in the baked product. For the chemical reaction where CO_2 is released to take place, water needs to be added to baking powder. Addition of water allows the acid and base components to react, leading to release of CO_2 from the sodium bicarbonate which in turn inflates the dough. More CO_2 is produced when heat is introduced as NaHCO_3 undergoes thermal decomposition at temperatures in excess of 80°C , producing one molecule of CO_2 for every two molecules of NaHCO_3 . Although sodium bicarbonate, commonly known as baking soda, can be used on its own, it is generally only used in recipes where an acid component such as lemon juice or buttermilk is already used in the recipe allowing the NaHCO_3 to undergo an acid-base reaction. In this case a single CO_2 molecule is released for every one NaHCO_3 molecule, which implies that half the amount of baking soda is required to get the same amount of volume and fluffiness obtained when using baking powder. Recipes that do not contain



an acidic component will generally use baking powder, which consists of one or a combination of acid components as discussed above.

Baking powder is classified by its rate of reaction (ROR) which represents the percentage of CO_2 released by the acid-base reaction and can be grouped into three different classes. Firstly, and most commonly, double acting baking powder contains a mixture of leavening acids which reacts immediately when liquid is added, and again when heat is introduced. Double acting baking powder only reacts partially at low temperatures to form a smooth batter, but typically requires higher temperatures to complete the reaction. Secondly, fast-acting baking powder releases most of its potential gas volume during the first few minutes of contact with liquid, creating the need to process the batter or dough relatively quickly. Thirdly, in contrast to fast-acting baking powder, slow-acting baking powder releases no gas when a liquid is added and requires heat to enable and complete the reaction.

BEYOND LEAVENING

Apart from its function as leavening agent, baking powder can also significantly influence crumb structure, moisture absorption and crust formation in baked goods. Crumb structure is influenced by the air pocket arrangement created by

the CO_2 gas produced by baking powder, which will affect the distribution and size of the air pockets leading to a more fine or more coarse crumb structure. Moisture absorption in baked goods can be negatively affected when too much baking powder is added, causing quick dry-out which will lead to a crumbly texture. Adding the optimal amount of baking powder generally yields a light and fluffy texture. However, when too much baking powder is added the batter or dough will overexpand, resulting in a cracked and uneven crust. Furthermore, adding too much baking powder, or using a baking powder with incorrect composition, can also affect the flavour of baked goods resulting in a bitter aftertaste. The addition of baking powder to baked confectionery items such as sponge cakes, biscuits, muffins, and scones is crucial as it will ultimately not only act as raising agent, but will also influence physio-chemical, textural, sensory, and aromatic properties of baked goods. The correct usage level of baking powder will result in tender and moist baked goods and by understanding the chemical reaction of baking powder and the interaction thereof with other ingredients, it can aid baking consistently high-quality products. 🌱

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