



# OPTIMIZING YOUR CHEMICAL LEAVENING SYSTEM

Arm & Hammer™, a brand of Church & Dwight's Performance Products Group, is a leading sodium bicarbonate supplier, providing materials across the entire world. Sodium bicarbonate's most widespread use is as a chemical leavening agent for baked goods. Commonly known as baking soda, sodium bicarbonate releases carbon dioxide (CO<sub>2</sub>) gas when reacted with an acid or subjected to heat. The CO<sub>2</sub> bubbles cause batter and dough to rise, resulting in lighter biscuits, cakes, pancakes, cookies and other baked goods. Sodium bicarbonate is a key ingredient in baking powders, self-rising flours and packaged baking mixes. It is also used to develop light textures in candies such as brittles and crisps.

Church & Dwight offers different types and grades of bicarbonates that enable formulators to achieve their goals. From improved shelf stability to healthier nutritional statements or cleaner labels, we can help optimize results. Read further to learn which grade of Arm & Hammer sodium bicarbonate is best for your specific application and challenge.

## Enhance Your Leavening System With the Right Bicarbonate

Whether it's sodium bicarbonate, available in four grades specifically for baking, Flow K™ Potassium Bicarbonate or Ammonium Bicarbonate, Arm & Hammer offers targeted leavening qualities that are well-suited to meet most baking requirements.





### Bicarbonate Solutions

- Sodium Bicarbonate Grade 1 Powdered, the industry standard for scratch baking, dissolves rapidly to assure quick, complete availability for reaction with the acid ingredients.
- Sodium Bicarbonate Grade 1 TFF is treated with tricalcium phosphate to improve flow quality. Like regular grade, it dissolves rapidly to assure quick, complete availability for reaction with the acid ingredients. The flow aid can provide some protection against pre-reaction of the leavening package in pre-mixes.
- Sodium Bicarbonate Grade 2 Fine Granular is the product of choice for more challenging stability applications such as baking powders or dry mixes with higher levels of acidic components such as corn bread and muffins.
- Sodium Bicarbonate Grade 4 Granular is like Grade 2 but with a narrower particle size range that makes it especially useful in refrigerated doughs to limit pre-reaction with the acid ingredients.
- Flow K Potassium Bicarbonate performs exceptionally well as a replacement for sodium bicarbonate in most chemically leavened products. Never bitter, it can enhance perception of sweetness in finished goods.
- Ammonium Bicarbonate reacts rapidly in the presence of moisture and/or heat to release CO<sub>2</sub> and ammonia (NH<sub>3</sub>) gases that contribute to leavening. Used in this way, ammonium bicarbonate leaves behind no residue for a positive impact on clean labels.

- Tortilla Blend™ is a unique sodium bicarbonate product formulated to produce leavening reactions at specific stages in the production of wheat flour tortillas. Used in combination with conventional leavening acids, Tortilla Blend helps optimize leavening performance.

### Frozen/Refrigerated Dough

Chemical leavening with bicarbonates keeps these products convenient. Frozen dough can be placed directly from the freezer or refrigerator into a cold oven. Chemical leavening is much more stable and tolerant of adverse storage conditions than yeast, ready to perform 100% of its action in the short proofing time.

### Bicarbonate Recommendation:

- Sodium Bicarbonate Grade 2 Fine Granular
- Sodium Bicarbonate Grade 4 Granular

### Pre-Mixes

Sodium bicarbonate is typically used in conjunction with a combination of a fast-acting leavening acid such as monocalcium phosphate (MCP) and a slower, heat-activated leavening acid such as sodium acid pyrophosphate (SAPP). This leavening system releases carbon dioxide in a controlled way, creating gas pockets in the batter. These pockets are preserved as voids as the proteins warm, extend and gelatinize during baking. The leaveners provide volume to the cakes that impacts cell structure, “bite”, finished product pH, crumb color, crust color and taste.

### Bicarbonate Recommendation:

- Sodium Bicarbonate Grade 1 TFF
- Sodium Bicarbonate Grade 2 Fine Granular

### Cookies

For most cookies, it is very important to control the diameter and thickness (spread) within a narrow range. The use of sodium, potassium and ammonium bicarbonate contribute to the physical attributes of the cookie such as height, diameter, surface cracking and grain. Bicarbonates also function to control the pH of the system, which impact the flavor and color of the cookie.

### Bicarbonate Recommendation:

- Sodium Bicarbonate Grade 1 Powdered
- Sodium Bicarbonate Grade 1 TFF
- Sodium Bicarbonate Grade 2 Fine Granular
- Flow K Potassium Bicarbonate
- Ammonium Bicarbonate

### Crackers

Crackers can be divided into two basic categories: soda crackers (saltines) and snack crackers (sprayed and savory). A third group consists of graham crackers, which are made with higher levels of sugar.

Leavening can be accomplished either by yeast fermentation or by chemical leavening. Most yeast leavened crackers (saltines) are processed using a sponge-and-dough fermentation process. The bicarbonates serve to neutralize the acids formed from the fermentation reaction. Chemically leavened crackers are processed using the carbon dioxide produced from the reaction of the bicarbonate with an acidic salt. Sodium, potassium and ammonium bicarbonate function as leaveners to provide gas release that results in the rise of the cracker. Cracker height and texture depend on the use of bicarbonates for proper leavening.

### Bicarbonate Recommendation:

- Sodium Bicarbonate Grade 1 Powdered
- Sodium Bicarbonate Grade 1 TFF
- Sodium Bicarbonate Grade 2 Fine Granular
- Flow K Potassium Bicarbonate
- Ammonium Bicarbonate



# Formulations

## Baking Powder Biscuit

Ingredient	% Flour Weight Basis
Flour	100
Water	54.0
Shortening	26.0
Nonfat Dry Milk	10.0
Sugar	6.0
Salt	2.0
Sodium Acid Pyrophosphate	2.0
Sodium Bicarbonate*	1.5

\*Potassium bicarbonate may be used at appropriate substitution ratio.

## Typical Self-Rising Pizza Crust Formula

Ingredient	% Flour Weight Basis
Flour	100
Salt	1.75
Sugar	2.00
Oil	2.00
Leavening Acid (SALP)	0.75
Sodium Bicarbonate	0.75
Yeast (Compressed)	0.25
Water	50.00
Hard Fat Flakes (Optional)	8.00
Reducing Agent	as required

## Soda Crackers

Ingredient	% Flour Weight Basis
<i>Sponge</i>	
Soft Wheat Flour	60
Water	30
Instant Yeast	0.1
<i>Dough</i>	
Soft Wheat Flour	40
Cracker	4
Shortening	12
Diastatic Malt Syrup	1.5
Salt	1.5
Sodium Bicarbonate	1



# Industry Trends and Leavening Solutions

## **New Label Requirements**

Clean and clear labeling is a driving trend in the food industry today. Consumers not only want a short list of ingredients but are also looking for ingredients that they believe are functional. New labels will require clearly listed serving size information, detailed calorie data and the amount of added sugars, as well as the addition of more vitamins and minerals. Bicarbonates and leavening phosphates are safe, functional ingredients that provide more than just aeration and rise to baked products. The profile of a chemical leavening system has an impact on color, taste, appearance and shelf life. Organic labeling guidelines allow bicarbonates and many phosphates to be used as an ingredient or in a processed organic food.

## **Removal of Partially Hydrogenated Oils**

These artificial trans fats used in processed foods are no longer Generally Recognized as Safe (GRAS). Food manufacturers have until 2018 to remove partially hydrogenated oils (PHOs) and to reformulate. Currently, many food processors are still reformulating their baked goods and refrigerated doughs. One challenge many formulators face is the retention of baked volume. Increasing the overall leavening system will maintain the required aeration and ensure the desired structure of the finished product. Additionally, shelf life is affected by the removal of PHOs, although modifications of the leavening system can have a positive impact on this effect.

## **Sugar and Salt Reduction**

Leavening options for reduced-sugar formulations include Flow K Potassium Bicarbonate and calcium leavening acids to provide greater sweetness. Adjusting the leavening system balance will address some of the browning changes that result from cutting sugar in a formulation. Last but not least, adjusting the leavening system to occur earlier in the baking process is needed to offset the impact of reduced sugar on the set of the product.

Arm & Hammer Flow K Potassium Bicarbonate may be used in place of sodium bicarbonate to leaven breads, cakes, pancakes, muffins and cookies. It can reduce sodium levels while continuing to maintain overall quality, integrity and flavor of the baked product. Low-sodium or no-sodium baking powders can also be formulated with Flow K Potassium Bicarbonate. Additionally, ammonium bicarbonate, calcium-based phosphates, aluminum phosphates and blends can be substituted in a leavening system to lower sodium levels.

Whether adapting a recipe to meet new dietary guidelines or adjusting color, texture or spread, visit [www.ahperformance.com](http://www.ahperformance.com) to learn which bicarbonate product is right for your unique needs.