

# Fermentation



## A Natural Process With Myriad Benefits

History proves that we learn from our mistakes. Observation, as well as trial and error, have led to many discoveries and successes. This is as true with fermentation as it is with the microwave oven and Velcro. One could say virtually every fermented food was a result of an accidental action — a brilliant discovery! Long before microorganisms were understood, or even the existence of these “little powerhouses” recognized, mankind enjoyed and reaped their attributes and benefits. Attributes can be identified as flavor, texture, and functionality. Key benefits include preservation, shelf-life, and sustainability.

Fermentation is indeed an ancient process, used by humans for hundreds of years, and it is at the core of many things we enjoy in life: from coffee, tea, chocolate, alcoholic beverages, sausage, bread, cheese, pickled vegetables to a myriad of other food products and ingredients.

One can barely walk down the street these days or read a blog without tripping over “do-it-yourself” cheesemaking or recipes for homebrewing. Fermented foods are all the rage, but they are popular for many reasons beyond current fads.

“Fermentation is simply the process of putting nature to work.”

Microorganisms utilize some of the natural components in foods (sugars, proteins and fats) as an energy source for their metabolism and growth. The fermentation process is self-serving for the organism. It has become obvious that some of the by-products from their fermentation provide desirable attributes for many kinds of foods and beverages.

Fermentation can refer to the chemical conversion of sugars to ethanol (alcoholic beverages), to using yeasts for the leavening of bread (CO<sub>2</sub> production), or for the acidification and preservation of foods with the production of lactic acid, such as in the production of yogurt and countless dairy products. Over the years, this process has been employed, and at times was solely used, as a reliable method of food preservation. Fermentation is also desirable from a health standpoint, increasing the digestibility of foods or the availability of various nutrients in the gut.

It has become a perfected art through science, as food manufacturers needed efficiencies to optimize production processes. Today, bacteria used in food production have been carefully isolated and tested. For example, many bacteria can produce lactic acid, but depending on the substrate provided (nutrients for bacterial growth) and culture conditions, they can also yield other desirable compounds.

Today, food scientists use nature to their advantage. Bacterial fermentations have an unlimited potential to provide many flavor and textural attributes desired for the development of new food products. Manipulation of various substrates and growth parameters can unlock the potential of bacteria to the product developer's advantage. Control of the fermentation process indeed yields optimal solutions to formulation challenges.



## Fermented products are part of a rapidly growing market.

According to market research, the global fermentation market reached \$47.4 billion in 2016<sup>1</sup>. North America currently holds the largest share of the market, while Asia is projected to have the largest market growth potential.

## How Does Fermentation Play a Role in Dairy?

In the world of food ingredients, flavors play a key role and often determine the success of a product in the marketplace. The process of fermentation adds layers upon layers of complexity in foods and drinks.

Dairy-derived flavors are widely used in numerous food applications such as snacks, cheese sauces, bakery and confectionary products, dressings, soups, and many other products. There could be well over 400 varieties of cheese consumed around the world. The major varieties have unique flavor and texture, which is due not only to the type of milk used, but also to the specific microbial cultures applied for their production, enzymes, and ripening conditions.

<sup>1</sup> Global Fermented Ingredients Market Analysis and Trends, Industry Forecast to 2025. Research and Markets, 2017. Dublin, Ireland.

In the past, flavoring products with a dairy aroma was done by using traditional dairy products such as cream, butter, or cheese, or, at times, using extracts of products of distillation. A drawback of this approach was the lack of shelf-stability and the relative weakness of the flavoring, hence, needing to use large quantities of material; a formulation (bulk) and cost challenge.

Modern industrial processes utilize defined lactic acid bacteria as starters for fermented dairy products. The most common lactic acid bacteria (*Lactococcus* and *Lactobacillus* species) are responsible for the acidic taste from the lactic acid elaborated through their metabolic process. Lactose, a source of energy for bacteria, is metabolized for their growth, resulting in lactic acid — which is recognized not only as a flavorful compound, but also as a powerful preservation agent.

In addition, different cultures can be used to produce other acids; for example, propionic acid-producing bacteria can be added to deliver the characteristic flavor associated with Swiss cheese. Other bacteria can be added to provide a unique buttery taste, and/or some of the more astringent flavors found in yogurt, buttermilk, and sour cream.

## Dialing in Flavor Notes & Clean Label Advantages

**Cost reduction:** There is no doubt that it is important to reduce manufacturing and storage costs to keep products competitive with other food options. Unfortunately, cheese flavor development is highly influenced by these factors. Over the years, milk prices have increased, and this makes the use of cheese (or cream) as a simple starting material less attractive. A lot of research has been directed towards the selection of specific fermentation agents and substrates to produce dairy-like flavors which are more cost-effective.

Food scientists can use flavors produced through fermentation, rather than the traditional cheese-making process, to achieve a desired organoleptic profile. One can also achieve significant cost savings through greater efficiencies of production and well-regulated process.

**Consistency and shelf-life:** Consumers expect consistency, the same flavor from bag to bag, bite to bite. The ability to precisely control a fermentation allows the flavor manufacturer to consistently dial-in optimal conditions to define the end product.

The natural flavorings also tend to be more stable over time than block cheese, which continues to age during storage. This results in a consistent flavor profile and extended shelf life, which are critical factors for product developers.

**Clean Label:** Today's consumers demand to know what they are eating. They pay attention to the additives, chemicals, artificial flavors, sodium, GMOs, and many other things in their food. Fermentation allows ingredient manufacturers to provide flavors that present a clean label. The substrate used in a fermentation will define what is likely to appear on the label.

If the flavor being derived from fermentation requires Certifications such as Organic, non-GMO, Halal, Kosher or others, a simple change of the substrate to meet those requirements is necessary and certified accordingly.

## ASCENTRA® can lower sodium content by 25 to 50 percent in a broad range of food systems <sup>2</sup>.

**Innovation:** The flexibility of fermentation technology opens the door for innovation, allowing food scientists and product developers to extend their capabilities and create flavors that consumers love. It can also serve as a stepping stone for other flavor enhancing concepts. Take for example, ASCENTRA®, which assists with achieving lower levels of sodium chloride in commercially manufactured foods. This convenient and clean label, powdered ingredient created by DairiConcepts® is a product of fermentation. Giving the perception of “salty” and other savory nuances, the product is made from a proprietary, whole-milk based fermentation process that produces potassium glutamate. Ascentra can lower sodium content by 25 to 50 percent in a broad range of food systems.

The food industry took notice of Ascentra in February of 2018 when the American Society of Baking (ASB) honored DairiConcepts with an ASB Innovation Award in the Health, Wellness, and Nutrition category for Ascentra.

<sup>2</sup> DairiConcepts, L.P. The Tasteful Way to Reduce Sodium, 2016.

## Partnering with The Right Ingredient Company: The Core to Your Success

DairiConcepts has screened several hundred food-safe, commercially available bacteria and enzymes. The bacteria and enzymes have been challenged in several substrates, primarily derived from dairy components, but other substrates such as grains, legumes, and non-dairy sugars have also been tested. Thousands of fermentations have been conducted and catalogued. A team of DairiConcepts sensory specialists participated in the characterization of the resulting fermentations.

Success of a fermentation ultimately depends on customer acceptance. Several dozen prospective flavors have been developed. In most cases, these flavors can be labeled as cultured milk, cream, lactose, therefore avoiding terms such as “other natural flavors”, “flavor added,” or some chemical names which may not be desirable from a consumer standpoint.

The advantage offered by DairiConcepts is vertical integration and traceability. DairiConcepts has control over milk, cheese, fermentation, and spray drying capacity. This offers optimal control and traceability — desirable attributes for the food technologist and product developer.

Because of the versatile nature of fermentation, a few key building blocks can be rearranged into a multitude of different flavors, each unique in their use. Input from customers and scientists on the exact needs for their projects has thus far provided DairiConcepts’ greatest successes and can open new opportunities for growth.

Finally, many of these flavorings can be certified Halal, Kosher, and non-GMO. Organic versions are available too. This is critical in many domestic applications and important in international markets as well.

DairiConcepts is a leading U.S. provider of dairy-based ingredients for the global food industry, producing cheese and dairy powders and concentrates, seasonings, flavor enhancers, and hard Italian cheeses. Founded in 2000, the company today has eight manufacturing plants in the U.S., two development laboratories, and a pilot testing plant. Facilities are SQF Certified and recognized by the Global Food Safety Initiative.

To learn more about how fermentation can play a role in your products,  
contact us today: 1-877-596-4374.