Strategic Assessment of the

U.S. Bakery Industry

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Executive Summary

Industry Overview

Introduction and Study Highlights

The US bakery industry outlook provides an overview of bread, morning goods, cakes & pastries and biscuits markets.

The bakery industry in U.S. is in the mature stage, growing at the rate of 2.0 – 3.0 percent per year. The industry is characterized by increasing consolidation. Bakery manufacturers need to keep innovating inorder to sustain in the industry. Their efforts in this direction have been witnessed in the past few years. Strategic innovation is the sole way to capture emerging consumer trends with potential growth opportunities in the U.S. bakery industry.

In recent times, the U.S. bakery industry has undergone significant changes as it responds to shifting consumer trends- particularly the growing preference for products providing health, convenience and indulgence.

The competitors in the bakery industry can be classified as commercial bakeries and retail bakeries. The level of competition is high in the market and is on the rise. Also, a few restrictions pose difficulty for new companies to enter the market. The key competitive factors include price, product quality, product differentiation, innovation, branding, and technology.

Bread forms a part of the staple diet of most of the U.S. population and this market has witnessed the most innovation, with healthy bread variants such as natural, functional, light or low-carb and organic breads being developed. Biscuits were the second most innovative product sector and are capitalizing upon the indulgence trend in the U.S. Innovations in biscuits were focused on formulation with exotic flavors, rich textures and packaging. The cakes and pastries sector also displayed some level of innovation and differentiation in terms of novel healthy variants such as low/light, fat-free and sugar-free products.
The emerging trend toward new product development and healthy variants has provided significant opportunities to ingredient manufacturers. Manufacturers of bakery ingredients such as enzymes, emulsifiers, antimicrobials, colors, flavors, fiber, starch, functional and formulated bakery ingredients are becoming more innovative in order to cater to the novel product introductions taking place in the U.S. bakery industry. Some of the main competitive factors of ingredient manufacturers include price, innovation, broad product portfolio and value-added customer support such as technical assistance in product development. These competitive factors if focused upon by the ingredient manufacturers can assure them growth as a part of U.S. bakery industry’s supply chain.

Research Scope and Methodology

Scope of the Study

This industry outlook examines the U.S. bakery industry, providing an overview of bakery product types, a detailed analysis of the supply chain, and a discussion on regulations pertinent to the industry. The study analyzes the following U.S. bakery ingredients markets, covering the market trends, revenue trends and competitive analysis for each market:

- Enzymes
- Starch
- Fiber
- Colors
- Flavors
- Emulsifiers
- Antimicrobials
- Other Bakery Ingredients
- Formulated Bakery Ingredients

The major trends that are driving innovation in the U.S. Bakery industry are also highlighted in this study.

The bakery industry is broadly classified into:

1. Bread and Morning Goods (buns, rolls, muffins, scones, bagels and croissants)

2. Cakes and Pastries

3. Biscuits (sweet and savory)
Research Methodology

The first step while conducting research of this kind is to understand the market for which an in-depth study of proprietary Frost & Sullivan legacy data is undertaken to accomplish this. This is followed by secondary research on the bakery industry to understand recent developments and develop an updated database of the key market participants.

The next stage involves preparing a discussion guide and conducting primary research interviews with the market participants to understand the market from the perspective of both the bakery product manufacturers and the bakery ingredient suppliers. This helps develop a detailed understanding of critical factors driving the markets in the bakery industry, as well as impeding its growth.
Introduction to the Industry

Introduction

Overview

The U.S. food and beverage ingredients industry encompasses several markets such as bakery, beverage, confectionery, dairy, processed foods and so on. Consumer inclination towards healthy food and convenience products is the leading driver governing innovations and growth in most of these markets. The present food and beverage industry is marked by strong competition which demands meticulous strategies by the market participants to cater to the dynamic needs of the global market. The manufactures need to understand the fact that in the present world of cut-throat competition meeting consumer demands through innovation is the key to sustain and grow in the industry.

The U.S. bakery industry outlook analyses the major trends and opportunities in this industry. Bakery products covered under this study includes bread, morning goods, cakes & pastries and biscuits. Shifting consumer trends and increasing consolidation have posed a significant challenge to bakery manufacturers. However, if manufactures work towards meeting consumer demands, they can easily translate this challenge into a potential driver. Hence, this trend has presented significant growth opportunities for the bakery ingredient manufactures as well, who grow along with the bakery market.

The major product types discussed in this study include bread and morning goods, cakes and pastries and biscuits. Bread is the largest source of revenue for the market followed by morning goods, cakes and pastries and biscuits.

This study provides an overview of the trends by product category. Also, this outlook covers an indepth analysis of the U.S. bakery industry structure, and various bakery ingredient markets such as starch, fiber, enzymes, emulsifiers, colors, flavors, antimicrobials, yeast, other functional ingredients (omega-3, and 6, vitamins, minerals, pre-biotics, probiotics) and formulated bakery ingredients.
I N D U S T R Y S N A P S H O T

The bakery industry in U.S. is in the mature stage, growing at the rate of 2-3 percent per year. Western Europe leads the global bakery industry, with 42.0 to 45.0 per cent of sales, followed by North America. The U.S. bakery industry was estimated to be close to $34 billion in 2007.

Bread represented the largest product category accounting for 50.0 per cent of the volumes. Morning goods such as bagels, muffins, croissants, buns and rolls represented 20.0 per cent of the volume. Pastries and biscuits represented the rest of the market.

The level of competition is high in the market and is on the rise. This is because a few restrictions pose difficulty for new companies to enter the market. This is one of the major reasons that have kept the concentration of industry assets low. However, the inspite of the competition, the U.S. bakery industry has been able to increase the average per unit prices of the baked goods almost every year since 1991. This indicates that the competition has its own limits in this market space and this has resulted in the profitability for the industry participants. The key competitive factors include price, product quality, product differentiation, innovation, branding, and control over the quality of ingredients used, and technology.

The competitors in the bakery industry can be classified as commercial bakeries and retail bakeries. Commercial bakeries are involved in production of baked goods. There are both big and small commercial bakers who sell their offerings to retailers and supermarkets. In addition to private label brands of the retailers, they also produce their own branded products. Retail bakeries are primarily engaged in the retail sale of bakery products. They either purchase the baked goods from the commercial bakeries or manufacture themselves on the premises. These bakers either produce bakery items from the scratch or prefer going for the “bake-off” method where part-baked / frozen dough is used.

The bakery industry is moderately fragmented with about 2,600 commercial bakeries and 7,000 small retail bakeries. Examples of some of the leading commercial bakers include Interstate Bakeries Corporation, Sara Lee Corporation, Flowers Foods, Incorporated, Bimbo Bakeries USA, Krispy Kreme Doughnuts, Inc., and Tasty Baking Company. Some of the key retail bakeries in U.S. are A B P Corporation, Nonni’s Food Company Inc, Maple Leaf Bakery Hendersonville, and Thorntons Inc.

The supermarkets account for around 64.0 percent of the bakery industry sales in U.S. Other significant distribution points for baked goods include food service, convenience stores and other small retail outlets.
Bakery Market Trends

The U.S. bakery industry encompasses a diverse range of products. In this study bakery products in the U.S. are broadly classified into three major categories:

- Bread and Morning Goods
- Biscuits
- Cakes and Pastries

Bread and Morning Goods

Bread

Bread is a staple household food for the U.S. population. There are a variety of breads available in the U.S. market in different formats and versions. Hence, there is at least one product to cater to almost every American consumer’s fondness and preference.

The bread sector can be further segmented into three categories that include:

- White bread
- Wholemeal and brown bread
- Specialty bread/ artisan bread

These breads can be wrapped, unwrapped, sliced or unsliced.

White Bread

White bread is made from wheat flour which is free from bran and germ. In order to avoid yellow coloration in the bread, it is generally bleached using potassium bromate or chlorine dioxide gas. Bleaching also allows long shelf life enabling it to survive storage and long transit times. However, since it is made from refined flour, it has less fiber compared to the whole grain bread. Since most of the vitamins are also lost as a side effect of the bleaching process, U.S. law requires that white flour must be enriched with vitamins which then can be employed to make white bread. The growing health consciousness of consumers and consequent increasing demand for wholegrain or specialty breads has resulted in a decline in the demand for white bread in the U.S.

Wholegrain and Brown Bread

The flour used in the production of brown bread consists of crude fiber and a wholegrain content of about 85.0 per cent. Wholemeal bread is made from whole wheat grain and does not involve any refining. This sector also includes wheat germ bread that consists of processed wheat germ. The market for these breads is witnessing growth owing to health awareness of consumers.
Specialty Breads

These are breads from other continents and are also referred to as ethnic breads. Examples of specialty breads include French baguettes and pain de campagne, Italian focaccia, Greek pita, Indian naan, chapati and paratha, American flatbread and sourdough and Irish soda bread. Also breads made from flour other than wheat such as rye or oat flour, or from organic flour, and bread containing additions such as nuts and seeds also are also sub-categorized as specialty breads.

Some of the significant trends identified in the bread sector include:

- More varieties of specialty breads being rolled out by the white bread manufacturers to compete with the increasing popularity of whole grain breads.
- Growing trend towards fortified breads (seeds, omega-3, prebiotics)
- Consumer inclination toward wholemeal and premium breads due to health reasons.
- Demand for natural and fresh products
- Increasing number of in-store bakeries.
- Rising sales of baked goods in food service sector.
- Emerging trend towards healthy organic breads with organic flax bread being most popular.
- Organic-sprouted wheat bread is gaining prominence.
- Artisan bakers are rolling out flavorful speciality bread creations, contributing to the upgradation of bread baskets, in-store offerings and even fast food menus.
- Branding and high level of promotional activity
- Advancements in production and packaging leading to improved shelf-life.
- More preference for fibers from oat and wheat, as against other fiber sources such as resistant starches and maltodextrins, in breads.
Morning Goods

This segment includes baked foods such as buns, rolls, muffins, crumpets, scones, teacakes, pancakes, croissants, bagels etc. Since these products were traditionally sold fresh in the morning to be consumed in the same day, these are categorized as morning goods. Some of the significant trends identified in this sector are listed below:

- Indulgence trend
- On-the-go bakery consumption trend
- Convenience trend favors baked goods as an impulse purchase
- Growing popularity of healthy variants
- Rise of in-store bakeries

Bread and morning goods together hold approximately 50.0 per cent of the bakery market in U.S. growing at a slow rate of 1.0.-2.0 percent yearly.

Biscuits

Biscuits can be broadly categorized as sweet and savory in the U.S. bakery industry. This sector is mainly driven by snacking and indulgent trend. The sweet biscuits segment consisted of American cookies, assortment cookies, butter-based cookies, chocolate cookies, cream-filled cookies, plain cookies and wafer cookies. The market for savory cookies is likely to witness significant growth owing to their healthy image. U.S. sweet biscuits category accounts for approximately 55.0 percent of the total U.S. biscuit market, growing at the rate between 1.5 to 1.7 percent. The U.S. represents around 29.0 percent of the biscuits market globally, valued at $ 12.0 – 13.0 billion. Key market participants include Kraft Foods International, Kellogg Company, Parmalat Finanziaria S.p.A., and McKee Foods Corporation.

The major trends observed in this segment are:

- Growing indulgence trend
- High level of branding and promotional activity
- Convenience and packaging innovation (example: Single serve cookies)
- Sweet biscuits segment witnessing increased innovation
- There is an upswing in the number of organic cookies being launched, subtly infused with flavors like lavender, orange blossom, and peppermint. Such essences add value and character to the organic cookies.
- Organic biscuits with no trans fats, no hydrogenated oils, no artificial colors or flavors, no preservatives, no refined sugars, and no high fructose corn syrup are the promotion tag lines for most of the manufacturers who have stepped into the organic biscuits and cookies market in the United States.

- Uncommon savories such as thyme are being added to organic cookies

- Low and light trend is influencing innovation in both sweet and savory biscuit segments.

- Biscuits feature prominently in many fast food breakfast sandwiches and as a side dish at fried chicken restaurants

**Cakes and Pastries**

Cakes and pastries, often categorized as indulgence products, form an important part of the bakery industry in the U.S. However, with the rising incidence of conditions such as obesity and cardiac disorders, manufacturers are trying to make products that are low in fat and sugar in order to portray a healthy image. Cupcakes, snack cakes, cheese cakes, sponge cakes, pies, Danish pastries and brownies are products that belong to this category. The cake segment in the United States is growing at 5.8 percent every year, accounting for 14.0-15.0 percent of the U.S. bakery market. The Key participants in this segment are Interstate Bakeries Company (IBC), McKee Foods Corporation, and George Weston Bakeries, and Tasty Baking Company.

Key trends observed in this market include:

- Soaring product innovation

- Single-serve and low sugar cakes are gaining popularity

- Reduced home baking and rising demand for commercially baked products boosts the demand for these indulgence baked goods.

- Availability of improved home freezers and microwaves are driving sales for the frozen cakes and pastries.

- Increasing presence of ISB (In-store Bakeries)

- Improvisation in processing technology (for combining ingredients and freezing the end-product) for cakes and pastries is positively influencing volume sales.

- Indulgence and on-the-go eating trend

- Emerging organic pastry sector

- The trend of whole grains being used in cakes is being witnessed. For example, Gak’s Snacks™’s 100 percent whole grain frozen organic apple coffee cake and whole grain frozen organic cranberry coffee cake are attracting many consumers because of their flavors.
Industry Structure

Supply Chain Analysis

The key participants in the supply chain of the bakery industry include miller, raw material supplier (ingredients), ingredient manufacturers, ingredient distributors, blenders / premixers, bakers, bakery products distributors and end users. In addition, the industry structure also involves intermediary participants such as traders, transporting and packaging companies. Industry organizations and legislative bodies are the other stakeholders in this industry.

Chart 2.1 depicts the supply chain of the U.S. bakery industry in 2007.

Chart 2.1
Bakery Industry: Supply Chain (U.S.), 2007
RAW MATERIAL SUPPLIER

The basic raw material used for the production of ingredients/additives such as flour, emulsifier, flavors, colors, fats and sweeteners include wheat, rye, palm oil, aroma compounds, fruits and vegetables and starch derivatives (dextrose). These raw materials are supplied by the farmers to the manufacturers of these ingredients/additives. Most of the large players in the ingredient manufacturing market space prefer to integrate vertically and deal with the farmers directly to procure the necessary raw material. Also, with the anticipated increase in the consolidation in this tier of the value chain, there is likely to be a further reduction in the participation of intermittent channels such as traders or contractors. However, the present market status shows that the ingredients sector is still fragmented with a number of small scale manufacturers. These small ingredient manufactures still prefer to take the help of traders for raw material procurement.

MILLER

The millers supply the flour to either the ingredient manufacturers or the bakery manufactures directly. A significant proportion of wheat flour is sold to the bread manufacturers (hard wheat flour), industrial bakeries and cookie manufacturers (soft wheat flour). The key players in this tier include Cargill, ADM, ConAgra Foods, Inc., General Mills Inc, Horizon Milling LLC., Cereal Food Processors Inc, and Chelsea Milling Company. The flour milling market in the U.S. is moderately concentrated with the top four players holding more than 55.0 percent of the market share. Recently the demand of flour is being influenced by the production techniques used by bakeries, pasta manufacturers, breweries, etc. For example, flour consumption by the bakery market has dropped due to the increasing production of extended shelf life (ESL) bread and other baked products. This in turn reduces the amount of flour that is needed to make enough bread to meet the same level of demand. However, the consumer inclination towards whole grain breads and bread products has been one of the drivers for the flour milling market in U.S. for baked goods. Also, the increasing popularity of pre-packaged, take-away or restaurants meals is giving a favorable thrust to the market for flour-based products such as buns and bagels. The per capita consumption of wheat flour in the U.S. baked goods application has declined from 141 lbs in 2001 to 133.2 lb in 2007.

INGREDIENT MANUFACTURERS

There are various ingredients used in making baked goods. The companies that manufacture and supply these ingredients form a part of this tier. These companies can be a supplier of one or more than one ingredient. Also, some of the multi-national companies that participate in this segment cater to the ingredient needs of other industries as well including bakery. These are called as Multi-Ingredient Suppliers. Examples include DSM, and Danisco A/S. On the other hand, there are also certain players in this segment such as CSM, AB Mauri and BELDEM, for whom a major chunk of the turnover is obtained from the ingredients supplied to the bakery market. These bakery–centered ingredient companies are named as Speciality Bakery Ingredient Suppliers.
Distributors/ Premixers

Distributors play an important role in the supply chain of bakery industry in the U.S. Due to the strengths of distributors such as better Local coverage, easy access via established customer base and ability to provide value-added services (blending, premixing), the ingredient companies find them better way to communicate further in the supply chain. Some examples of participants at this level include Alsiano, and Basic Supply Group BV. However, some of the negatives associated with dealing through distributors include chance of loss of exclusivity of brands (the distributor can be undertaking sales of various manufacturer’s products which may substitute each other), lack of experienced technical staff, lack of audit on sales skill required for specific ingredients / products, lack of ownership, sharing of profit margin which otherwise is exclusive to manufacturers. Under these given circumstances, an ingredient manufacturer intelligently analyses the pros and cons as well as the feasibility of operations based on its own strengths and weakness and finally decides for or against the option of an external distribution system.

However, there is another prominent trend in the bakery sector is that the majority of the leading ingredient manufacturers usually segment their key customers into various categories depending on the size of the company and purchase pattern / volume. Under this system, they prefer to serve their important customers themselves and external distributors are asked to serve the smaller customers.

Bakery Manufacturers

Commercial Bakeries

Commercial bakers in the U.S. bakery industry are those establishments that are primarily involved in manufacturing fresh and frozen bread and bread-type rolls and other fresh bakery products. These bakeries buy the bakery ingredients from the ingredient manufacturers. They mostly procure the flour from the millers directly. They sell their products through supermarkets, Food service, convenience stores, small retail outlets, and speciality stores. Some of these commercial bakeries also produce their own branded products in addition to private label brands of the retailers.

The U.S. Bakery industry has about 2,600 commercial bakeries who account for combined sales of close to $25 billion. This segment is moderately consolidated with the top 50 commercial bakeries holding more than 80.0 percent of the market share. Interstate Bakeries Corporation, Sara Lee Corporation, Flowers Foods, Incorporated, Bimbo Bakeries USA, Krispy Kreme Doughnuts, Inc., and Tasty Baking Company are the key players in the market. Other smaller players are Lance, Inc., Ise Blu Equity Corp, Vitafoft International Corporation.
Retail Bakeries

Retail bakeries are establishments which are primarily engaged in the retail sale of bakery products. They either purchase the baked goods from the commercial bakeries or manufacture themselves on the premises. These bakers either produce bakery items from the scratch or prefer going for the “bake-off” method where part-baked / frozen dough is used. The top 20 retail bakeries in the United States are listed below:

- A B P Corporation, Boston, MA
- Nonni's Food Company Inc, Tulsa, OK
- Maple Leaf Bakery Hendersonville, TN
- Thorntons Inc, Louisville, KY
- Pepperidge Farm, Incorporated, Norwalk, CT
- Paradise Bakery & Cafe, Inc, Scottsdale, AZ
- Ecce Panis, Inc East Brunswick, NJ
- Robert Kinsella Inc, Irving, TX
- Eatzi's Texas Beverage Corp, Carrollton, TX
- Mamolo's Continental & Bailey Bakeries Inc, Burbank, CA
- Jean's Posh Pantry, Inc Poway, CA
- Jacques Gourmet, Inc, San Marcos, CA
- I Batt Inc, Durham, NC
- Andersen Bakery, Incorporated, Hayward, CA
- Sunbeam Country Hearth Thrift Store Lakeland, FL
- Saint-Germain America, Inc, Honolulu, HI
- Busken Bakery, Inc, Cincinnati, OH
- Viktor Benes Continental Pastries, Inc, Burbank, CA
- Cheesecake Factory Tampa, FL
- Crestone Group Llc, Carlsbad, CA
**Distribution Channels**

There are mainly four channels through which the baked goods reach the end consumer in U.S. These are discussed below:

**Supermarkets**

These establishments are engaged in purchasing the baked goods from commercial bakeries. These commercial bakeries serve as both manufacturer and wholesaler because of the sheer reason that it is not financially feasible to use a wholesale trader as the third party. It is estimated that about 64.0 percent of the bakery industry sales in U.S. was contributed by the supermarkets. Some of the key supermarkets in U.S. that offer baked goods include Winn-Dixie Stores, Inc., Kroger Food Stores, Great A&P Food Stores, Safeway Stores, Inc., American Stores Companies, and Albertson’s, Inc.

**Food service and Hospitality**

These comprise the catering firms, hotels, motels and restaurants which buy the bread and other baked foods from the manufacturers.

**Convenience Stores**

These buy bread and other bakery foods directly from the bread and baked goods manufacturers, mostly from a small commercial bakery.

**Other Specialty Stores**

These include retail outlets, such as cake shops, coffee shops and cafes. These contribute to a very little extent to the total bakery sales in the U.S.

**Regulations**

Like other food markets, regulations govern the U.S. bakery market as well. However, presently the level of regulations governing the market is medium.

**Product Labeling**

The production and labeling concerning regulations are governed by the clauses in the Federal Food, Drug, and Cosmetic Act and the Fair Packaging and Labeling Act. According to the Fair Packaging and Labeling Act, 1967 the food manufacturers have to conform to certain labeling requirements. These are related to:

- Placement, form, and contents of statement of quantity; supplemental statement of quantity.
- Unfair and deceptive packaging and labeling.
- Cooperation with state authorities.
- Effect upon state law.
This cost of compliance is nominal as packaging itself is a necessary criterion for the consumption, transport and sales of the product. For instance, the regulation to include the date of expiry of the product ensures consumer safety from any sort of health hazard due to spoiled food consumption and thereby also releases the manufacturer from any sort of liability if such a label warning is ignored by the consumer.

ENVIRONMENTAL REGULATIONS

Various Federal environmental regulations and statutes, such as the Federal Water Pollution Control Act or the Clean Water Act (CWA), Clean Air Act (CAA), Pollution Prevention Act (PPA), and Resource Conservation and Recovery Act (RCRA), govern the way of processing facilities handle their products and dispose of their waste. However, since the amount and nature of waste is not that alarming for the bakery industry, pollution is not a major issue for this industry. Hence, such legislation does not have a pronounced impact on the day-to-day operations of retail and commercial bakeries in the U.S.
U.S. Bakery Enzymes Market

Opportunities and Trends

Introduction

Enzymes are an important ingredient used in most bakery products. Among the enzymes used in food applications, those used in the bakery industry constitute nearly one fourth of the market. The growth rate of the United States bakery enzymes market is the highest among all the food enzymes in U.S. There is a moderately expanding application base for the enzymes used in the bakery segment which are driving growth. The radical improvements in the quality of bakery products over the past ten years in terms of flavors, texture and shelf-life are largely attributed to the use of enzymes.

The market for bakery enzymes includes all enzymes used in baking and milling applications to:

- Maintain flour consistency
- Reduce impact of variations of raw material quality on dough
- Improve bread volume
- Extend shelf-life in baked goods

This sector comprises of enzymes for:

- Free market sales: A free market sale implies the supplier can sell enzymes to any interested customer

- Captive use by suppliers: This is when a supplier produces enzymes to supply its parent company or a sister company. An example of this is Beldem, which supplies bakery enzymes to its parent the Puratos group.
Classification

The key enzymes in the bakery market include:

- **Amylases**— Amylases are the most common and frequently used enzymes in bakery. These enzymes break the starch present in flour into sugars. These sugars in turn react with the yeast to produce carbon dioxide causing the bread to rise. Fungal amylases are employed to fully develop dough and to give volume to the bread, with fine crumb, good crust and appetizing flavor and colour. Certain anti-staling amylases are effectively used to prevent staling of baked goods and maintaining their freshness for a prolonged period of time. A final use for amylases in bakery products is as a replacement to potassium bromate, an oxidizing agent that strengthens gluten strands. Strengthened gluten produces a dough with improved gas retention and, consequently, higher volume in the finished product.

- **Xylanases and Hemicellulases** — These enzymes help in the formation of a homogeneous and flexible gluten network in the dough. Xylanases act upon the non-starch polysaccharides (NSPs) in the wheat flour and make significant improvements in the bakery product by increasing volume, increasing fermentation stability and resistance to mechanical stress and forming softer bread with lasting freshness.

- **Oxidases**— These enzymes are used to bleach the flour and strengthen the dough.

- **Proteases**— These enzymes are used to reduce the elasticity of gluten and preserve the vitamin content. They are also used as replacers for sodium sulfites in cracker doughs.

- **Lipases**— are comparatively a new to the list of enzymes used in the bakery market. These are extremely effective in replacing partially or totally the emulsifiers (DATEM, SSL) in bread and bakery.

- **Pentosanases** – They help in hydrolyzing the pentosans present in the wheat flour and help in improving the wheat – based product volume. Pentosanases that aid in hydrolysis of cellulose also are available in the market that are added specifically in high-fiber bakery products to help avoid the gritty mouthfeel that is otherwise attributed to the presence of long cellulose chains.
Market and Revenue Trends

Trends

- Enzymes such as amylases are increasingly replacing emulsifiers such as DATEM and mono and di-glycerides in the bakery industry.

- The enzyme companies are concentrating on small bakery segments such as cakes. For example, in 2004, Danisco-Genencor partnership rolled out an enzyme Grindamyl PowerSoft that claims to double the shelf life of cakes. Recently, DSM launched CakeZyme a microbial phospholipase, is added directly to the cake batter during processing, claimed to enhance the emulsifying properties thus reducing egg (natural emulsifier) use by up to 20.0 per cent finally resulting in less baking costs and extension of cake shelf-life.

- Blends of emulsifiers and enzymes are coming out to achieve the desired functionalities in the baked goods.

- There is a relatively declining popularity of low carb diets and new whole grain bread products flooding the market. This is encouraging the usage of more enzymes, since they help to overcome the processing difficulties, poor volume and unacceptable quality, otherwise associated with whole grain bread manufacturing.

- An increasing demand for the whole grain and high fiber breads is being witnessed which is driving bakery enzyme sales.

- Growth in the small bakery segments such as cakes, tortillas, crackers fuel growth of the bakery enzymes market.

- The decline in white bread sales with high-carb content has to some extent been compensated by the increase in the sales of whole grain and high-fiber breads.

- Bakery market consolidation is leading to decreased bargaining power for the bakery enzyme manufactures.

- The enzyme products that cater to specialty baked products manufacturers are likely to grow in the next seven years.

- Between 75.0 – 80.0 percent of the enzymes used in the bakery market are accounted by those used in breads. Cakes, cookies, crackers, tortillas are the other important segments that use enzymes.

- The industrial bakers have started focussing more on the specialty bakery products that have been the exclusive domain of the small-scale bakers.
Revenue Trends

Figure 3-1 and Chart 3.1 show the revenue trends for the U.S. bakery enzymes market from 2004 to 2014.

Figure 3-1

Bakery Enzymes Market: Revenue Trends (U.S.), 2004-2014

<table>
<thead>
<tr>
<th>Year</th>
<th>Revenues ($ Million)</th>
<th>CAGR (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>48.7</td>
<td>---</td>
</tr>
<tr>
<td>2007</td>
<td>61.1</td>
<td>7.9</td>
</tr>
<tr>
<td>2014</td>
<td>106.4</td>
<td>8.2</td>
</tr>
</tbody>
</table>

Key: CAGR = Compound Annual Growth Rate

Note: All figures are rounded; the base year is 2007. Source: Frost & Sullivan

Chart 3.1

Bakery Enzymes Market: Revenue Trends (U.S.), 2004-2014

The market for bakery enzymes was worth $61.1 million in 2007. At 8.0 percent, the growth rate of the bakery enzymes market was the highest in the food enzymes market among all other food and beverage applications such as dairy, starch and sugar processing and beverages. Enzymes are increasingly replacing the emulsifiers in bakery products at a replacement rate between 5-10 percent. Due to this the enzymes market in bakery is growing at a higher growth rate than the end-user market growth rate.
The market is expected to be worth $106.4 million by the end of 2014. The compound annual growth rate (CAGR) is expected to be at 8.2 percent during the period 2007-2014. New product development in bakery enzymes as well as bakery products is likely to pick up pace during the forecast period.

Competitive Structure

Figure 3-2 shows the competitive structure of the U.S. bakery enzymes market in 2007.

**Figure 3-2**

Bakery Enzyme Market: Competitive Structure (U.S.), 2007

<table>
<thead>
<tr>
<th>Number of Companies in the Market</th>
<th>13-17</th>
</tr>
</thead>
<tbody>
<tr>
<td>Types of Competitors</td>
<td>Enzyme manufactures with both captive use and sales to free market, enzyme manufactures that sell to end users and resellers, co-producers or blenders with their own fermentation facility, traders and blenders without own fermentation facilities.</td>
</tr>
<tr>
<td>Industry Structure</td>
<td>Top three companies account for 85 percent of the market share, fragmented end-user segments</td>
</tr>
<tr>
<td>Tiers of Competition</td>
<td>4</td>
</tr>
<tr>
<td>Notable Acquisitions, Mergers</td>
<td>2005- Genencor International was acquired by Danisco A/S 2004- Kerry Group acquired Quest’s food ingredient business gave Kerry Group the ownership of Quest’s six new technologies including enzymes for bakery applications.</td>
</tr>
<tr>
<td>Key End-user Groups</td>
<td>Baking ingredient companies, flour mills, bread improver manufactures, industrial / artisanal bakers, cracker/cookie manufactures and other cereal-based product manufactures</td>
</tr>
<tr>
<td>Competitive Factors</td>
<td>Price and cost-in-use ratio  Price  Research and product development capabilities  Patents and licences  Highly developed distribution and supply chain  Technical support and customer service</td>
</tr>
</tbody>
</table>

*Source: Frost & Sullivan*

Market Share Analysis

Figure 3-3 and Chart 3.2 show the company market share by revenues in the U.S. bakery enzymes market in 2007.
In the bakery enzymes market the manufacturers either sell their enzymes in different activities to the ingredient companies such as Caravan Ingredients, Innovative Cereal Systems, who in turn use them to make different formulations or sell them to the end users such as the milling industry, bread improver manufacturers and other cereal-based industries.

The market at the manufacturer’s end is therefore of a comparatively much smaller size in terms of revenue compared to that at the ingredient companies’ end.

Looking at the market at the manufacturer’s end, the leader is the Denmark-based Novozymes N.A., which has a market share of 45.0 percent in 2007. This large share is largely due to the successful bacterial maltogenic amylase brand, Novamyl®. Novozymes has a market share of around 75.0 percent in the maltogenic amylases market in the United States.
The second largest participant in the market is DSM with a market share of 20.0 percent in 2007.

DSM mostly sells the enzymes to the bakery ingredient manufacturers. DSM’s enzymes are marketed under the brand name Bakezyme®.

The third place in the market was held by another Denmark-headquartered company, Danisco. It commanded a market share of 19.0 percent which is very closely behind DSM. Grindamyl is the leading amylase brand of Danisco. Danisco supplies three different delivery systems: non-dusting granulates, tablets, and enzymes blended with emulsifiers.

There are also a number of smaller participants in the market that collectively hold 16.0 percent of the market. Though many produce their own enzymes, others also co-blend and reformulate.
U.S. Bakery Emulsifiers Market

Opportunities and Trends

Introduction

Emulsifiers are substances that facilitate the dispersion of lipids in aqueous solutions. The addition of emulsifiers enhances compatibility of various components such as starch, proteins, fats and water. Emulsifiers play a significant role in baked products, helping to maintain product shelf life and texture. In addition to forming a smooth blend, emulsifiers have other functions in the bakery industry such as:

- Promotion of emulsion in filling and coating
- Whipping agent
- Conditioning
- Aeration
- Starch complexing
- Antistalling
- Shelf-life extension
- Crumb softening

Diversified functions of emulsifiers in bread making include dough conditioning, strengthening, shelf-life extension, and crumb softness. However, the antistaling function of emulsifiers makes it a critical component in the bakery industry. Emulsifiers when added to the dough prevent gelatinization of the starch molecules, which otherwise would lead to re-crystallization resulting in a stale product. On the whole, it improves the overall quality of the bread and other yeast–raised products.
Classification

Emulsifiers used in baked foods include mono- and diglycerides (starch complexing and crumb softening), Di-Acetyl Tartrate Ester of Monoglyceride or DATEM (dough strengthening), sodium stearoyl lactylate (crumb softening and dough strengthening), Polyglycerol Esters of fatty acids and Propylene Glycol Esters of fatty acids (PGE/PGME) and calcium stearoyl lactylate. These emulsifiers are regarded as synthetic as they are manufactured using a chemical process.

Market and Revenue Trends

Trends

- The all-natural trend is boosting the sales of soy-based breads, which in turn promotes the use of lecithin.

- Shift toward whole grain baked products increases demand for emulsifiers. Danisco A/S successfully launched PANODAN® DATEM, which is widely used in artisan breads that contain high level of whole grains.

- Increasing popularity of premium products such as low-fat, low-calorie, sugar-free, mineral and vitamin-fortified breads and cakes is favoring augmented use of emulsifiers. This is because these products pose a serious challenge while processing and make it mandatory to use emulsifiers to offer the right texture, taste, and shelf life.

- Expansion in the cakes segment from traditional cakes to snack cakes, cup cakes, and brownies is boosting growth of the market for both natural and synthetic emulsifiers. This is attributed to the need of these single-serve variants for assured stability, quality, and long shelf life.

- Enzymes such as amylases are increasingly replacing emulsifiers such as DATEM and mono and di-glycerides in the bakery industry at the rate of 5.0 to 10.0 percent.

Revenue Trends

Figure 4-1 and Chart 4.1 show the revenue trends for the U.S. bakery emulsifiers market from 2004 to 2014.
The U.S. bakery emulsifiers market was valued at $222.1 million in 2007. The market registered a growth rate of 2.5 percent in the base year. The market is expected to grow at the rate between 2.7 to 3.0 in terms of revenues yearly from 2008 to 2014 which is expected to take the revenue figure to $290.8 million.
Competitive Structure

Figure 4-2 shows the competitive structure of the U.S. Bakery Emulsifiers market in 2007.

**Figure 4-2**

Bakery Emulsifiers Market: Competitive Structure (U.S.), 2007

<table>
<thead>
<tr>
<th>Number of Companies in the Market</th>
<th>More than 20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Types of Competitors</td>
<td>Emulsifier manufactures who sell their products directly to bakery manufacturers</td>
</tr>
<tr>
<td></td>
<td>Emulsifier manufactures who sell their products to bakery manufacturers through distributors</td>
</tr>
<tr>
<td></td>
<td>Companies who source emulsifiers from other companies, make customized blends and sell</td>
</tr>
<tr>
<td>Key End-user Groups</td>
<td>Producers of bread, rolls, biscuits, crackers, and other baked products</td>
</tr>
<tr>
<td>Competitive Factors</td>
<td>Diverse Product range</td>
</tr>
<tr>
<td></td>
<td>Technical and customer service</td>
</tr>
<tr>
<td></td>
<td>Research and development</td>
</tr>
<tr>
<td></td>
<td>Compliance to regulation</td>
</tr>
<tr>
<td></td>
<td>User-friendly delivery system</td>
</tr>
<tr>
<td></td>
<td>Innovative products</td>
</tr>
<tr>
<td></td>
<td>Strategic alliances</td>
</tr>
</tbody>
</table>

Source: Frost & Sullivan

Market Share Analysis

Figure 4-3 and Chart 4.2 show the company market share by revenues in the U.S. Food Emulsifiers market in 2007.

**Figure 4-3**

Food Emulsifiers Market: Company Market Share by Revenues (U.S.), 2007

<table>
<thead>
<tr>
<th>Company</th>
<th>2007 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Danisco A/S</td>
<td>24.0</td>
</tr>
<tr>
<td>Caravan Ingredients</td>
<td>21.0</td>
</tr>
<tr>
<td>Cargill, Incorporated</td>
<td>13.0</td>
</tr>
<tr>
<td>Kerry Group</td>
<td>10.0</td>
</tr>
<tr>
<td>ADM</td>
<td>7.0</td>
</tr>
<tr>
<td>Others</td>
<td>25.0</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Note: Others include Solae LLC, Lonza Inc., American Lecithin Company, Cognis Corp USA, BELDEM, Palsgaard A/S, and so on.

Note: All figures are rounded; the base year is 2007. Source: Frost & Sullivan
In the total U.S. food emulsifiers Market, Danisco A/S holds the first rank with 24.0 percent of the market share in 2007. Second rank is held by Caravan Ingredients (a subsidiary of CSM) with 21.0 percent of the market revenues. The third and fourth places are held by Cargill, Inc. and the Kerry Group with 13.0 and 10.0 percent of the market, respectively. ADM with 7.0 percent of the market share is ranked fifth. Others that include companies such as Solae LLC, Lonza Inc., American Lecithin Company, Cognis Corp USA, BELDEM, and Palsgaard A/S account for the rest 25.0 percent of the market revenues.

All the above mentioned these companies also participate in catering to the bakery market, as bakery accounts for almost 44.0 percent of the total US food emulsifiers market in 2007.
U.S. Bakery Fiber Market

Introduction

In 2004, the emergence of the low-carbohydrate trend revolutionized the food and beverage market in the U.S. There was suddenly a considerable demand for products with decreased carbohydrate content that did not compromise on taste. In order to reduce the level of carbohydrates in the products, manufacturers mostly began using fibers as a substitute.

According to the FDA, which has borrowed the definition of fiber from the Association of Official Analytical Chemists, fiber is defined by the following statement:

“Dietary fiber is the edible parts of plants or analogous carbohydrates that are resistant to digestion and absorption in the human small intestine with complete or partial fermentation in the large intestine; dietary fiber includes polysaccharides, oligosaccharides, lignin, and associated plant substances”.

Dietary fibers promote beneficial physiological effects including laxation, blood cholesterol attenuation, blood glucose attenuation, and prevention and Management of Diverticulosis.

Giving importance to these health benefits of fiber, the Food and Nutrition Board in North America has offered two new definitions to differentiate between added fiber and dietary fiber. The definition states that dietary fiber consists of non-digestible carbohydrates and lignin that are intrinsic and intact in plants. Added fiber consists of isolated, non-digestible carbohydrates that have beneficial physiological effects in humans. Total fiber is the sum of dietary fiber and added fiber.

Although the demand for low-carbohydrate food has diminished since then, the importance of nutritionally rich foods made up of whole grains and added fiber, especially whole grain breads, has increased among the U.S. population.
Classification

Food fiber can be classified into soluble and insoluble fibers. Gums, mucilages, and some forms of hemicelluloses are classified as soluble fibers. Insoluble fibers are the remainder of the hemicelluloses, lignins, and celluloses. In the human body, fibers bypass the small intestine undigested and enter the large intestine. Soluble fibers are then fermented by microflora that line the intestinal wall and insoluble fibers are excreted from the body in their original form.

For the purpose of the study, insoluble fiber has been further segmented into wheat fiber, oat fiber, soy fiber, cellulose fiber, sugar beet fiber, pea fiber, and functional insoluble fibers. On the other hand, insoluble fiber includes inulin fiber, fructooligosaccharide fiber, resistant maltodextrin fiber, and beta-glucan fiber.

Fibers are usually non-starch polysaccharides, oligosaccharides, lignin, and associated plant substances. As resistant starches also enter the large intestine undigested. For this reason, they are considered as dietary fiber. There are a few companies manufacturing purified resistant starch products to be directly added as a food ingredient. However, resistant starch will be covered under prebiotics in this study.

Market and Revenue Trends

Trends

- Increasing demand for whole grain bread is driving the food fiber market.
- There increased use of soy and wheat fibers in baked goods.
- In 2007, the bakery industry accounted for 78.0 percent of the US soy fiber usage, in terms of revenue, amounting to $20.1 million.
- Oat fibers are increasingly being used in bakery and bread foods because of their superior water binding capabilities, ability to increase fiber content, and natural taste.
- In 2007, the bakery industry accounted for 62.8 percent of the US oat fiber revenues, amounting to $70.1 million.
- Wheat fiber has been increasingly being used in baked goods for fortification, since it delivers certain significant functional properties to the product such as water binding capabilities, ability to increase fiber content, gives natural taste and color.
- Bakery application accounted for 38.4 percent of the wheat fiber revenues, amounting to around $8.7 million in 2007.
Inulin fibers are used in bakery products because of their ability to increase dietary fiber and to dissolve, and because they have little flavor or color.

Resistant maltodextrin is a good choice for fiber supplementation in bakery products because it has a very low viscosity and little flavor.

Fructooligosaccharide is also employed in bakery products to some extent.

Cellulose fiber, pea fiber and sugar beet fiber markets in bakery application were estimated to be $10.2 million, $2.0 million, and $0.59 million in 2007.

In 2007, inulin fiber, fructooligosaccharide fiber, beta glucan fiber and resistant maltodextrin markets in bakery application were valued at $5.7 million, $3.7 million, $1.3 million and $1.6 million, respectively.

Bakery fiber market was valued at $124.0 million in 2007.

**Revenue Trends**

Figure 5-1 and Chart 5.1 show the revenue trends for the U.S. food fiber market from 2004 to 2014.

**Figure 5-1**

Food Fiber Market: Revenue Trends (U.S.), 2004-2014

<table>
<thead>
<tr>
<th>Year</th>
<th>Revenues ($ Million)</th>
<th>CAGR (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>192.8</td>
<td>---</td>
</tr>
<tr>
<td>2007</td>
<td>286.4</td>
<td>14.1</td>
</tr>
<tr>
<td>2014</td>
<td>490.4</td>
<td>8.0</td>
</tr>
</tbody>
</table>

Key: CAGR = Compound Annual Growth Rate

*Note: All figures are rounded; the base year is 2007. Source: Frost & Sullivan*
Food Fiber Market: Revenue Trends (U.S.), 2004-2014

The U.S. food fiber market was valued at $286.4 million in 2007. The market registered a growth rate of 14.2 percent in the base year. The market grew at a CAGR of 14.1 percent for the period 2004-2007. Growth within the market is expected to continue at a CAGR of 8.0 percent from 2007-2014 and the market is expected to reach an estimated $490.4 million in 2014. Growth within this market is mainly due to growth in the usage of both soluble and insoluble fibers in baked goods. However, a mild decline in the growth rate of most of the individual food fiber markets is expected to reflect in the total US food fiber market as well.

Competitive Structure

Figure 5.2 shows the competitive structure of the U.S. Food Fiber market in 2007.
Figure 5-2

Food Fiber Market: Competitive Structure (U.S.), 2007

<table>
<thead>
<tr>
<th>Number of Companies in the Market</th>
<th>25-30</th>
</tr>
</thead>
<tbody>
<tr>
<td>Types of Competitors</td>
<td></td>
</tr>
<tr>
<td>Major Multi-ingredient suppliers</td>
<td></td>
</tr>
<tr>
<td>Major single-ingredient suppliers</td>
<td></td>
</tr>
<tr>
<td>Small single-ingredient suppliers</td>
<td></td>
</tr>
<tr>
<td>Key End-user Groups</td>
<td>Food manufacturers</td>
</tr>
<tr>
<td>Competitive Factors</td>
<td></td>
</tr>
<tr>
<td>Technical and customer service</td>
<td></td>
</tr>
<tr>
<td>Research and development</td>
<td></td>
</tr>
<tr>
<td>Close working relationship</td>
<td></td>
</tr>
<tr>
<td>Application</td>
<td></td>
</tr>
<tr>
<td>Price</td>
<td></td>
</tr>
</tbody>
</table>

Source: Frost & Sullivan

Market Share Analysis

Figure 5-3 and Chart 5.2 show the company market share by revenues in the U.S. food fiber market in 2007.

Figure 5-3

Food Fiber Market: Company Market Share by Revenues (U.S.), 2007

<table>
<thead>
<tr>
<th>Company</th>
<th>2007 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>J. Rettenmaier USA LLC</td>
<td>29.7</td>
</tr>
<tr>
<td>SunOpta Ingredients, Inc</td>
<td>20.7</td>
</tr>
<tr>
<td>International Fiber Corporation</td>
<td>13.4</td>
</tr>
<tr>
<td>Fiberstar, Incorporated</td>
<td>9.4</td>
</tr>
<tr>
<td>Orafti North America Inc.</td>
<td>2.7</td>
</tr>
<tr>
<td>Others</td>
<td>24.1</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Note: Others include Sensus America LLC., The Fibred Group, Cargill, Inc., Nurture, Inc., Grain Millers, and so on.

Note: All figures are rounded; the base year is 2007. Source: Frost & Sullivan
In the U.S. food fiber market the top three players collectively control approximately 65.0 per cent of the market share. In 2007, J. Rettenmaier USA LLC possessed the largest share of the market. Its revenues from sales of insoluble fiber, mainly Vitacel® brand oat fiber, wheat fiber, and cellulose powder fiber, generated 29.7 percent of the U.S. bakery fiber market. SunOpta Ingredients, Inc. held the next largest share with 20.7 percent. The company is known worldwide as the leading producer and supplier of oat fiber products. It has the broadest line of oat fiber products available to food manufacturers. International Fiber Corporation held 13.4 percent of the US bakery fiber market in 2007. The company markets a variety of insoluble fiber products. Fiberstar, Incorporated holds 9.4 percent of the market share.

The leading soluble fiber manufacturer was Orafti North America Inc. Of the total U.S. bakery fiber market, it held 2.7 percent. Others hold 24.1 percent of the market share and include companies such as The Fibred Group, Cargill, Inc., Nurture, Inc., Grain Millers, and so on.
U.S. Bakery Antimicrobials Market

Opportunities and Trends

Introduction

Antimicrobials are additives that inhibit or destroy microbes such as bacteria, fungi and viruses and thus play a very significant role in ensuring food safety. Some of the widely employed antimicrobials in the food and beverage industry include sorbates, benzoates, propionates, acetates, lactates, sulphites, nitrites, and nitrates. The importance of these antimicrobials becomes even more important with the heightened consumer concerns about ill effects of high sugar and salt which have been traditionally used to preserve foods.

Classification

With optimal pH and moisture baked foods provide an ideal environment for the growth of microbes such as molds and bacteria.

Antimicrobials can be classified into:

- Synthetic Antimicrobials
- Natural Antimicrobials

Synthetic antimicrobials such as sorbates, benzoates, propionates, lactates, acetates, nitrites, and sulphites are commonly used in the food industry. However, the increased consumer demand for foods containing reduced synthetic additives is creating new market opportunities for natural antimicrobials such as nisin and natamycin.

Examples of antimicrobials that are widely used in the bakery industry include:

- Calcium propionate
- Sodium propionate
- Potassium sorbate
- Sodium lactate
The natural variants of antimicrobials are gaining popularity primarily because of the consumers’ zeal for foods free of chemical additives and the common perception that foods, which contain natural or near-natural additives, are more safe and healthier. Some examples of natural antimicrobials include lysozyme, natamycin, and nisin. Natural antimicrobials are increasingly used in dairy, meat, bakery, and convenience food sectors. Many food manufacturers resort to use of synthetic antimicrobials mainly due to proven efficacy unlike natural antimicrobials, which is still under experimental stage for certain foods. This significantly limits the areas of application of natural antimicrobials. Furthermore, natural antimicrobials are priced at a premium compared to their synthetic counterparts, partly due to the limited supply of natural antimicrobials.

**Propionates**

**Calcium Propionate**

The use of calcium propionate in baked food applications depends on factors such as type of products, season of the year, and other climatic conditions. For example, brown breads typically use more calcium propionate compared to white bread products. Calcium propionate is most effective at pH 5.5 or lower. To prevent interaction between calcium propionate and baking powder, bakers add this ingredient at the mixing stage. Calcium propionate is available in powder, liquid, or encapsulated form.

**Sodium Propionate**

It is commonly used in chemically leavened products such as cakes where calcium ions obstruct rising or leavening process.

**Lactates**

The most commonly used lactate in the bakery industry is sodium lactate. The effect of lactates on texture system depends on the product category. For example, they help to maintain plasticity in biscuits and softness in cakes.

**Sorbates**

Sorbates are effective over a wide range of pH. Potassium salt of sorbic acid is one of the most efficient salts of sorbic acid owing to its high solubility. The addition of potassium sorbate at one-tenth the propionate level reduces mix time by around 30 per cent. The synergistic activity of calcium propionate and sorbic acid can help to extend the shelf life of bakery products. In addition to being added to directly to the product, sorbates can also be applied through other methods, such as spraying and incorporating the product in wrapping.

**Natural Antimicrobials**

These account for 6.0 percent of the revenues registered by the total US antimicrobials market in baked goods.
Market and Revenue Trends

Trends

- Natural Antimicrobials such as nisin, natamycin, are gaining gradual popularity. Manufactures such as Danisco and DSM are among the prominent manufacturers of these natural antimicrobials.

- Antimicrobial manufacturers continue to invest more money in research and development (R&D) of new value-added products. For example, Danisco Cultor recently launched GRINDSTED® PRO 45, which is a combination of emulsifiers and microencapsulated calcium propionate, which reduces the fermentation time from 60 to 50 minutes and secures shelf life of baked products up to 10 days.

- The use of liquid technology for the production of calcium propionate is also gaining a lot of prominence as this technology eliminates the problem of dust associated with dry powders. Also it facilitates easy addition to mixtures, is cost effective and easier to ship it across.

- Microencapsulation technology has increased the scope of a variety of antimicrobials in baked foods. For example, despite superior functional characteristics such as high solubility and low interference with flavor profile of food products, sorbates were not used widely in the baked foods segment. This was mainly because sorbates obstruct the function of yeast. However, microencapsulated sorbic acid overcomes this limitation.

- In order to meet the increasing consumer demand for natural foods, bakers are showing an increasing interest in the use of live cultures, fermentates, enzymes, and natural protectants in product formulations. For example, Nutraceutical Clinical Laboratories International introduced NuPreserve™, which is based on natural ingredients that are permitted for use in food by FDA. Currently, Nupreserve is used in over 300 bakery products including cupcakes, donuts, honey buns, carrot cake, and cinnamon buns.

- Ongoing innovations in packaging such as active packaging, oriented polypropylene (OPP) films, and certain other barrier films, particularly suit the needs of baked foods packaging and are therefore serving as a substitute for antimicrobials.

- In 2007, propionates contributed $32.8 million (78.0 percent) in revenues made by antimicrobials used in the baked foods application.

- In 2007, lactates contributed $3.8 million (9.0 percent) in revenues made by antimicrobials used in the baked foods application.

- In 2007, sorbates contributed $2.9 million (7.0 percent) in revenues made by antimicrobials used in the baked foods application.
Revenue Trends

Figure 6-1 and Chart 6.1 show the revenue trends for the U.S. bakery antimicrobials market in 2004 to 2014.

Figure 6-1
Bakery Antimicrobials Market: Revenue Trends (U.S.), 2004-2014

<table>
<thead>
<tr>
<th>Year</th>
<th>Revenues ($ Million)</th>
<th>CAGR (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>28.3</td>
<td>----</td>
</tr>
<tr>
<td>2007</td>
<td>42.1</td>
<td>14.2</td>
</tr>
<tr>
<td>2014</td>
<td>53.7</td>
<td>3.5</td>
</tr>
</tbody>
</table>

Key: CAGR = Compound Annual Growth Rate

Note: All figures are rounded; the base year is 2007. Source: Frost & Sullivan

Chart 6.1
Bakery Antimicrobials Market: Revenue Trends (U.S.), 2004-2014

The U.S. antimicrobials market in bakery application was valued at $42.1 million in 2007. The market registered a growth rate of 5.7 percent in the base year. The market witnessed a CAGR of 14.2 percent in the period 2004-2007.

Growth rate is expected to decline gradually in the years to come and is expected to achieve a revenue figure of $53.7 million dollars in 2014, growing at a CAGR of 3.5 percent from 2007-2014.
Competitive Structure

Figure 6-2 shows the competitive structure of the U.S bakery antimicrobials market in 2007.

**Figure 6 - 2**

Bakery Antimicrobials Market: Competitive Structure (U.S.), 2007

<table>
<thead>
<tr>
<th>Number of Companies in the Market</th>
<th>Less than 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Types of Competitors</td>
<td></td>
</tr>
<tr>
<td>Manufacturers with revenue share between $10-20 million</td>
<td></td>
</tr>
<tr>
<td>Manufacturers with revenue share less than $10 million</td>
<td></td>
</tr>
<tr>
<td>Tiers of Competition</td>
<td>2</td>
</tr>
<tr>
<td>Notable Acquisitions, Mergers</td>
<td>2005 - Kemira acquired Verdugt B.V</td>
</tr>
<tr>
<td>Key End-users</td>
<td>Bakery mixes and product manufacturers</td>
</tr>
<tr>
<td>Competitive Factors</td>
<td>Product differentiation</td>
</tr>
<tr>
<td></td>
<td>Consistent quality of product</td>
</tr>
<tr>
<td></td>
<td>Customer Service</td>
</tr>
<tr>
<td></td>
<td>Price</td>
</tr>
</tbody>
</table>

*Source: Frost & Sullivan*

Market Share Analysis

Figure 6-3 and Chart 6.2 show the company market share by revenues in the U.S bakery antimicrobials market in 2007.

**Figure 6 - 3**

Bakery Antimicrobials Market: Company Market Share by Revenues (U.S.), 2007

<table>
<thead>
<tr>
<th>Company</th>
<th>2007 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Niacet Chemical Corporation</td>
<td>30.0</td>
</tr>
<tr>
<td>AB Mauri</td>
<td>19.7</td>
</tr>
<tr>
<td>Kemira</td>
<td>15.8</td>
</tr>
<tr>
<td>Kemin Industries Inc</td>
<td>11.0</td>
</tr>
<tr>
<td>Others</td>
<td>23.5</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Note: Others include Purac, Noveon Kalama, Galactic, and DSM.

*Note: All figures are rounded; the base year is 2007. Source: Frost & Sullivan*
In 2007, Niacet Chemical Corporation had the largest share of the market (30.0 percent). The company supplies the following antimicrobial products under the brand name of Niacet to the baking industry:

- Calcium propionate
- Sodium propionate

AB Mauri followed with 19.7 percent. The company supplies a wide range of ingredients including calcium propionates to the bakery industry.

Kemira held the third position with 15.8 percent of the market share. The company supplies the following antimicrobial products to the bakery industry:

- PROBAK® Calcium propionate
- Sodium propionate
- Sodium diacetate
- Calcium acetate

Kemira is followed by Kemin Industries Inc that holds fourth rank with 11.0 percent of the market share. Kemin produces Calcium propionate under the brand name of SHIELD® for the bakery industry.

Others such as Purac, Noveon Kalama, Galactic, and DSM combined had less than 23.5 percent of the market share.

Purac supplies sodium and potassium lactates under the brand name of PURASA®L to the bakery industry while Galactic supplies lactic acid under the brand name of GALACID to the baked foods segment.
U.S. Bakery Starch Market

Opportunities and Trends

Introduction

Starch is the basic ingredient used in the manufacture of bakery products. In the US, the predominant raw material used for the manufacture of starch is maize. Maize accounts for almost 93.0 per cent of the total starch produced in the US. The other raw materials used are wheat, rice, potato, cassava, barley and oats. It is the difference in the amount of starch polymers namely amylose and amylopectin present in the grain or tuber brings differences in the properties of starches from different sources. Also, the way these polymers are packed in the starch granule governs the functionalities of the starch.

There are four types of corn starch, which are primarily used in the U.S. Common corn starch has 25.0 per cent amylose, while waxy maize is almost totally composed of amylopectin. The two remaining corn starches are high-amylose corn starches. One has 50 to 55 per cent amylose, while the other contains about 70 to 75 per cent amylose.

Classification

Starch can be classified into three categories based on the extent of processing, which includes:

- Native starch
- Modified starch
- Resistant Starch
- Starch derivatives
Native Starch

These are the most natural, raw unmodified starches produced from various raw materials involving solely physical processes. Wheat, corn, maize, oat starches are examples of this category. Native starches are mainly used as fat replacement agents, as thickening agents and as dusting powder. Native starch is the most widely used form of starch. Nearly 47 to 50.0 per cent of starch used in the bakery industry is native starch.

Modified Starch

Starch products that have been subject to physical or chemical treatments are referred to as modified starch. Modification of starch is aimed at altering its gelling and thickening properties, texture, viscosity, and performance in extreme conditions (temperature, alkaline, acidic and so on). The main forms of chemically modified starches based on the reacting agents are:

- Acid-modified starch
- Alkaline-modified starch
- Bleached starch
- Oxidized starch
- Enzyme-treated starch
- Acetylated starch
- Acetylated oxidized starch

Modified starches are used to enhance moisture retention (biscuits), fibre content (bread) and to replace fat in cakes. Modified starch represent about 9.0 per cent of the total starch used in the bakery industry.

Resistant Starch

These can be defined as the summation of starch and the products of starch digestion, which is not absorbed in the small intestine of healthy individuals. Resistant starches are classified under prebiotics and are discussed later under functional ingredients.

Starch Derivatives

This segment encompasses products that are produced using acid and/or enzymatic hydrolysis of starch. These include maltodextrin, dextrose and glucose syrups which are employed as fillers, thickeners and sweeteners in a variety of bakery products.

The scope of the study does not cover the starch derivatives quantitatively as majority of them are used in the beverage industry and very less in the bakery application. Also these are derived from starch and not a form of starch.
Native and modified starches are used as thickeners, binders and stabilizers in the food and beverage industry. Some of the functions which they deliver the prevention of undesired hydration, rendering the desired texture and mouth feel, shelf life extension and encapsulation of other ingredients. Native and modified starches together account for 2.36 million tons in terms of volume and $1.63 billion of revenue.

Starches are used in the bakery products for the below listed functions:
- To enhance dough binding, machinability and texture
- To control dough rheology
- To control batter viscosity and correct batter pickup
- To ensure bake stability, freeze thaw and chill stability

Native and modified starches are mainly used in cakes and biscuits. Native starches are used for its fat replacement and thickening properties and also as dusting powder. Modified starches are used for their moisture retention and heat resistant properties. The growth segments within bread market are the reduced-fat/low calorie breads, multigrain products and vitamin enriched breads.

Market and Revenue Trends
- Cakes, pastries and biscuits are usually perceived by consumers as indulgence products. The growing trend towards snacking due to changing eating habits is causing an increased demand for cakes, pastries, biscuits, and cookies. This in turn is favoring increased usage of starch via these products.
- Growing health awareness of consumers boost growth of resistant starch market.
- Emerging demand for clean label and wholesome food will boost the development of native starch.
- Growing need for more functional and sophisticated ingredients stimulates growth of specialty/modified starches.
- The rapid development of ethanol industry and its dynamically growing demand for corn and other materials is causing hike in the prices for the raw materials (including corn) used for making starch.
- Bakery accounts for 7.2 per cent of the native and modified starch used in foods in U.S. in terms of volume.
- The U.S. bakery starch market was valued at $117.4 million in 2007.
- Growth within this market has been partially driven by an increase in demand for cakes, cookies, biscuits, pasteries and whole garin breads.
Competitive Structure

Figure 7-1 shows the competitive structure of the U.S. food starch market in 2007.

**Figure 7-1**

Starch Market: Competitive Structure (U.S.), 2007

<table>
<thead>
<tr>
<th>Number of Companies in the Market</th>
<th>30 to 35</th>
</tr>
</thead>
<tbody>
<tr>
<td>Types of Competitors</td>
<td>Big manufacturers of native and modified starches</td>
</tr>
<tr>
<td></td>
<td>Smaller or niche manufacturers</td>
</tr>
<tr>
<td></td>
<td>Distributors</td>
</tr>
<tr>
<td>Industry Structure</td>
<td>Top three companies account for 75 percent of the market share, fragmented end-user segments</td>
</tr>
<tr>
<td>Tiers of Competition</td>
<td>3</td>
</tr>
<tr>
<td>Key End-User Groups</td>
<td>Bakery mixes and product manufacturers</td>
</tr>
<tr>
<td>Competitive Factors</td>
<td>Price</td>
</tr>
<tr>
<td></td>
<td>Highly developed distribution chain</td>
</tr>
<tr>
<td></td>
<td>Technical support and customer service</td>
</tr>
</tbody>
</table>

*Source: Frost & Sullivan*

Market Share Analysis

The U.S. starch market is extremely competitive and concentrated. The top three players – Cargill Incorporated, National Starch Food Innovation and Tate & Lyle - control among themselves approximately 75.0 per cent of the market share. Other tier one include Roquette America, and Corn Products International, Tier 2 players involves smaller or niche manufacturers, like Grain Processing Corporation, Farbest Brands or Ciranda. Some of the key distributors in the market are Atlantic Ingredients, Gillico Ingredients, Alfachem and Essex Grain products.

New entrants are very few as the initial costs and market saturation is quite high.
U.S. Bakery Colors Market

Opportunities and Trends

Introduction

Many natural food materials are characteristically associated with an attractive color which, in part, may act as a guide to their quality and edibility. However, during processing, especially if heated, this intrinsic color is often partially or totally destroyed, in turn resulting in an end product that lacks its natural look and a major chunk of its desirable colors. On the other hand, some other food products may themselves lack the desired color due to too little or incorrect colors in the ingredients. Hence in these cases using food coloring agents helps to retain or increase the aesthetic appeal of the food product.

However, in case of baked goods, the selection of the most appropriate coloring system can be challenging. This is because variables such as heat processing, extrusion, pH, color migration, and fat content can influence the performance of most of the colorants.

Classification

According to the FDA, colors can only be used to enhance visual appeal and cannot be used to conceal inferior portions or deceive consumers. The FDA has defined a color additive as any substance that, when added or applied to a food, drug, cosmetic, or to the human body, is capable of imparting color. Coloring agents that are permissible for use in food products can be classified as:

- Synthetic Colors- colors which are not found in Nature, and are manufactured by a synthetic process.
- Natural Colors - colors derived from plant material, including carmine, which is extracted from cochineal insects.
Market and Revenue Trends

- Consumer preference for food products containing natural colors due to their associated health benefits causing manufacturers to increasingly invest in R&D activities pertaining to natural colors.

- Color manufactures are concentrating more on research and development which has resulted in better products with improved characteristics such as their coloring capacity and their stability. For example, the use of micro- and nano- encapsulation technology has significantly boosted the stability of food colors in combination with the added advantage of reduced staining during processing. WILD’s NETColors (turmeric and anythocyanins) are live examples of the miracles of nano-encapsulation technology. This technology allows even the highly unstable natural colors such as turmeric and anythocyanins to be used in a wide range of applications including baked goods

- Trend towards consolidation in bakery industry is negatively affecting pricing of colors

- There is declining trend being witnessed in the sales of synthetic colors.

- Unique blends of natural and synthetic colors are also being supplied by some food color manufacturers.

- The percentage share of the revenues generated for the food colors market from bakery application is declining due to an increased application in the prepared foods application.

- The U.S colors market in bakery application was valued at $38.8 million in 2007. The market registered a growth rate of 2.6 percent in the base year. Growth within this market has been partially driven by an increase in demand for low fat and low calorie products which may require the use of flavorings to mask off-notes and bitter after-tastes.

- Growth in the U.S. colors market is likely to continue as a result of the persistent interest shown by manufacturers in the use of natural colors in baked goods.

Competitive Analysis

Figure 8-1 shows the competitive structure of the U.S. bakery colors market in 2007.

U.S. Bakery Flavors Market

Opportunities and Trends

Introduction

Flavors and fragrances are derived from natural and synthetic materials and are developed to enhance the appeal of food, beverages, and consumer products. These components are derived from natural or synthetic materials and aid the perception of four basic tastes that include sweet, sour, salty and bitter. Umami flavor, which is the fifth and recent inclusion, is a savory flavor. Sweet flavors dominate the bakery industry in U.S. Some of these are listed below:

- Vanilla
- Chocolate
- Strawberry
- Apple
- Cocoa
- Orange
- Cream
- Honey
- Lemon
- Cinnamon

Flavor and fragrance production involves the mixing and blending of ingredients. The production process involves the combination of precise amounts of ingredients. Aroma chemicals are often the raw materials of flavors and fragrances. The bakery market accounts for approximately 9.3% of flavorings consumed globally.
Classification

Based on the source of extraction flavors can be classified into:

- Natural- chemicals and volatile oils extracted from plant extracts by a physical method
- Nature-identical – synthesized or biosynthesized to mimic natural flavorings found in plants
- Artificial- aldehydes and aromatics synthesized by controlled chemical processes.

Market and Revenue Trends

Trends

- The trend towards fortified bakery foods will present many more opportunities for flavors and fragrance companies.
- Vanilla is the most commonly used flavor in bakery products
- Dry powdered flavorings are required for easier mixing with other powdered ingredients. Controlled release of flavorings during baking is also becoming more important.
- There is an increasing demand for natural flavors, ethnic flavors, intense flavors, fusion flavors, flavors with nutraceutical properties and customized flavors blends.
- The U.S. flavors market is witnessing a rise in popularity of flavors with functional properties (pomegranate).
- Popularizing organic flavors market is an attractive trend.
- Increasing demand for functional bakery and the addition of nutritional ingredients to bakery products is driving U.S. flavors market.
- Increased demand for healthier products such as granary and wholemeal breads, low fat, low calorie and high fiber products are creating opportunities for flavor houses to sell their flavors mainly to mask any unwanted sensory characteristics associated with these products.
- Convenience is driving growth of the bakery products, in turn favoring U.S. flavors market. Examples include rolls, and other `single-portion' products.
The microencapsulation flavors are growing between 8.0 to 10.0 per cent annually. Microencapsulation flavors come at low cost and can be used for a number of different reasons including delaying the release of the active or core ingredient until a certain time or set of conditions is achieved. Also, specifically in baked goods, these give a necessary stability to flavors even under extreme heat processing conditions.

Flavor consumption has been dominated by the U.S. Japan and Western Europe, however these regions will lose market share to developing areas of the world.

Factors influencing price of flavors include cost of raw materials, application type, applied technology, cost of shipping, legislation and dosage level.

Bakery Products account for 9.3 percent of the volume usage of flavors, globally.

Global market for bakery flavors is valued at $ 480.7 million in 2007.

Revenue Trends

Figure 9-1 and Chart 9.1 show the revenue trends for the U.S. bakery flavors market from 2004 to 2014.

Figure 9 - 1
Bakery Flavors Market: Revenue Trends (U.S.), 2004-2014

<table>
<thead>
<tr>
<th>Year</th>
<th>Revenues ($ Million)</th>
<th>CAGR (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>174.1</td>
<td>---</td>
</tr>
<tr>
<td>2007</td>
<td>189.1</td>
<td>2.8</td>
</tr>
<tr>
<td>2014</td>
<td>229.9</td>
<td>2.8</td>
</tr>
</tbody>
</table>

Key: CAGR = Compound Annual Growth Rate

Note: All figures are rounded; the base year is 2007. Source: Frost & Sullivan
The U.S. bakery flavors market was valued at $189.1 million in 2007. The market registered a CAGR of 2.8 percent for the period 2004-2007, respectively. Growth within this market has been partially driven by an increase in demand for low fat and low calorie products which may require the use of flavorings to mask off-notes and bitter after-tastes. Growth within the market is expected to continue at a steady CAGR of 2.8 per cent from 2007-2014 and the market is expected to reach an estimated $229.9 million in 2014. During this period, growth is likely to continue as a result of the continued development of healthy products, as well as the functional breads.

**Competitive Structure**

Figure 9-2 shows the competitive structure of the U.S. flavors market in 2007.
Market Share Analysis

Figure 9.3 and Chart 9.2 show the company market share by revenues in the global flavors market in 2007.

Figure 9.3

Flavors Market: Company Market Share by Revenues (Global), 2007

<table>
<thead>
<tr>
<th>Company</th>
<th>2007 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Givaudan</td>
<td>23.4</td>
</tr>
<tr>
<td>IFF</td>
<td>13.3</td>
</tr>
<tr>
<td>Fermenich</td>
<td>10.0</td>
</tr>
<tr>
<td>Symrise</td>
<td>9.5</td>
</tr>
<tr>
<td>Others</td>
<td>43.8</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Note: Others include Sensient Technologies Corporation, T. Hasegawa Co. Ltd, TAKASAGO INTERNATIONAL CORPORATION, A. M. Todd Company, Kerry Group, Frutarom, and so on.

Note: All figures are rounded; the base year is 2007. Source: Frost & Sullivan
The global flavors market is moderately consolidated with the top four companies holding 56.2 per cent of the market share.

The merger of Givaudan with Quest in 2007 has aided the new organization to gain access to a wider customer base as well as increase its market share. Givaudan’s market share in 2007 was 23.4 per cent as a congenial effect of Quest’s integration into Givaudan.

IFF was placed second among the leaders in the flavor industry with a market share of 13.3 per cent in 2007.

Firmenich is the largest private company in the global flavor industry. In 2007, it held a market share of 10.0 per cent and was placed behind IFF. The most recent acquisition of Danisco A/C Flavor’s division by Firmenich has very mildly increased the market share of Firmenich, further narrowing the gap between Firmenich and IFF.

Symrise is holding a market share of 9.5 per cent and being placed in the fourth position in the global flavors market.

Others account for 43.8 percent of the global flavors market by revenue and include companies such as Sensient Technologies Corporation, T. Hasegawa Co. Ltd, TAKASAGO INTERNATIONAL CORPORATION, A. M. Todd Company, Kerry Group, Frutarom and so on.
Other Bakery Ingredients

I N T R O D U C T I O N

There are many other ingredients which are used in making various bakery products. Among these are the traditionally used functional ingredients such as vitamins and minerals. However, there has been growing consumer awareness about certain other novel functional ingredients such as Omega–3 and -6, prebiotics and probiotics which are drawing consumer attention in U.S. due to the associated health benefits they have. This augmented demand for use of such functional ingredients for fortification in baked goods in U.S. is an upcoming trend. This trend has presented opportunities for bakery manufacturers to roll out innovative products with added nutritional features. These functional baked goods fortified with functional ingredients also fetch these manufacturers more value as compared to the traditional baked foods. However, fortified / functional bakery products accounted for less than 2.0 percent of total bakery value sales in 2005.

O P P O R T U N I T I E S   A N D   T R E N D S

Omega – 3 and Omega-6

"Not all fat is bad" has emerged as the most noticeable and highlighted phrase by the media in the past few years. The health food manufacturers in U.S. have also started giving heightened importance to the health benefits of good fat. All this promotion has contributed immensely to draw consumers' attention towards the functional roles of Omega – 3 and Omega-6 fatty acids and its associated positive health implications. With research supporting the various health benefits attributed to unsaturated fats, the interest in Omega-3 and Omega-6 fatty acids has continued to increase.

Fatty acids can be divided into three main categories:

- Saturated fatty acids (SFA)
- Monounsaturated fatty acids (MUFA)
- Polyunsaturated fatty acids (PUFA)
Among the above three mentioned, PUFAs are the ones which have been shown to be essential for the general health and well-being of the body. Omega-3 and Omega-6 are the main P U F A Groups. Since the human body cannot synthesize Omega-3 and Omega-6 fatty acids, they are termed as essential fatty acids (EFA) and must be supplied through diet.

The primary Omega-3 fatty acid is alpha-linolenic acid (ALA). In the body, ALA can be converted into eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), although the rate of this conversion is believed to be less than 10.0 percent. On the other hand, the primary Omega-6 is linoleic acid (LA). LA is converted in the body to gamma-linolenic acid (GLA) and arachidonic acid (AA).

These essential fatty acids have considerable biomedical importance for the body. A high ratio of PUFAs compared to SFAs in the diet can effectively lower cholesterol in an individual. Besides, they are precursors of pharmacologically active compounds such as prostaglandins (PG), thromboxanes (TX), leukotrienes (LT) and lipoxins (LP), which control a number of processes in the human body. For instance, clotting, inflammation, and other functions are mediated by these compounds.

Some of the other roles that EFAs can play in the body are listed below:

- They are associated with thermogenesis or the 'heat-generating capacity of the body'. They increase energy production and thereby improve the performance of the individual. Moreover, they assist in muscle building and effectively prevent muscle breakdown, as well as hasten recuperation from fatigue.

- They can also play a significant role in the weight loss process. Thermogenesis leads to increased energy levels and by keeping energy levels high, hunger cravings are not as evident thereby reducing the intake of food. EFAs are also known to suppress a gene that aids fat production.

- They are imperative for the good health of the mucous membranes as well as for cell growth and cell division. They maintain and monitor cell activity. Hence, they are absolutely indispensable in the process of healing and wound repair.

- Vitamins and minerals required for maintaining bone strength and density need EFAs for their absorption and transportation within the body. Thus, they help in the prevention of the occurrence of osteoporosis.

- EFAs are innately antifungal, antiviral, and anti-yeast in nature. This helps the system increase resistance to the onset of diseases.

- They maintain the quality of skin, hair, and nails. With a deficiency of EFAs, the skin turns dry and flaky, the nails become brittle and the hair becomes rough and dull, and loses its elasticity.
About 60 percent of our brain is composed of EFAs. They promote the production of specific neurotransmitters such as serotonin.

Deficiency of EFAs could lead to excessive thirst, frequent urination and sleep disturbances.

A number of vision afflictions may also result as a direct effect of EFA deficiency.

Extreme emotional sensitivity is also a side effect of a deficiency in essential fatty acids.

**Omega - 3 and Omega - 6 PUFA ingredients market**

The U.S. Omega-3 and Omega-6 polyunsaturated fatty acid (PUFA) ingredients market is in the development stage of the product life cycle. Hence, the average growth rate of this market is comparatively higher than the global growth rate.

U.S. Omega-3 and Omega-6 PUFA ingredients market can be segmented by ingredient source as:

**Omega-3 PUFA sources**

- Marine oils
- Algae oils
- Flaxseed oils

**Omega-6 PUFA sources**

- Borage oils
- Evening primrose oils

**Drivers**

Some of the key factors driving the usage of Omega-3 and Omega-6 PUFA ingredients market in Bakery products include:

- Intensified media coverage and increased consumer awareness about PUFA's health benefits
- Novel and convenient Delivery systems for Incorporation of PUFAs in the Diet
- Consumer inclination toward fortified health foods
- Trend towards healthy snacking
- Research focus by well-known organizations contributing to PUFA's consumer acceptance.
- Technological advancements that have overcome shelf-life challenges and have been able to provide PUFA ingredients with improved organoleptic profile.
Significant Developments and Statistics

An increasing number of functional food and beverage products have PUFA oils because of their associated health benefits. The functional food and beverage industry accounts for 5 percent of the Omega-3 and Omega-6 PUFA ingredients volumes consumed in the United States. The largest application sector for Omega-3 PUFA ingredients is in the dairy industry. With the increased focus on DHA deficiency in infants and children, the market for DHA-rich milk has increased significantly.

The bakery industry has also captured a decent share of the Omega-3 ingredients market. However, Bakery manufacturers were a little slow to react to this trend in the U.S. as compared to dairy manufacturers. Such products are doing well in the European market and, with sufficient media promotion, are likely to appeal to the ageing U.S. population as well in the next few years.

After the FDA approved a health claim pertaining to omega-3 in 2004, the bakery manufacturers and retailers, including Wegmans Food Market, Bimbo Bakeries USA, The Baker and Arnold Foods Co., have rolled out omega-3 fortified breads in the U.S. in 2005.

The beverage industry is another area where PUFA ingredients have been successfully added. Examples of other fortified products include spreads, mayonnaise, cereals, energy bars and snacks.

North America accounts for 30.0 percent of the total Omega – 3 PUFA market globally. Whereas, Europe and Rest of the world accounts for 40.0 percent and 30.0 percent respectively. 14.0 percent of the global Omega – 3 PUFA market is being used in bakery application.

Competitive Structure

The major manufacturers in the Omega-3 PUFA ingredients market included, Martek Biosciences Corporation, Cargill, Incorporated, Celanese Corporation, ONC (Ocean Nutrition Canada), Croda Inc, Omega Nutrition USA Inc., and Omega Protein Corporation, Inc.

The number of participants and market concentration varied between different omega-3 sources. The marine oil/fish oil omega-3 market was comprised of more than 30 companies and the manufacturers had relatively low bargaining power as compared to the bakery manufacturer. However, the algal omega-3 market consisted of less than 7 manufacturers. Martek Biosciences Corporation was the dominant manufacturer with majority of the market share. Consequently, the buying power of bakery manufacturers was relatively low in this segment. The flaxseed omega-3 oil market has few manufacturers giving higher bargaining power in terms of price to these oil manufacturers. The major competitive factors in this market are price, quality, ease of processing, and availability.
U.S. Omega-6 PUFA borage and evening primrose oils have not achieved the same levels of popularity in functional food and beverages application as in the dietary supplement application.

Prebiotics

The term ‘prebiotic’ was coined by Professors Gibson and Roberfroid in 1995. It is used to refer to those ingredients that fit the following definition: "A prebiotic is a non-digestible food ingredient that beneficially affects the host by selectively stimulating the growth and/or activity of one or a limited number of bacteria in the colon to improve host health."

Some ingredients that are prebiotic by nature are:

- Inulin
- Fructo-oligosaccharide (FOS)
- Mannan-oligosaccharide (MOS)
- Galacto-oligosaccharides (GOS)
- Resistant Starch
- Dextrins

Some prebiotics such as inulin and FOS have been on the market longer than others. Many others are still in the development or embryonic stage in the U.S. market. Europe is estimated to have a larger market than the U.S. currently, but Japan is expected to be the most advanced market for prebiotic use.

Drivers

Some of the key factors driving the usage of prebiotics in Bakery products include:

- Established Benefits of Prebiotics
- Growing Demand for Probiotics
- New Research Drives New Applications
- Multifunctional Properties
Significant Developments and Statistics

In 2007, the U.S. prebiotic market was estimated to be worth $68.9 million, with a corresponding unit shipment of 20,945 metric tons. In 2007, the leading products in this market were fructans (inulin and FOS), which accounted for 43.4 percent of the unit shipment in this market and correspondingly accounted for 51.9 percent of the revenues.

In 2007, food and beverage applications accounted for the largest share, accounting for more than 60.0 percent of the unit shipment. Animal feed use was driven mostly by MOS. Other applications like dietary supplements and pharma applications accounted for the rest of the market.

Food and beverage application accounted for 80.0 per cent of the U.S. fructans market by volume. Out of this, bakery applications share was 18.0 per cent. The most popular products for the inclusion of inulin/FOS are breads and biscuits. In this case as well, the long-standing association of bread products with fibers has made it easier to market prebiotics in these applications. Examples of products incorporating inulin and FOS are Sporting bread from Purato, Vitafit Gold, and Intermill Balance Bread.

Prebiotics such as resistant starch and maltodextrins are used in bakery, cereal and confectionery products. Some of the bakery products which use these include breads, rolls, buns, pancakes and biscuits, cookies, cakes, muffins, and sweet breads.

Competitive Structure

The major players in the U.S. prebiotic market include Orafti, Sensus America, GTC Nutrition, Cargill, Incorporated, TIC Gums, Inc., Colloides Naturels, Inc, Carbomer, Inc. and Questcor Pharmaceuticals Inc (for fructans); Tate & Lyle, National Starch, Archer Daniels Midland or ADM (for other prebiotics such as resistant starch, maltodextrins).

Probiotics

Probiotics are live bacteria or yeast that has potential health benefits. Probiotics improve the microbial balance of intestine thereby promoting optimal health. Bifidobacteria, Lactobacilli, Lactococci, Saccharomyces and Streptococcus thermophilus are examples of micro-organisms used as probiotics. These are mostly used in dairy products (63.0 percent by revenue) and dietary supplements (36.0 percent by revenue).

Use of probiotics in bakery products is a budding concept. In bakery application, probiotics and prebiotics are used in combination. Symbiotic combinations of probiotics and prebiotics are known to have better efficiency in the digestive system.
Vitamins and Minerals

Vitamin A has long been used in the food and beverage applications. In foodstuff, oxygen free radicals can cause rancidity, undesirable flavors and odors, and deterioration of the product’s nutritional value. Substances that fight free radical activity are known as anti-oxidants. They help to scavenge these unstable oxygen molecules and help prevent oxidation in foodstuffs. Vitamin A is a powerful anti-oxidant and is used in the food and beverage industry to help increase shelf-life and stability of products and to prevent damage by free radicals and resultant rancidity and loss of nutritional value.

Vitamin A is one of the vitamin forms which are used to some extent in bakery. In 2007, the revenues from the food and beverage application in the U.S. vitamin A market were $47.9 million.

Vitamin A is used in both food and beverage products. Food products commonly fortified with vitamin A are bread, cereal, rice, and dairy products. Within the beverage area, vitamin A is mostly used as a fortification ingredient in the "ACE" drinks sector, which incorporate vitamins A, C, and E. These are commonly marketed as sports drinks or energy drinks.

Minerals such as calcium and iron are used to fortify bakery products such as biscuits, and breads.
Formulated Bakery Ingredients

Overview

Introduction

There are a number of ingredients employed in the manufacturing of baked goods such as starch, flavors, colors, antimicrobials, emulsifiers, yeast, enzymes, and functional ingredients. These are either supplied by the multi-ingredient suppliers such as DSM, Danisco A/S or by the speciality bakery ingredient suppliers such as BakeMark CSM, AB Mauri and Beldem. The former includes companies which are active in diverse business sectors including food ingredients. On the other hand, the latter includes those companies who focus mostly to meet the ingredients needs of the bakery industry.

Apart from selling these ingredients standalone, certain ingredient manufactures also are into the business of using these different ingredients and making various formulations. The U.S. bakery market has categorized all the bakery ingredients into the following categories:

- Basic raw material – includes the flour, fats, yeast
- Speciality ingredients – includes the starch, flavors, colors, antimicrobials, emulsifiers, yeast, enzymes, functional ingredients and improvers
- Bakery materials – includes the pre-mixes for breads, cakes, biscuits, sponge
- Semi-finished – includes crude-frozen dough, fillings, coatings
- Ready to bake/thaw-packaged chilled dough, frozen dough products
Market Trends

- Consolidation is a vital activity that marks the dynamic nature of the ingredient business.
- Sustaining profitable business in the industry depends a great deal on manufacturers’ financial strength, R&D focus, technical know-how and inclination to value-added customer service.
- Major multi-nationals focus towards large scale plant bakers and big food companies whereas regional and small scale manufacturers cater to craft bakers.

Company Profiles and Product Analysis

CSM

Centrale Suiker Maatschappij (CSM) is the leading participant in the production and sale of bakery products and ingredients worldwide. The company’s activities are grouped into three main divisions that include Bakery supplies Europe (BSEU), Bakery supply North America (BSNA) and biochemical (PURAC). The company has a broad product portfolio that includes bakery fats, bread and pastry improvers, baking mixes, fruit and cream fillings, icings, releasing agents, and convenience products. The wide array of ingredients is supplied to an equally diverse application sectors in the bakery industry such as artisan and industrial bakers, chain bakeries, in-store bakeries, food service, and out-of-home sectors. The out-of-home sector is one of high growth arenas that consist of restaurants, hotels, coffee shops and fast-food chains. It manufactures emulsifiers, flavors, enzymes, premixes, improvers, crude-frozen dough, fillings, coatings, frozen dough products and so on. Some of the products which it buys form other suppliers and sells comprise flour, fats and yeast. CSM holds a strong position in selling its products via in-store bakeries in U.S. The company follows a regional approach in supply chain, distribution and procurement.

BELDEM

BELDEM, a subsidiary of the PURATOS Group, came into existence in 1975 as a supplier of emulsifiers. In 1994 the company established a manufacturing facility for enzymes and sourdoughs and a new yeast plant called Gelka International in 1999. In 2000, BELDEM and FRIMOND merged to form BELDEM S.A. which represents the Food Ingredients Division of the Puratos Group together with Gelka International. Presently, BELDEM is integrated in the new PURATOS Group organization as a part of the Strategic Business Unit Bakery. This is further divided into 3 Business Units namely, B.U. Enzymes, B.U. Emulsifiers and B.U. Bioflavours.
BELDEM sells enzymes, emulsifiers, dried sourdoughs, flavors, instant active dry yeast and starter cultures to cater the needs of the U.S. baking industry. They also sell emulsifiers and enzymes blends for the biscuits and cakes industry in U.S.

AB Mauri

ABF acquired the yeast and bakery ingredients businesses of Burns Philp. ABF then brought together these acquired businesses and its own pre-existing bakery ingredient businesses (Cereform) to form AB Mauri in 2004. The company is headquartered in the U.K. and is organized into six geographic regions namely Brazil, China East Asia Pacific, Europe, Hispano-America, North America and South & West Asia. The company operates in 24 countries and registers total sales turnover of US$ 800 million.

AB Mauri’s product range varies from country to country. It sells bakery fats & oils, dough conditioners/bread improvers, bread mixes & concentrates, cake mixes & concentrates, donut mixes & concentrates and toppings, fillings, colors & flavors.

AB Mauri serves the North American market through Fleischmann’s Yeast and Innovative Cereal Systems (ICS). Fleischmann’s has yeast factories and also manages the AB Mauri bakery ingredients factory in Greenville, Texas which produces chemical leaveners (used to leaven cakes, cookies etc.), preservatives and anti-mould ingredients as well as tableted ingredients. ICS, an Oregon based company, was established in 1996. ICS is known for its expertise in designing natural enzyme-based solutions for the baking industry that aid in improving the quality of products and give them extended shelf life and freshness. The company has made remarkable inroads to the U.S. and Canadian markets through its novel business approach which covers all aspects of the customer's ingredients, plant, process and products.

Watson Inc.

The company, headquartered in West Haven, Connecticut, was founded in 1939. In Connecticut the company has established facilities such as manufacturing, warehouse, analytical and research & development. Watson has a second 66,000 sq. ft. manufacturing and distribution center in Taylorville, Illinois and a distribution warehouse in Southern California as well as several other locations globally. The company is in the business of developing quality products and ingredient systems for the food, supplement and pharmaceutical industries and under the expert guidance of its superior microencapsulation, agglomeration, micronizing, spray drying and film technologies these value-added ingredients are converted into unique formulations and products.

The company caters to the needs of bakery industry in U.S. through the supply of bakery ingredients such as dough improvers, crumb softeners, mold inhibitors, dough conditioners, icing stabilizers, speciality and prepared bases/mixes (for rolls, breads and bagels) and speciality ingredients for tortillas.