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Xylitol

Polyol/Sugar Alcohol Sweetener

A Global Market Overview

"The report reviews, analyzes and projects the global market for Xylitol for the period 2009-2020."

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DuPont Danisco is the leading manufacturer of xylitol globally, with three plants located in Finland, USA and China. In addition to DuPont Danisco, leading players in xylitol market include Shandong Futaste, Roquette Freres and few Chinese players among others. The major concern in the xylitol industry is the overcapacity installed globally at the moment. Several Chinese players aggressively added capacity over the past few years and estimated to reach around [redacted] thousand tons till the end of 2013. Although the output rate of Chinese manufacturers is around [redacted]%, the concern remains a restrain for new entrants into the xylitol market.

Erythritol is the only polyol which is estimated to grow with a CAGR of [redacted]% from 2014-20, attributed to its usage with Stevia in many products. The price at US$[redacted] thousands per metric tons is the major concern for ehrythritol for its wide use application at the moment. After erythritol, xylitol is the only other polyol that is estimated to grow at an above average rate of [redacted]% CAGR from 2014 to 2020. In volume terms, sorbitol is the largest polyol in global market. Sorbitol, with a lowest cost among other polyols, is the preffered choice for manufacturers. In chewing gum industry, which is the largest application for xylitol, sorbitol is widely used in combination with xylitol to reduce the final cost of the product. Sorbitol global average price is only US$[redacted] per metric ton where as xylitol average price is US$[redacted] per metric ton in the global market. As new processes and technologies are being developed in the near future, xylitol price is expected to come down, allowing manufacturers to use xylitol in wide veriety of applications.

Polyol	Relative Sweetness to Sucrose (=1)	Energy	Price (US$/Metric Ton)	Volume 2012 (MTs)	Volume CAGR % 2014-2020
Sorbitol	0.6	2.6 kcal/g	$880	866,300	3.1
Maltitol	0.9	2.1 kcal/g	$1,130	182,000	3.3
Mannitol	0.7	1.6 kcal/g	$4,200	151,420	4.1
Xylitol	**1**	**2.4 kcal/g**	**$4,120**	**157,880**	**6.0**
Erythritol	0.7-0.8	0.2 kcal/g	$6,320	46,650	10.0

Main growth drivers include:

- Health concerns such as obesity and diabetes driving the growth of the alternative sweetener market
- Growth in sugar-free chewing gum and other sugar-free confectionery market
- Increasing consumer demand for low-calorie sweeteners
- Increasing awareness of naturally derived alternative sweeteners

Xylitol Application Overview

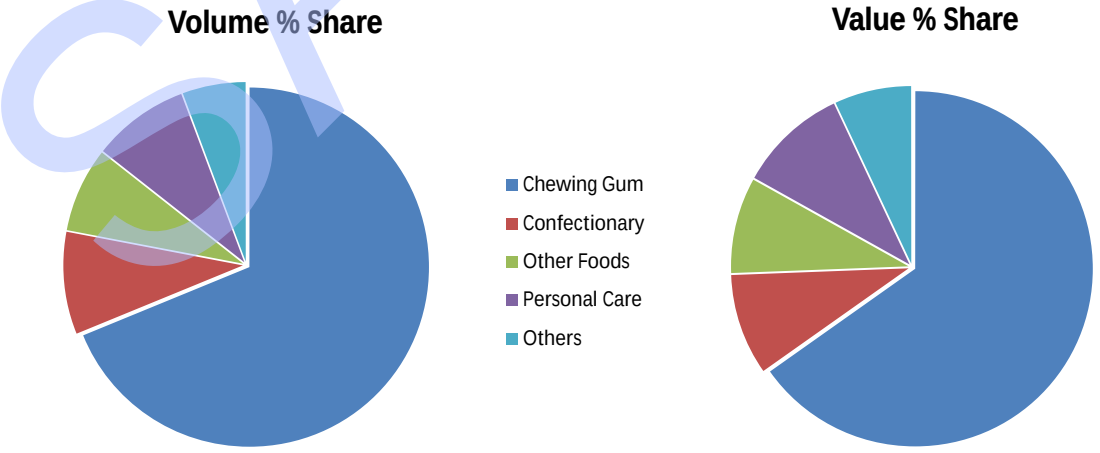
Due to xylitol's dental significance and low-calorie alternative, xylitol is used in variety of food and other applications. Different applications for xylitol are listed below:

- *Chewing Gums*: Xylitol is widely used as a sugar substitute, to prevent tooth decay and dry mouth in sugar-free chewing gums.
- *Confectionary*: Xylitol is used as low-calorie sweetener in sugar-free confectionary applications such as jellies, mints and other candies.
- *Other Foods*: Xylitol is used a sugar substitute in foods for people with diabetes and sugar substitute in bakery products.
- *Personal Care Products*: Xylitol applications include personal care products or oral hygiene products, such as toothpaste, fluoride tablets and mouthwashes. Xylitol usage in oral care products helps to prevent tooth decay and dry mouth.
- *Other Applications*: Other applications for xylitol include pharmaceuticals and nutraceuticals. As a medicine, xylitol is used to prevent middle ear infections (otitis media) in young children. The pharmaceutical industry uses xylitol as a sweetener in its products. Xylitol is sometimes included in tube feeding formulas as a source of energy. Variety of nutraceutical products such as vitamin chew jellies for kids and vitamin tablets.

Sugar-free chewing gum industry is the largest consumer of xylitol on global basis. Chewing gum accounts for around [redacted]% of the volume consumption of xylitol, converting into [redacted] thousand metric tons in 2012. In terms of value, the consumption of xylitol in chewing gum agina accounts for the major portion of the pie with around [redacted]% share. Other leading applications for xylitol include confectionary (excluding chewing gum) and personal care products with a volume share of [redacted]% and [redacted]% respectively in 2012.

Chart 1: Snapshot for Global Xylitol Market Share (2012) by End-use Application

Application	Volume (MTs)	% Share MTs	Value (US$ M)	% Share US$
Chewing Gum	[redacted]	[redacted]	[redacted]	[redacted]
Confectionary				
Other Foods				
Personal Care				
Others				
Total				



KEY MARKET TRENDS

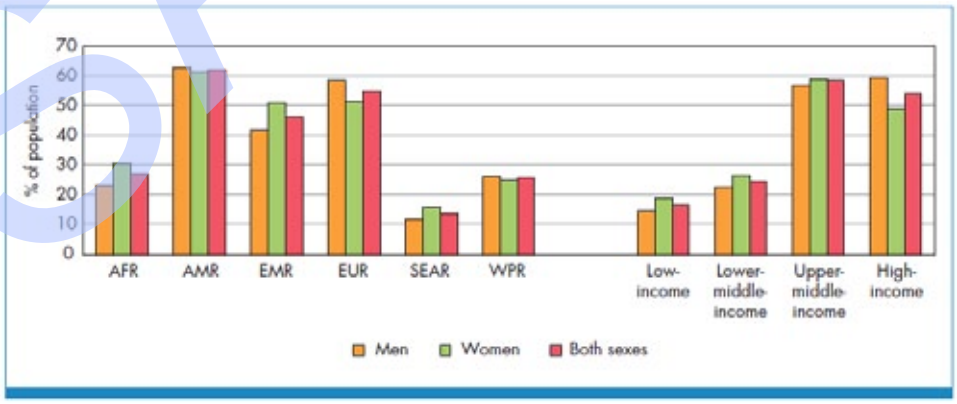
Prospects for Low-Calorie Sweeteners Brightened by Escalating Incidences of Obesity and Diabetes

The number of individuals afflicted with type 2 diabetes has been increasing at a fast pace, necessitating that priority status is provided to identify the components that either contribute to or are associated with this disease. Excessive weight gain has been a major factor that has been associated with the incidence of type 2 diabetes, with reduction in weight being high on the recommendations list of preventing and managing diabetes. In this context, low-calorie sweeteners offer an ideal substitute to added sugars, with the potential of assisting in losing and maintaining weight through limiting intake of calories, factors that have been corroborated through widespread research conducted for this purpose. Individuals with type 2 diabetes who replace sugars with low-calorie sweeteners are provided with a greater adaptability as regards their health goals and dietary preferences.

Overweight and Obesity: Some Statistics of Prevalence

The World Health Organization (WHO) estimates that on an annual basis, 2.8 million people die as a consequence of being overweight that includes obesity and roughly 35.8 million (2.3%) of global DALYs (disability-adjusted life-years) result from overweight or obesity. These conditions are found to be the cause of adverse metabolic effects on blood pressure, cholesterol, triglycerides and insulin resistance. An increase in body mass index (BMI), a measure of weight relative to height, has proven to have a direct link with greater risks of coronary heart disease, ischemic stroke and type 2 diabetes mellitus. The ideal median BMI for adult populations in achieving optimal health should range between 21 to 23 kg/m^2, with the ultimate aim for individuals being to maintain a BMI between 18.5 to 24.9 kg/m^2. The risk of co-morbidities increases for BMIs in the range of 25.0 to 29.9 kg/m^2, with the same increasing to moderate to severe levels for a BMI exceeding 30 kg/m^2.

Figure 5: Age-Standardized Prevalence of Overweight in Adults Aged 20+ Years, by WHO Region and World Bank Income Group, Comparable Estimates, 2008



Source: WHO, 2008

Polyols and High Intense Sweetener Regulations around the Globe

European Union

Sweeteners are food additives utilized to offer sweet taste in foodstuffs; or as table-top sweeteners. Earlier to market authorization, sweeteners are regulated substances subjected to safety assessment that is similar for all food additives. Food additive application has been regulated by the European Commission, Parliament and Council in the European Union (EU); mainly the Commission and Member States would set out the additives that could be used in foods and their levels. Every food additive is covered in the ingredient lists on product labels that should indicate both the function of the food additive in the finished food (sweetener) and the peculiar substance utilized either by pertaining to the proper E-number or its name (for example, E 954 for 'Saccharin').

In 1990s, the first regulation for the high intense sweeteners was provided at European level with the debut into force of Directive 94/35/EC of the European Parliament and the Council on sweeteners in foodstuffs, called the "Sweeteners Directive". Regulation 1333/2008, a framework regulation has been followed by the European Parliament and the Council in the recent times for merging each and every recent accreditation for sweeteners and food additives into one legal text. A Community list of sweeteners that have received approval for use in foods, beverages and table-top sweeteners and their conditions of use have been offered by Commission regulation 1129/2011's Annex II of this regulation.

At present, the high intense sweeteners accredited in the EU encompass acesulfame-K (E950), aspartame (E951), aspartame-acesulfame salt (E962), cyclamate (E952), neohesperidine DC (E959), neotame (E961), saccharin (E954), steviol glycosides (E960), sucralose (E955) and thaumatin (E957).

Regulation (EC) 1333/2008 on food additives that came into force on 20 January 2009 has governed the application of polyols in foods. The Union list of approved food additives and their conditions of application has been offered by Annex II of this regulation established by the regulation (EU) 1129/2011 that would be in force from June 1 2013. An amendment to the present regulations would be made by the European Commission when a novel polyol has been reviewed by EFSA for approving the novel polyol along with the polyols that have been currently present on the market (at present isomalt, lactitol, maltitol, mannitol, sorbitol, xylitol, erythritol, and polyglycitol syrup).

As per the Regulation 1129/2011 at "quantum satis", excluding polyglycitol syrup, polyols might be utilized in the food applications. "Quantum satis" means no specification of maximum level. As per the GMP, polyols should be utilized at a level not higher than is needed to attain the committed purpose and offered that they do not mislead the consumer.

New Entrants in Xylitol Foray

There are quite a few companies who recently invested in xylitol production such as Xylitol Canada (Canada), and several players who developed new technologies and planning to enter into this market such as zuChem Inc (USA), DFI Corp. (USA), Novagreen Inc (Canada) and few Chinese and Indian Companies. Below are profiles of select players entering into xylitol foray.

DFI CORPORATION (UNITED STATES)

15 Broadway North, Suite 500, Fargo, North Dakota 58102
United States
Tel: 425.605.8990
Fax: 425.605.8530
Email: info@dficorp.net
Website: www.dficorp.net

Business Overview

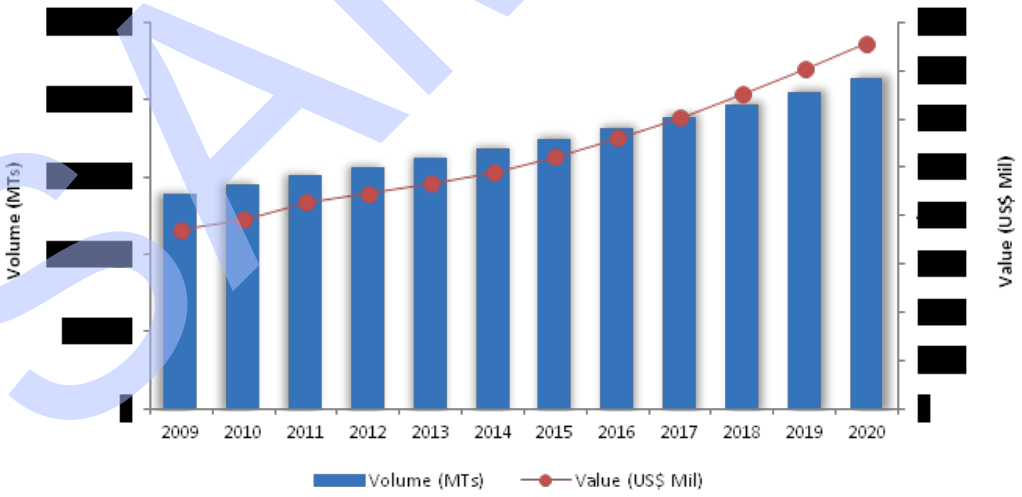
North Dakota head quartered DFI Corporation is a technology company engaged in the discovery, development and manufacture of two natural sweeteners, Erythritol and Xylitol using green electrochemistry process. These sweeteners with specific health benefits have been produced for use in the food and beverage industry. Researchers at Purdue University discovered a breakthrough technology for the production of xylitol. Purdue Research Foundation (PRF) immediately recognized the importance of this discovery and invested in its patenting and commercialization. DFI has received an exclusive worldwide license for this technology and started the engineering research for process optimization. As of 2013, the company has established an erythritol production unit in Buffalo, New York and a commercial scale plant in North Dakota. The company also considering plans to produce xylitol on a commercial scale using the patented technology.

GLOBAL ALTERNATIVE SWEETENERS MARKET

Driven by health concerns such as obesity and diabetis, consumption of alternative sweeteners is expected to increase by [redacted]% CAGR from 2014 to 2020 in volume terms by reaching [redacted] million metric tons by 2020 from [redacted] million metric tons in 2013. In terms of value, global alternative sweeteners market is expected to reach [redacted] billion USD by 2020 from [redacted] billion USD in 2013, exhibiting a CAGR of [redacted]% in the period 2013-20. The growth is mainly atrributed to new products such as stevia, netame and other natural sweeteners among varoius high intense sweeteners and erythritol and xylitol among polyols or sugar alcohols.

Chart 9: Global Alternative Sweeteners/Sugar Substitutes Market Overview (2009-2020) by Volume (Metric Tons) and Value (USD Million)

Year	Volume (MTs)	Value (US$ Mil)
2009		
2010		
2011		
2012		
2013		
2014		
2015		
2016		
2017		
2018		
2019		
2020		
CAGR% 2009-13		
CAGR% 2014-20		



End-use Application Market Overview by Geographic Region

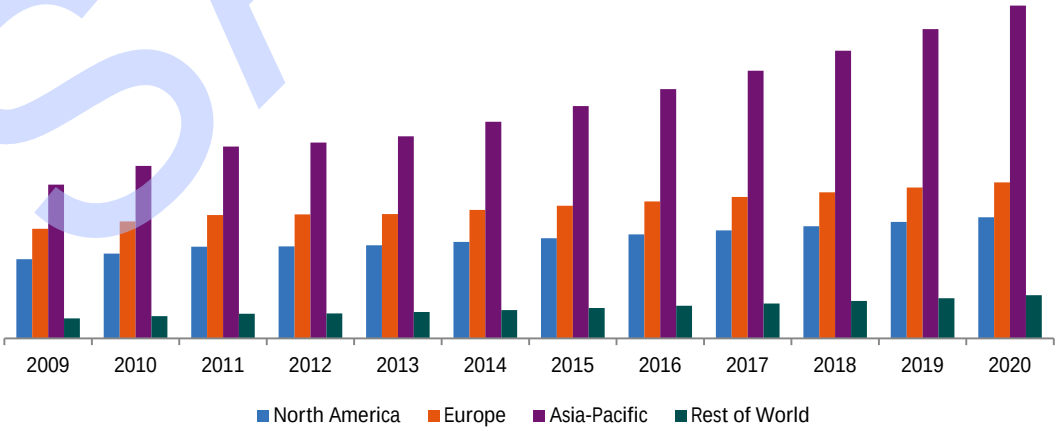
Chewing Gum

Volume Analysis

Consumption of xylitol in chewing gum segment worldwide is estimated at [redacted] thousand metric tons in 2014 and forecast to be [redacted] thousand metric tons in 2014. Expected to maintain a CAGR of [redacted]% between 2014 and 2020, the global xylitol consumption in chewing gum sector is further projected to reach [redacted] thousand metric tons by 2020. Asia-Pacific is the largest consumer, with an estimated 2014 consumption of [redacted] thousand metric tons. Forecast to be [redacted] thousand metric tons in 2015, Asia-Pacific consumption of xylitol in chewing gum is further anticipated to record the fastest CAGR of [redacted]% between 2014 and 2020 to reach a projected [redacted] million metric tons by 2020. At the other end, European consumption of xylitol in chewing gum, estimated at [redacted] thousand metric tons in 2014, is expected to witness the slowest 2014-2020 CAGR of [redacted]% in reaching a projected [redacted] thousand metric tons by 2020.

Chart 43: Global Xylitol End-use Application in Chewing Gum (2009-2020) by Geographic Region – North America, Europe, Asia-Pacific and Rest of World in Metric Tons

Year	North America	Europe	Asia-Pacific	Rest of World	Total
2009	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
2010					
2011					
2012					
2013					
2014					
2015					
2016					
2017					
2018					
2019					
2020					
CAGR% 2009-13					
CAGR% 2014-20					



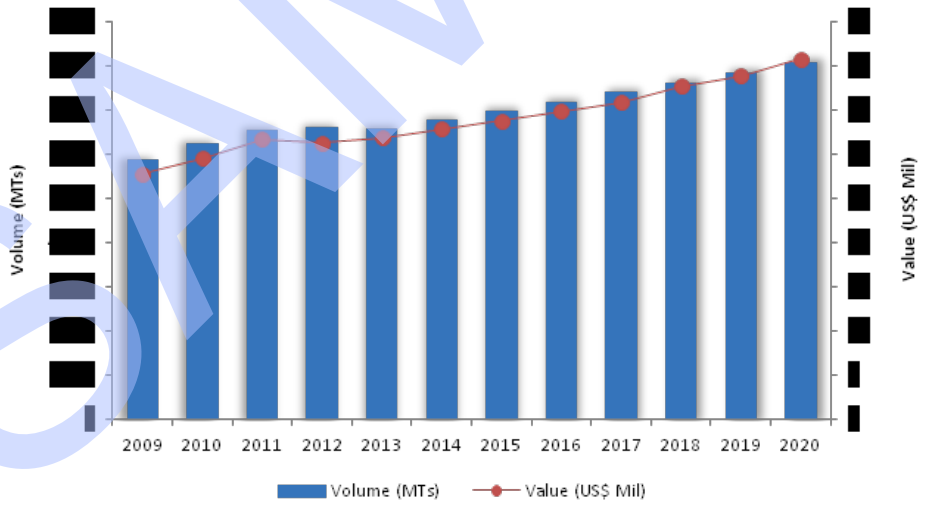
Europen Market Overview by Country

GERMANY

German volume consumption of xylitol, estimated at [redacted] thousand metric tons in 2014 and forecast to be [redacted] thousand metric tons in 2015, is further expected to maintain a CAGR of [redacted]% between 2014 and 2020 to reach a projected [redacted] thousand metric tons by 2020. In regard to value demand, the market for xylitol in the region is slated to register a CAGR of [redacted]% over the same period in reaching a projected US$[redacted] million by 2020 from an estimated US$[redacted] million in 2014.

Chart 100: German Xylitol Market Overview (2009-2020) by Volume (Metric Tons) and Value (USD Million)

Year	Volume (MTs)	Value (US$ Mil)
2009	[redacted]	[redacted]
2010		
2011		
2012		
2013		
2014		
2015		
2016		
2017		
2018		
2019		
2020		
CAGR% 2009-13		
CAGR% 2014-20		



Market Overview by Region

China is the largest Asia-Pacific market for xylitol with US$[redacted] million in 2014 converting to [redacted] thousand metric tons. India expected to be the fastest growing market in the region with a robust CAGR of [redacted]% for the period 2014-2020 to touch [redacted] thousand metric tons by 2020 from an estimated [redacted] metric tons in 2014. India is also projected to be the fastest growing market in terms value with a CAGR of [redacted]% in the same period to reach US$[redacted] million.

Volume Analysis

Chart 141: Asia-Pacific Xylitol Market Overview (2009-2020) by Country - China, Japan, South Korea, Australia, India and Rest of APAC in Metric Tons

Year	China	Japan	South Korea	Australia	India	Rest of APAC	Total
2009							
2010							
2011							
2012							
2013							
2014							
2015							
2016							
2017							
2018							
2019							
2020							
CAGR% 2009-13							
CAGR% 2014-20