Sugar Reduction & Substitution Technologies

Research Support Service

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PRESCOUTER

Intelligence Brief Question

What are recent examples of sugar reduction and sugar substitution technologies?

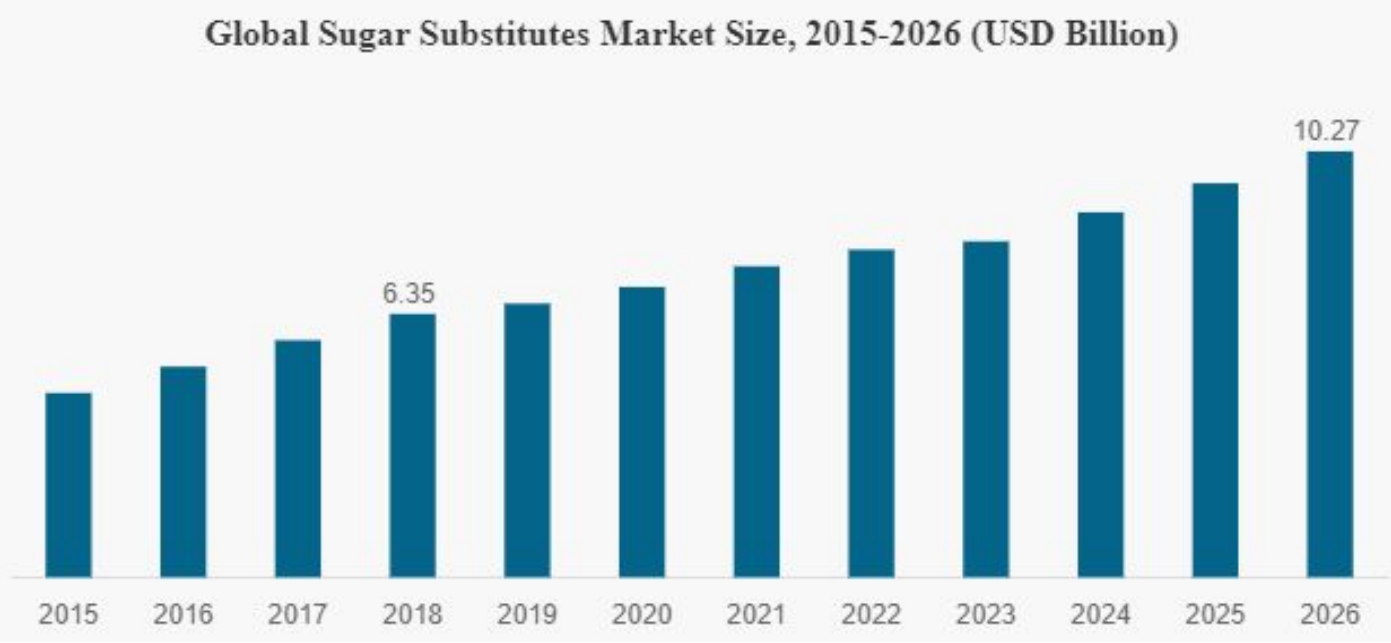
Over the last 5 years, there has been an increase in the number of published research that links high sugar consumption to various diseases of great public health concern, including cardiovascular diseases, obesity, and diabetes, that have helped to drive public policy toward the reduction of the amount of sugar that is consumed. Furthermore, there has been a general consumer trend towards healthier food options. While traditional sugar substitute options such as sugar alcohols are available, there is a consumer-driven desire for healthier sugar reduction and/or substitution options.

In this report, we present examples of recent sugar reduction and sugar substitution technologies as well as provide profiles of the startup companies behind the technologies.

Executive Summary

Market Overview

Interest in sugar substitutes is increasing. A 2018 market analysis report indicates that sugar substitutes have become more popular due to consumer perception and increased education regarding the imbalance that exists between consumed and expended calories that can be partly attributed to the sedentary lifestyles of many consumers. The current sugar substitutes market value is expected to increase by 3% over the next 6 years.

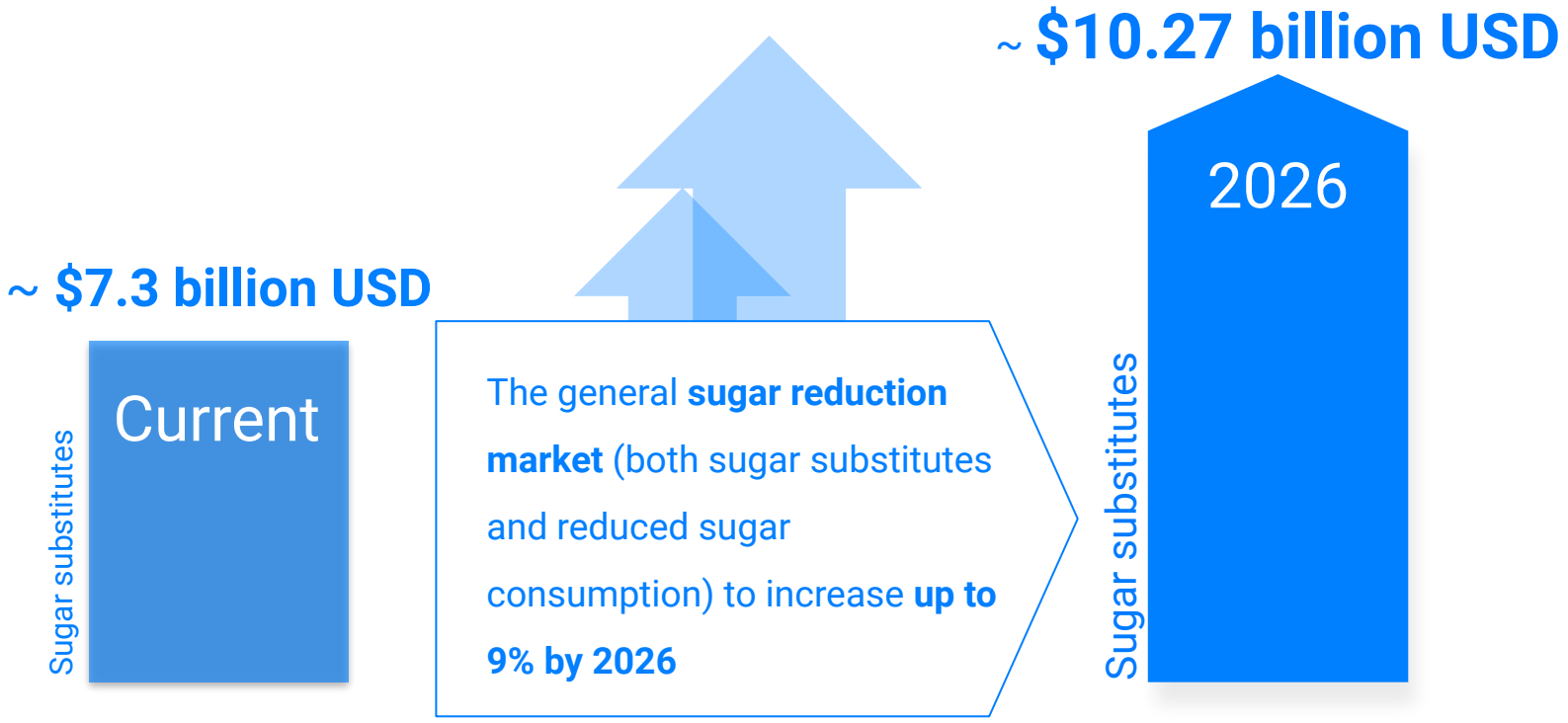


The sugar substitutes market size. Source: Fortune Business Insights

Executive Summary

Market Overview

Another market report[1] indicates that the overall sugar reduction market (both sugar substitutes and reduced sugar products) is expected to grow at a CAGR of 9.0% during the forecast period between 2018 and 2025. The report also indicates that the growing preferences for healthy eating and new governmental policies have also demanded that food and beverage manufacturers introduce sugar substitutes into products.



1. https://www.datamintelligence.com/research-report/sugar-reduction-market

Executive Summary

Summary of Profiled Companies & Technologies

PreScouter investigated the current state of the sugar reduction and sugar substitution space by identifying recent technology and/or strategy developments as well as providing profiles of the startup companies behind the technologies.

This report provides examples of two types of sugar reduction technologies and strategies — **structural modification of table sugar (sucrose) and targeted flavor delivery** — as well as two types of sugar substitutes — **soluble fiber-based sugar substitute and fermentation-based sugar substitute**.

The infographic below summaries the companies that are profiled in this report.

Sugar Reduction & Substitution Technologies

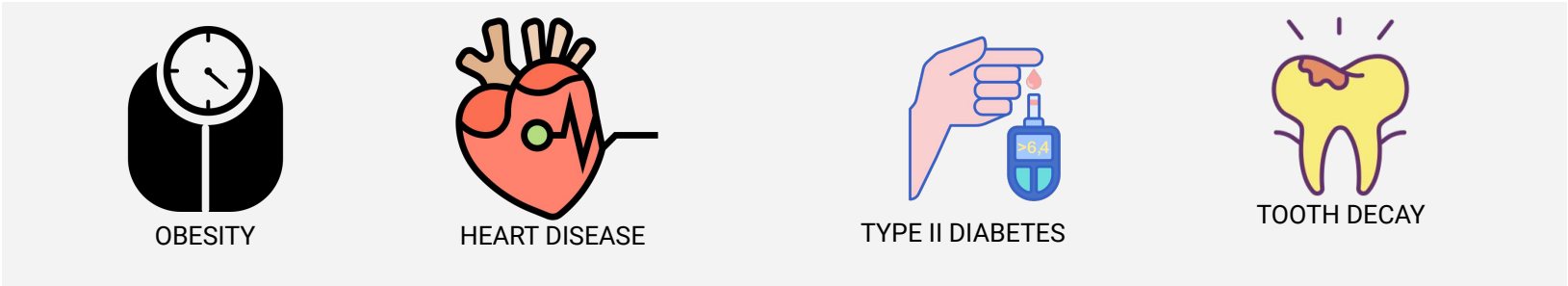
Sugar Alternatives/Substitutes

Sugar Reduction Technologies

Executive Summary

Health Implications & Concerns

As a result of the increase of available data suggesting strong linkages between high sugar consumption and various diseases such as obesity, cardiovascular disease, type 2 diabetes, tooth decay, and cancer, public policies in some countries and municipalities have been instituted to help combat the problem, since minimizing added sugar intake is central to the prevention and management of obesity and related chronic diseases.



Some health risks associated with high sugar consumption

In 2015, the World Health Organization (WHO) recommended that both adults and children reduce their intake of free sugars to less than 10% of their total daily caloric intake. They also recommended that a further reduction in sugar consumption to less than 5% of total caloric intake would contribute additional health benefits. In spite of the recommendations, sugar added to food and beverages accounts for approximately 13% of daily calories in the American diet.

Executive Summary

Health Implications & Concerns

In recent years, nearly 45 different countries and smaller geographical units (such as cities) have passed sugar-sweetened beverage (SSB) taxes as seen in the adjacent figure.

While the United States Congress has not passed similar tax laws, individual cities such as New York City have passed their own versions of SSBs.

Source: Open Access Government

1. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6587329/
2. https://www.who.int/mediacentre/news/releases/2015/sugar-guideline/en/

Executive Summary

Health Implications & Concerns

Such policy changes, coupled with changes in consumer purchasing patterns based on health consciousness, have started to drive some food manufacturers toward product reformulation as well as pivoting toward innovating new natural sweeteners.

Generally, consumers plan to limit their sugar intake by purchasing "no sugar added" products, while many consumers are avoiding artificial sweeteners. Natural sweeteners are more widespread due to consumers' perception that what is natural is less hazardous to health.

For the greater sugar industry, there is still **intense competitive rivalry**, with the threat of substitutes and new innovations.

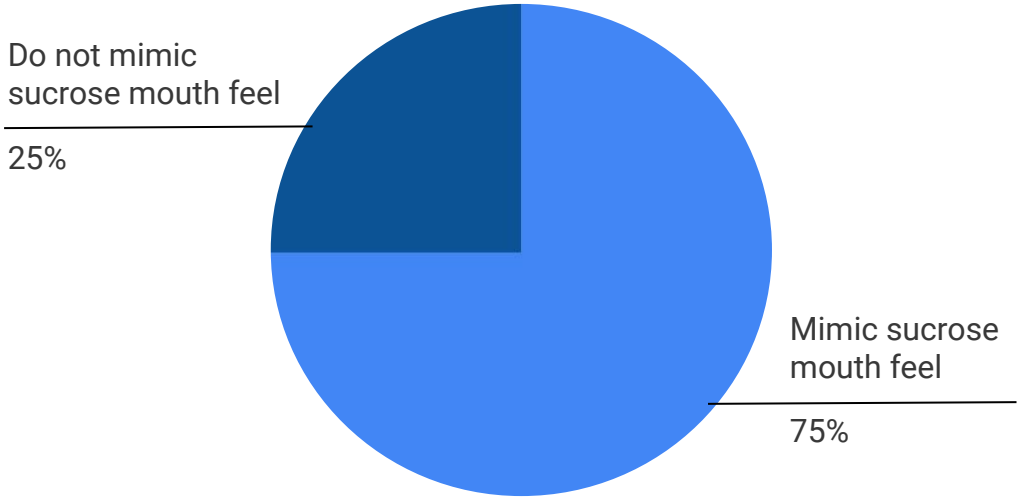
1. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6587329/
2. https://www.who.int/mediacentre/news/releases/2015/sugar-guideline/en/

Executive Summary

Improvements in Aftertaste, Mouth Feel, & Sweetness

There are, however, growing trends in the demand for clean label and natural ingredients that pressure sugar substitutes, while sugar reduction is also challenged by consumer sensory preferences. With some of the natural sweeteners that are currently available, there are challenges with mimicking the exact mouth feel, aftertaste, and other functional properties of sugar. One of the four examples presented in this report, the sweetener manufactured by Unavoo Food Technologies, purports to mask the bitter aftertaste associated with the natural sweetener stevia by combining stevia with soluble fiber.

The graph below shows the breakdown in percentage of technologies that mimic the feel of table sugar (sucrose) in the mouth.

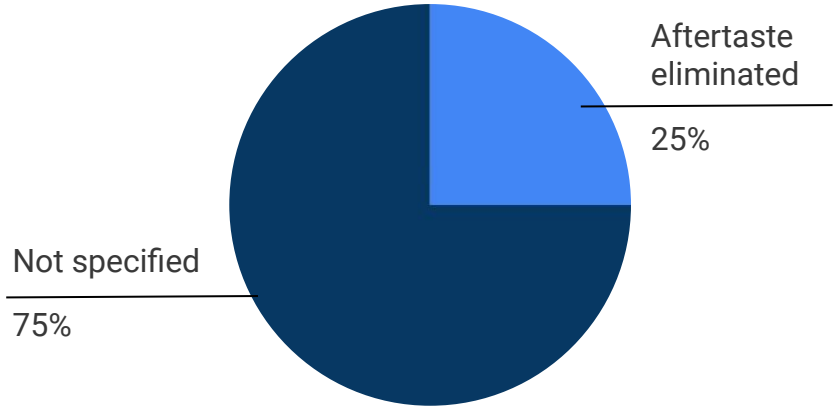


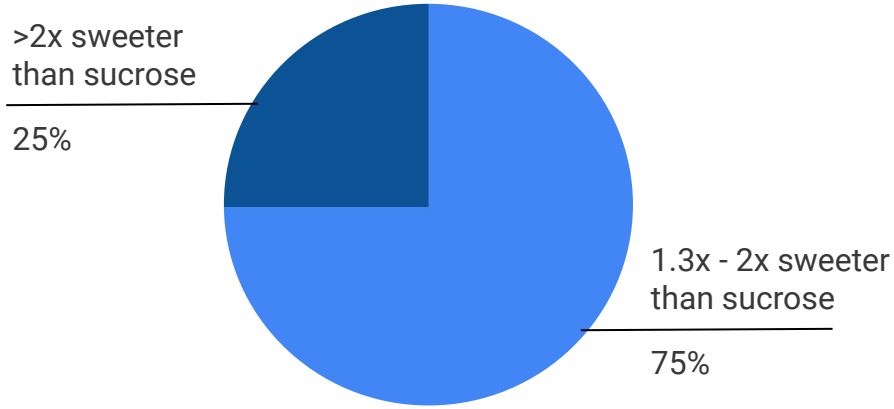
Executive Summary

Improvements in Aftertaste, Mouth Feel, & Sweetness

The accompanying pie charts indicate the percentage of examples that purport to eliminate the aftertaste associated with a number of sugar substitute and reduction technologies and the sweetness levels.

Summary tables outlining some of the key properties for the four sugar reduction and substitution technologies can be found on the next slide.





Summary Table

Company	Key Leveraged Technology and Ingredients	Aftertaste Issue Resolved*	Sweetness Compared to Sucrose	% Achieved Sugar Reduction	Mimics Sucrose Mouth Feel	Application
Unavoo Food Technologies	Mix natural sweetener (stevia) with soluble acacia fiber	✓	10-15 times sweeter than sucrose, depending on application	100%	✓	Food & Beverages
Fooditive B.V.	Fermentation of apple & pear derived fructose	Not specified	1.5 times sweeter than sucrose	100%	Not specified	Food & Beverages
DouxMatok	Targeted flavor delivery of table sugar and various sugar derivatives (can be table sugar, glucose, xylitol, high fructose corn syrup, and others)	Not specified	1.3-2 times sweeter than sucrose, depending on application	40-50%	✓	Food
Tosla	Structural modification of table sugar	Not specified	1.4 times sweeter than sucrose	30-40%	✓	Food

*All information is based on manufacturers' claims

Sugar Alternatives/Substitutes

Unavoo
Food Technologies

Fooditive
sweetener

Unavoo Food Technologies

Founded: 2016

Headquarters: Rehovot, Israel

Website: https://www.heylosweet.com/

Contact: +1-845-842-2952

Overview

Unavoo Food Technologies seeks to reduce sugars and artificial sweeteners in foods and beverages through better ingredients. The company was founded by Yucal Maymon, a gelato manufacturer who was diagnosed with diabetes in 2009. Unavoo Foods currently has approximately 50 employees. The company's philosophy is that people who want or need to be healthier should be able to continue enjoying sweeteners in foods and beverages. They have conducted approximately 700 trials to develop their novel sugar alternative that has no glycemic value, no hidden sugars, and no chemicals. Unavoo Food Technologies is the parent company of **Heylo**.

At a glance			
Key Ingredients:	*Soluble acacia fiber and stevia*	**Stage of Development:**	*Product was launched in October 2018*
Sweetness compared to sucrose:	*10 to 15 times sweeter than sucrose, depending on application*	**Key Technology/ Strategy:**	*Mix natural sweetener with soluble fiber*
GMO:	*Not specified*	**Percent Sugar Reduction:**	*100%*

Unavoo Food Technologies

Technology

Heylo is a patented, zero-calorie sugar replacement that is made from a combination of soluble fibers from acacia (also called acacia gum or gum arabic) and stevia. Stevia is a high-intensity sweetener, 10 to 15 times sweeter than sugar, and almost 300 times sweeter than sugar when purified. However, it leaves a bitter aftertaste and lingering astringency. Unavoo's patented technology combines the two ingredients in a manner that **masks the bitter aftertaste of the stevia component, giving Heylo a sugar-like taste and mouthfeel**. The acacia gum component makes up about 90% of Heylo. Acacia gum is known to be a prebiotic due to its soluble fiber content, offering added benefits, promoting gut health, and protecting against diabetes.

The product is available in three different formats: a white alternative, a brown alternative, and a dissolved and liquid alternative.

Heylo has USDA FDA GRAS status as well as the following ingredient certifications: European 1334/2008/EC, Fed Reg 21CRF101.22. Heylo has a shelf life of 3 years.

Applications

Applications for Heylo include ketchup, peanut butter, sugar-free jams, beverages, salad dressings, yogurts in various flavors, syrups, and ice creams, among others. The product does not change food product consistency, pH, or density. It is stable under processing conditions.

Unavoo Food Technologies

Recent News

According to a 2018 interview with the Chief Marketing Officer for Heylo, the company has partnered with some food industry corporations to commercialize the product in the United States and other markets. Further, the company has signed a deal with Royal Ingredients, the US subsidiary of sugar distributor ED&F Man, to distribute the product. The images below show the different formats of Heylo on offer..

The white alternative

The brown alternative

The dissolved and liquid alternative

Heylo packaged in packets

References:

1. https://www.marketwatch.com/press-release/alternative-sweeteners-market-is-poised-to-reach-a-valuation-of-usd-158-bn-towards-the-end-of-2023-
2. https://www.heylosweet.com/revolution
3. https://patents.google.com/patent/US10525136B2/en?assignee=unavoo&oq=unavoo
4. https://www.foodnavigator.com/Article/2018/10/26/Unavoo-Food-s-fibre-based-sweetener-offers-natural-health-HEYLO
5. http://www.edfman.com/news/973-stevia-sweeteners

Fooditive B.V.

Founded: 2018

Headquarters: Rotterdam, Netherlands

Website: https://www.fooditive.nl/

Contact: +31 1 07 98 62 72

Overview

Fooditive, formerly 7th Circle, is a company whose mission is to make the world a better place without inventing new raw materials and using what is already available. The company's flagship product, Fooditive Sweetener, is made by recycling apple and pear waste. With the adoption of a circular economy model, Fooditive seeks not only to meet the need for healthier alternatives to sugar but also to provide a sustainable solution to food waste. The company currently has approximately 10 employees. Fooditive also makes emulsifiers from potato extracts, thickening agents from banana skins, and preserving agents from carrot waste. Fooditive is a member of Rotterdam Circulair, an organisation that is committed to reusing, reducing, and recycling waste.

At a glance			
Key Ingredients:	*Apples and pears*	**Stage of Development:**	*Commercialized*
Sweetness compared to sucrose:	*1.5 times sweeter than sucrose*	**Key Technology:**	*Fermentation*
GMO:	*Not specified*	**Percent Sugar Reduction:**	*100%*

Fooditive B.V.

Technology

By adopting a **circular economy**, Fooditive has developed Fooditive Sweetener from apples and pears. Third-grade apples and pears (apples and pears with brown spots or uncharacteristic colors) that would normally not make it to the shelves in stores are sourced directly from Dutch farmers with a traceability system in place so that all the fruits can be tracked and traced from seeds up until delivery to Fooditive.

Fructose extracted from the fruits are converted into the no-calorie sweetener by a fermentation process using yeast. The fermentation pottage is filtered, concentrated, and spray dried to 99.5% purity.

Fooditive Sweetener is available in three main varieties:

1. The **regular** variety is a fine powder made using third-grade apples and pears, yeast, and water.
2. The **liquid** variety is made up of 30% Fooditive Sweetener
3. The **syrup** variety is made up of 70% Fooditive Sweetener.

Fooditive B.V.

Technology

All the varieties of Fooditive Sweetener are available in organic and nonorganic forms. The supply chain for the organic products is highly monitored, and only organic ingredients are used for these organic products.

Applications

Food applications of the sweetener include baked goods, ice cream, dairy products, candy (both soft and hard), chewing gums, chocolate, tea, soft drinks, cordials, juices, sport drinks, and coffee.

The regular variety is best suited for applications such as baked goods, confectionery, and jams.

The liquid variety is best used in beverages, while the syrup variety is best applied in confectionery.

Fooditive Sweetener can also be used in pharmaceutical applications.

Fooditive B.V.

Recent News

In 2019, Fooditive raised over 100,000 Euros from 51 investors to boost its production.

Apart from the Netherlands, where the company is based, Fooditive is registered in Sweden. The company hopes to extend its reach to other Nordic countries as well as Jordan and the United Kingdom.

Although the company's spokesperson recently pointed out that the food regulations in the United States make it quite difficult to move into the US market, the company is working on penetrating the US market, as well.

Foodditive Sweetener

References:

1. https://www.foodditive.nl/about
2. https://www.fastcompany.com/90458997/this-new-sugar-substitute-is-made-from-food-waste
3. https://www.linkedin.com/company/7th-circle/about/
4. https://www.fundedbyme.com/en/campaign/8387/jordanian-twist/
5. https://www.prnewswire.com/news-releases/
6. https://www.foodingredientsfirst.com/news/World-first-Dutch-start-up-launches-zero-chemical-additives-and-sweeteners.html

Sugar Reduction

DouxMatok

DouxMatok

DouxMatok

Founded: 2014

Headquarters: Petach-Tikva, Israel

Website: https://www.douxmatok.com/

Contact: +972 3 8060200

Overview

DouxMatok is a startup based in Israel that specializes in targeted delivery of flavor ingredients like sugar and salt. The company provides solutions that offer the right taste while encouraging healthier food consumption. DouxMatok, with its targeted flavor delivery technology, has developed a patented sugar reduction technology, and the company also offers salt reduction solutions. The company currently has approximately 50 employees. DouxMatok has 14 patents granted and more than 20 pending.

At a glance			
Key Ingredients:	*Varies (can be table sugar, glucose, xylitol, high fructose corn syrup, and others)*	**Stage of Development:**	*Commercialized in 2019*
Sweetness compared to sucrose:	*1.3 to 2 times sweeter than sucrose, depending on application*	**Key Technology:**	*Sugar reduction by targeted Flavors Delivery Platform (patented technology)*
GMO:	*Not specified*	**Percent Sugar Reduction:**	*40 - 50%*

DouxMatok

Technology

DouxMatok uses their patented **targeted flavor delivery system** to enhance the taste perception of sugar and consequently reduce the quantity of sugar needed to deliver the same amount of sweetness.

In the system, sugar or sugar alcohol (polyol) is loaded onto mineral carriers by coating. This creates clusters of sweetness that are heavier than sugar and mucoadhesive, making them stay longer at the taste receptors, hence, delivering sweetness more efficiently to taste receptors. As a result, the taste perception of the sugar or polyol is enhanced.

The targeted flavor delivery system allows **more than 20%** of the sugar to be perceived at the taste receptors on the tongue, unlike in conventional sugar, where only 20% of the sugar's sweetness is perceived and 80% of the sugar heads to the digestive system to be processed.

This technology achieves a **40-50% reduction in sugar**, significantly reducing the caloric load of sugar.

DouxMatok

Technology

Using this targeted flavor delivery system, DouxMatok has developed a wide array of products including enhanced sucrose, glucose, and other sugar replacements like maltitol, xylitol, and erythritol.

Furthermore, the company offers customers a turn-key solution that makes up for the sugar bulk and other properties of conventional sugar using a combination of fillers.

Applications

DouxMatok sugar can be used in various applications, such as cookies, cakes, chocolates, spreads, cereals, cereal bars, and biscuits.

Recent News

In 2018, DouxMatok announced a partnership with Südzucker AG, Europe's largest sugar producer, to set up the production, joint marketing, and sales of DouxMatok sugar. In 2019, the company raised $22 million USD to commercialize its technology in Europe and North America. Investors in the last round of series B funding included BlueRed Partners from Singapore, Royal DSM, Singha Ventures (a Thai food & beverage company corporate venture fund), Pitango Venture Capital (Israel's largest venture capital fund), and others.

DouxMatok Sugar

References:

1. https://www.douxmatok.com/matrix-page
2. https://nocamels.com/2018/07/douxmatok-deal-eu-sugar-producer/
3. https://www.fooddive.com/news/douxmatok-raises-22m-to-commercialize-its-sugar-reduction-technology/557223/
4. https://agfundernews.com/breaking-douxmatok-raises-22m-series-b-to-commercialize-its-silica-based-sugar-reduction-technology.html
5. https://www.prescouter.com/2018/01/sugar-reduction-innovations-2017/

Tosla

Founded: 2014

Headquarters: Ljubljana, Slovenia

Website: http://www.tosla.si/

Contact: +386 81 601 100

Overview

Tosla is a Slovenian sweetener company with about 50 employees. Tosla serves the beverage, food, nutraceutical, and pharmaceuticals industries. The company runs the SLADCORE project, which seeks to further develop the company's sugar reduction technology. Tosla is currently a member of FoodTech 500, an ecosystem of food companies who are contributing to the future of food. Tosla has two patents: a patent for the process they use to make their sweetener and one for the sweetener itself. They also have premixes that make the production of nutraceutical supplements easier.

At a glance			
Key Ingredients:	*Table sugar*	**Stage of Development:**	*Commercialized in 2019*
Sweetness compared to sucrose:	*1.4 times sweeter than sucrose*	**Key Technology:**	*Structural modification of table sugar*
GMO:	*Not specified*	**Percent Sugar Reduction:**	*30-40%*

Tosla

Technology

Tosla's SLADCORE project operates under the principle that it is better to fix sugar than to replace it. After conducting lab trials and pilot plant tests, the company has developed a patented technology for sugar reduction that **increases the sweetness of sugar by about 40% while the texture is retained**.

With their patented technology, The process begins with transforming sucrose into a liquid form. Further details on how the transformation into the liquified sucrose is done has not been made available. The proprietary technology is then applied to the liquified sucrose to increase the sweetness. The final product is a 100% natural sweetener*, which is available in three different formats: SLADCORE liquid, SLADCORE paste, and SLADCORE crystal.

The transformed liquid product (SLADCORE liquid) is crystalized to produce the crystals (SLADCORE crystal). A partially dehydrated product that is generated mid-way through the crystallization process is sold as SLADCORE paste.

Beyond the advantage of reducing the caloric load of the resultant sweetener, **the technology reduces cooking time by 20% and retains the functional properties of sugar**, making SLADCORE suitable for applications that use sugar as a bulking agent and/or browning agent.

**According to manufacturer's claims*

Tosla

Technology

The company is currently scaling up the process for the production of the crystalline product. According to the company, their technology is the most cost-effective sugar reduction solution in comparison to production of other sweeteners like stevia, sugar alcohols, coconut sugar, and artificial sweeteners.

The following chart shows the cost index of replacing 1 kg of sugar (obtaining same sweetness). This data is valid for all food categories except for beverages.

Tosla

Applications

SLADCORE can be used in ice creams, jams, beverages, syrups, fillers, and other items. SLADCORE liquid is best used in food applications with high water activity. SLADCORE paste is best applied in semi-solid foods.

Recent News

In 2018, Tosla received a grant of 89,400 Euros through the European Union's Horizon 2020 research and innovation program. In an interview with Food Ingredients First, the CEO noted that they are still in Phase 2, searching for partners to further explore the sugar reduction technology. The company's vision is to be worth over 100 million Euros in the nutrition and carbohydrates industry by the end of 2025. Currently, Tosla's distribution covers Germany, Poland, Czech, Italy, Austria, Slovakia, Croatia, and Slovenia.

SLADCORE® Liquid

SLADCORE Crystal

SLADCORE® Paste

References:

1. https://www.sladcore.com/
2. https://forwardfooding.com/foodtech500?limit=500&subscribed=true
3. http://www.tosla.si/management-policy.html
4. https://www.foodingredientsfirst.com/video/Reinventing-sugar-through-technology-Tosla.html

About the Authors

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Gareth Armanious is one of PreScouter's Project Architects. He specializes in the Food & Beverage and Life Sciences industries. As an academic, he specialized in membrane protein biochemistry, working with an international research group assembled to study structural and functional aspects of these challenging targets in health and disease. Gareth graduated with a BSc in biochemistry, medical specialization, from the University of British Columbia, and is completing his PhD in Biochemistry at the University of Alberta.

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Gloria is a microbiologist and science writer with 6+ years of collaborative-interdisciplinary drug discovery research experience designing and modifying assays to determine the antifungal effects of plant extracts on fungal physiology. She has developed and optimized various microbiological assays and analytical chemistry lab protocols for the separation of plant products via HPLC and flash chromatography. She also has previous environmental toxicology and molecular biology research experience.

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Bezalel is a PreScouter Scholar and food scientist with experience in food analysis, food chemistry, food microbiology, and food processing. He writes a blog (staywellnow.com), interpreting research findings in simple language to educate readers on the effects of food on health. Bezalel has worked on projects aimed at assessing the quality and safety of dairy products and other food products. His research also focused on developing shelf-stable food products. He has also worked on some nutrition projects in Ghana as well as some climate change and food security projects in Zambia and Kenya.

Next Steps

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- ☑ TRENDS MAPPING
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- ☑ PATENT COMMERCIALIZATION STRATEGY
- ☑ DATA ANALYSIS & RECOMMENDATIONS
- ☑ REVIEW BEST PRACTICES
- ☑ SUPPLIER OUTREACH & ANALYSIS
- ☑ CONSULT WITH INDUSTRY SUBJECT MATTER EXPERTS
- ☑ INTERVIEWING COMPANIES & EXPERTS

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