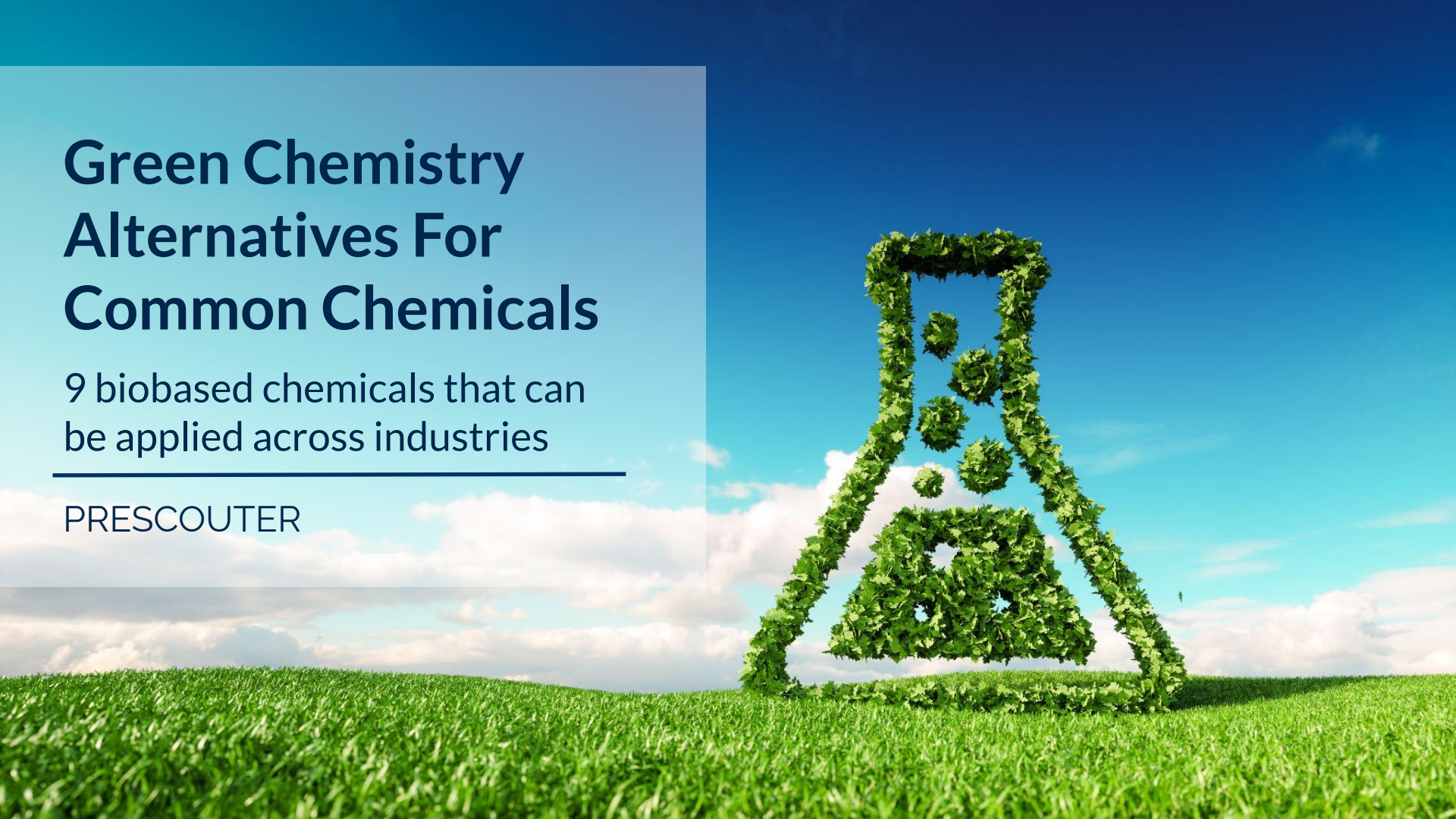
Green Chemistry Alternatives For Common Chemicals

9 biobased chemicals that can be applied across industries

PRESCOUTER



Green chemistry is the next industrial revolution and it has already started.

Going from a fossil- to renewable-based world requires a major shift in the way we think about every aspect of life. Chemicals in this new world would need to be thoughtfully designed keeping in mind that they should be non-depleting (renewable), nontoxic, and nonpersistent (degradable) in the environment. Performance will be coupled with sustainability aspects and a product's value proposal will be linked to selling its function rather than merely the quantity of the chemical.

There are already many examples of green chemistry developments, demonstrating that change is on the way. According to a market report, the market size for green chemicals was valued at $9.5 billion in 2019, and a 6.6% CAGR between 2020 and 2030 is predicted.

In this Intelligence Brief, we highlight some examples across industries, showing that slowly, but surely, every segment will be impacted by green chemistry development on our way to a sustainable civilization.

SUMMARY OF THE COMPANIES PROFILED

	# of employees	Product name	Composition / Source	Aims to replace / Function	Biodegradable	End industry application	Scale of production
Corbion	1,000 - 5,000	FDCA	2,5-Furandicarboxylic acid derived from sugars	Terephthalic acid in PET	Not specified	Food and beverage	Sample request
Pyran	2-10	1,5-PDO	1,5-pentanediol derived from corn cobs	Fossil-based diols	Not specified	Textile, paints and coatings, automotive	Unknown
ecovia renewables	2-10	Azura Gel™	Based on D,L-γ-poly-glutamic acid from biomass	Acrylate polymers	☑	Agriculture - soil amendments	Sample request (for R&D use only)
BioTAK™ the completely biodegradable label	2-10	BioTAK Adhesives	Proprietary - compostable from renewable resources	Conventional adhesives	☑	Labels, Packaging	Unknown
Lankem	11-50	BioLoops	Based on soybean oil	Conventional surfactants	☑	Detergent, cleaners, textile processing	Commercial
Sternchemie Lipid Technology	11-50	Lecithin	Lecithin from soya, sunflower, rapeseed	Conventional emulsifiers	Not specified	Food and beverage	Unknown
solugen	51-200	BioPeroxide	Hydrogen peroxide from plant starch	Conventional hydrogen peroxide	☑	Chemicals, Consumer goods, Textile	Pilot
BEYOND SURFACE TECHNOLOGIES	11-50	miDori	Microalgae oil or plant-seed oils	Fossil-based textile finishes	Not specified	Textile	Unknown
BioPOWDER.com	11-50	BioPowder	Olive pit, fruits shells and stones	Polyethylene, polypropylene and polyurethane additives	☑	Paints and coatings, Consumer goods	Commercial

9 GREEN CHEMICAL ALTERNATIVES

Biobased 1,5-PDO

Derived from corn cobs

Yran

As an alternative to oil-based diols

Biobased adhesive BioTAK™ the completely biodegradable label

Derived from a proprietary material

As an alternative to non-compostable labels

Biobased FDCA

Derived from sugars

Corbion Keep creating

As an alternative to PET packaging

Superabsorbent biopolymer ecovia renewables

Derived from renewable biomass

As an alternative to acrylates

Natural emulsifier Sternchemie Lipid Technology

Derived from soya, sunflower, rapeseed

As an alternative to synthetic emulsifiers

Biobased surfactant Lankem

Derived from soybean oil

As an alternative to surfactants

Natural additive for various applications BioPOWDER.com

Derived from olive pits, fruit shells and stones

As an alternative to industrial abrasives or fillers used in plastics

Biobased textile solutions BEYOND SURFACE TECHNOLOGIES

Derived from microalgae oil or plant-seed

As an alternative to chemically-based textile finishes

Biobased hydrogen peroxide solugen

Derived from plant starch

As an alternative to hydrogen peroxide

PRESCOUTER

Corbion - FDCA

At A Glance
www.corbion.com
Online Contact Form
HQ Noord-Holland, Amsterdam
1,000 - 5,000 employees

FDCA Overview:

Corbion produces 2,5-furandicarboxylic acid (FDCA), derived from sugars, as a monomer for the bioplastic polyethylene furanoate (PEF). Its main application is aimed at replacing conventional terephthalic acid in PET, although it also can replace other plastics. With this substitution, the new sustainable material formed is known as PEF and can be applied in packaging. One characteristic besides the green source is that it can help to keep food and beverages fresher than the conventional PET due to its higher barrier properties.

SUMMARY

TYPE OF MATERIAL

2,5-furandicarboxylic acid (FDCA), derived from sugars

SCALE OF OPERATIONS

Sample request. Interested parties must fill in personal information and intended application

APPLICATION

Packaging

END INDUSTRY USE

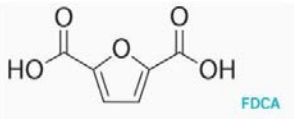
Food and beverage containers

Corbion - FDCA

Technical Data:

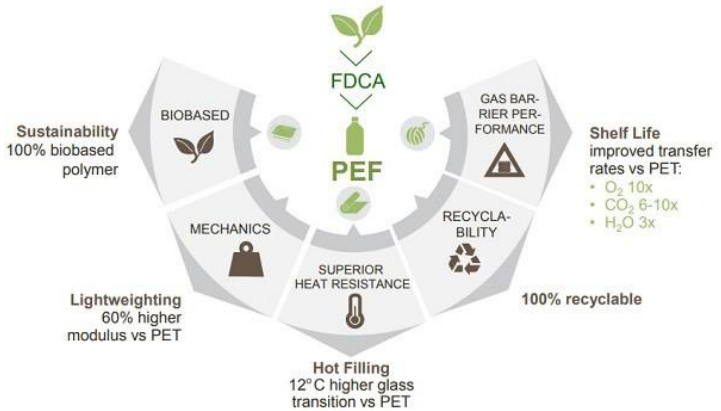
FDCA is produced from 5-hydroxymethylfurfural (5-HMF) via enzyme fermentation and is then polymerized to PEF, which has the potential to replace a wide variety of plastics.

The most common route for producing FDCA is through 5-HMF oxidation, which in turn is traditionally produced by dehydrating hexoses, especially fructose. The conversion can be performed via an acid catalyzed dehydration reaction in supercritical acetone, water with phase modifiers, or high-boiling solvents.



Advantages:

When biobased monoethylene glycol (MEG) is used, PEF is a 100% biobased polyester resin with claimed better barrier, thermal, and mechanical properties, high glass transition temperature, and lower melting point. It's recyclable, thus reducing its carbon footprint, and at industrial scale, it is cost competitive with existing packaging materials such as oil-based PET. Furthermore, PEF can be used in fibers, films, and other polyester applications.



Source: Corbion

Corbion - FDCA

Applications:

The improved properties of PEF compared to PET offer better performance in existing applications, such as in carbonated soft drink bottles. In addition, PEF can be applied to applications for which PET properties do not suffice, like in smaller serving sizes and lightweighting, and also for replacing other packaging materials like glass and aluminum cans.

		PEF	PET	Application
BARRIER	O_2	6-10x	1 x	O_2 sensitive drinks to eliminate use of O_2 scavenger (e.g., juice, beer)
	CO_2	4-6x	1 x	Carbonated drinks (e.g., smaller serving size)
	C_2O	2 x	1 x	Water bottles
MECHANICAL	Modulus	~ 1.6	1	Lighter bottles
THERMAL	T_g(C)	86 - 87	74 - 79	Hot fill applications
	T_m(C)	213 -235	234 - 265	Energy reduction for preform production

Comparison of PEF and PET. Source: Corbion.

References:

1. https://cdn.ihs.com/www/pdf/RP294-toc.pdf
2. http://www.corbion.com/bioplastics/fdca
3. https://biorrefineria.blogspot.com/2017/06/FDCA-furandicarboxylic-acid-biorefineries-PEF.html
4. https://www.corbion.com/base/DownloadHelper/DownloadFile/9985
5. https://omnexus.specialchem.com/selection-guide/polyethylene-furanoate-pef-bioplastic

Pyran - 1,5-PDO

At A Glance
www.pyranco.com
Online Contact Form
HQ Wisconsin, USA
2-10 employees

1,5-PDO Overview:

Pyran has developed a new chemical pathway to make an oil-based chemical called 1,5-pentanediol (1,5-PDO) out of corn cobs. 1,5-PDO is part of a class of chemicals called “diols.” Diols are used in the chemical industry as a starting material in manufacturing paints, coatings, plastics, and adhesives. Pyran’s purpose is to replace the currently made 1,5-PDO with corn cob–based 1,5-PDO.

SUMMARY

TYPE OF MATERIAL

Corn cobs

SCALE OF OPERATIONS

Not specified

APPLICATION

Paints, coatings, plastics, and adhesives

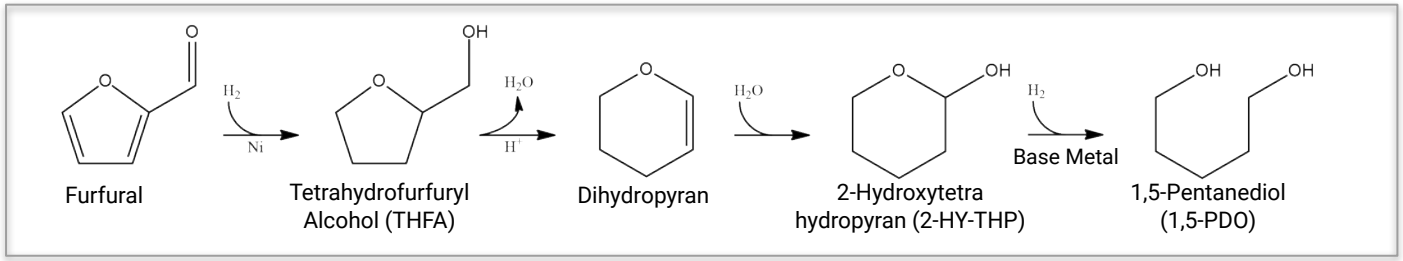
END INDUSTRY USE

Clothing, nylon, paint, and car plastics

Pyran - 1,5-PDO

Technical Data:

Pyran produces 1,5-PDO from furfural, which is the largest by volume biochemical that is produced from corn cobs. 1,5-PDO cannot be produced on purpose from petroleum and is only produced as a minor byproduct during caprolactam production.



1,5-PDO can be used as monomers for polyester polyols, polycarbonate polyols, and UV-cure diacrylates. Products made with PyranDiol include:

ADHESIVES

COATINGS

PAINTS

SYNTHETIC LEATHER

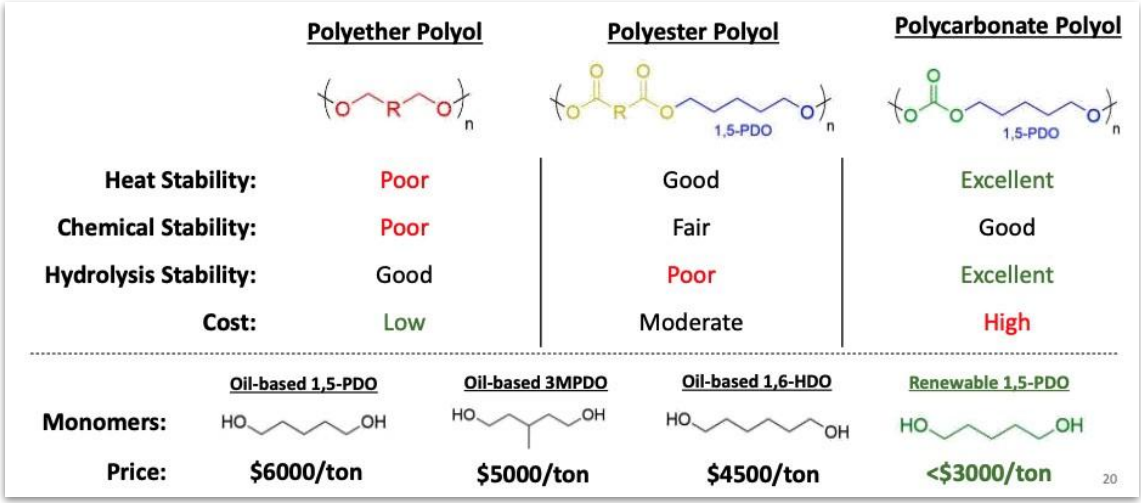
COIL COATINGS

FOOTWEAR

Pyran - 1,5-PDO

Advantages:

1,5-PDO replaces oil-based 1,6-hexanediol, at 30% lower costs with enhanced properties in polyester and polycarbonate polyols. Low-cost 1,5-PDO enables breakthroughs in polycarbonate polyols as a higher-quality replacement for polyesters/ethers.



Comparison of different polyols. Source: Pyran.

References:

1. https://pyranco.com/
2. https://www.pcimag.com/ext/resources/Events/CTT/2019ppt/BarnettKevin_Pyran.pdf
3. https://www.biofuelsdigest.com/bdigest/2020/09/10/competitive-edge-pyran/
4. https://adhesives.specialchem.com/tech-library/article/innovative-raw-materials-for-polyurethane-adhesives-and-sealants

Ecovia Renewables - AzuraGel

At A Glance
www.ecoviarenewables.com
info@ecoviarenewables.com
HQ Michigan, USA
2 - 10 employees

AzuraGel Overview:

AzuraGel Superabsorbent Biopolymers are 100% biobased, non-toxic, and biodegradable. This biopolymer is produced through fermentation of 100% renewable biomass (based on D,L-γ-poly-glutamic acid). AzuraGel Biopolymers are advantageous compared to conventional ones because they minimize the cost of production and maximize feedstock flexibility. AzuraGel can be used for consumer care and packaging and for agriculture and horticulture.

SUMMARY

TYPE OF MATERIAL
Based on D,L-γ-poly-glutamic acid

SCALE OF OPERATIONS
Sample request (for R&D use only)

APPLICATION
Agriculture and horticulture

END INDUSTRY USE
Soil amendments for water retention and tackifiers for revegetation & erosion control

Ecovia Renewables - AzuraGel

Technical Data:

AzuraGel is based on a water-swellable and water-dispersible cross-linked biopolymer. It forms biobased and biodegradable hydrogels with outstanding functional properties. They absorb up to 300x their weight in water and show improved absorption under load (AUL) over starch-based biopolymers.

Base Polymer	Polyglutamate (ecovia renewables)	Starch-Craft Acrylate	Biobased Acrylate	Oil-Based Acrylate
Absorbency Under Load (.7psi)	15-20	5-10	20-25	20-25
Free Swell Absorption Speed	45-50 50-60	20-40 60-90	50-60 40-55	50-60 40-55
% Biobased (ASTM D6866)	✓✓	✓	✓✓	✗
Biodegradabe (OEC D 301B)	✓✓	✓✓	✗	✗

How AzuraGel compares with other acrylates. Adapted from: Ecovia

Ecovia Renewables - AzuraGel

Applications:

AzuraGel can be used for:

- Consumer care and packaging (as superabsorbent fillers for hygiene products and as refrigerant gels for cold-chain packaging)
- Agriculture and horticulture (as soil amendments for water retention and as tackifiers for revegetation and erosion control.

In agricultural, AzuraGel can:

- Improve soil moisture retention; Reduce irrigation requirements
- Improve seed germination & plant growth
- Biodegrade — Will not accumulate in soil
- Improve rheology of hydraulic mulch mixes
- Improve hydraulic mulch & soil adhesion
- Prevent washout
- Provide similar performance to polyacrylamide / vegetable gum formulations

References:

1. https://www.ecoviarenewables.com/azuragel
2. https://synbiobeta.com/ecovias-azuragel-superabsorbent-awarded-100-usda-certified-biobased-product-label/

PRESCOUTER EXPERT NOTE:

“Green chemistry is the foundation of a sustainable future and the way to be at the frontier of business and consumer needs.”

- Marija Jovic, PreScouter Technical Director

BioTAK - BioTAK Adhesives

At A Glance
www.biotak.en
info@biotak.eu
HQ Venkelbaan, Netherlands
2 - 10 employees

BioTAK Adhesives Overview:

BioTAK is specialized in sustainable self-adhesive solutions using renewable and replenishable biodegradable materials. Their biodegradable and compostable adhesives were developed to compliment compostable packaging and products where glue is involved. All adhesives in the S-grades are waterborne adhesives. BioTAK can be used as self-adhesive labels, compostable labels, compostable fruit labels, packaging, and other applications, enabling food manufacturers to offer consumers 100% biodegradable and compostable packaging.

SUMMARY

TYPE OF MATERIAL

Proprietary

SCALE OF OPERATIONS

Not specified

APPLICATION

Adhesives

END INDUSTRY USE

Self-adhesive labels, compostable labels, compostable fruit labels, packaging and miscellaneous

Technical Data:

BioTAK S-grade adhesives are water-based adhesives. Examples include:

- **S100** - General-purpose chill/permanent pressure sensitive adhesive, formulated to include a high content of renewable materials. It is a waterborne adhesive based on specially modified acrylic copolymers. This permanent adhesive has a high initial tack and high final adhesion. BioTAK S100 is certified to the European compostable packaging standard (EN13432) at Vinçotte and it also has the BioTAK S100-FDA option that has been formulated to comply with direct food regulations in addition to the EN13432 and ASTM D6400 standards.
- **S200** - Removable pressure-sensitive adhesive, formulated to offer a good initial tack and a medium final adhesion.
- **S300** - Ultra removable pressure-sensitive adhesive (product is under development).
- **S500** - Laminating adhesive. Specifically formulated to laminate bioplastic films and papers for flexible packaging applications. Low viscosity enables excellent flow.

S100 TYPICAL PROPERTIES	
Color	Off White
Viscosity	850-1200 mpas 3@30 Brookfield @23ºC
pH	5,5 - 7,3
Density	1,05 kg/dm^3
Solids	48-50%
Tg	-45ºC
Initial Tack	420 N/m (FMT9/glass)
90 Peel Adhesion	250 N/m (FTM 2 Stainless Steel)

Source: BioTAK

BioTAK - BioTAK Adhesives

Applications:

- Self-adhesive labels: On compostable packaging or directly on fruit and vegetables
- Compostable labels: Coated to different surfaces to complement compostable or biobased packaging
- Compostable fruit labels: Approved for direct food contact, the label can be put in the green-waste stream or in compost. This application improves compost quality for home and industrial composting.
- Packaging: Applicable for flexible packaging. S500 is suitable for laminating (creating bioplastic films with higher barriers). Closing tape and double sided tapes can be made with S100 and S200 grades. BioTAK can be directly applied for closing bags and lids.
- Miscellaneous: Some of the applications of BioTAK are not disclosed, due to non-disclosure agreements.

Bio4Life, BioTAK's parent company, uses their self-adhesive compostable labels. These labels are applied to complement compostable packaging or to be utilized directly on fruit and vegetables. According to the company, BioTAK S100 achieved **91.2% biodegradation within 31 days**.

References:

1. https://biotak.eu/
2. https://bio4life.nl/en/home-2/
3. https://www.bakeryandsnacks.com/Article/2008/05/19/Adhesive-meets-standard-for-biodegradability

Lankem - BioLoops

At A Glance
www.lankem.com
+44 161 513 4125
HQ Dukinfield, Cheshire
11 - 50 employees

BioLoops Overview:

Lankem aims to develop a range of biobased products that offer comparable performance against synthetic products across a wide range of applications. BioLoop is the concept of new surfactants using novel biobased technologies designed to offer the formulator a wide range of options based on selection of products from hydrophobic to more hydrophilic types. Unlike many biobased surfactants, BioLoop products offer excellent surfactant properties and can be used as a green alternative to conventional synthetic nonionics such as alcohol ethoxylates.

SUMMARY

TYPE OF MATERIAL

Soybean oil

SCALE OF OPERATIONS

Commercial

APPLICATION

Surfactant

END INDUSTRY USE

Detergent, glass cleaners, spray cleaners, textile processing

Technical Data:

BioLoop is a group of three different products: BioLoop 56L, BioLoop 68L, and BioLoop 84L. The three surfactants are 100% renewable, have good detergency, no skin or eye irritancy, no ecotoxicity, and they are biodegradable.

BioLoop 56L: Based on soybean oil, the main feature of BioLoop 56L is the low foam characteristics. This will lend itself to be used in applications where foam control is essential. Many applications that are subject to high shears, such as industrial spray cleaners, textile processing, and machine dishwashing applications, need good foam control to function effectively.

BioLoop 68L: Based on a hydrophilic loop reacted onto a vegetable oil hydrophobe, classed as medium foam surfactant in applications as hard surface cleaners and general cleaners. BioLoop 68L is an excellent substrate wetting on nylon 6, nylon 66, and polycarbonate. Compared to water, which has a contact angle of 46º, BioLoop 68L has a initial contact angle of 17º.

BioLoop 84L: Based on soybean oil and classified as a medium/high foam surfactant, has great wetting on glass, and is palm-oil free. BioLoop 84L has a initial contact angle of 17º.

Source: Lankem

Sternchemie - Lecithin

Sternchemie
Lipid Technology

At A Glance
www.sternchemie.com
sales@sternchemie.com
HQ Hamburg, Germany
11 - 50 employees

Lecithin Overview:

Lecithin is a naturally occurring and versatile creation due to its structure: The active components of lecithin (phospholipids) are both lipophilic and hydrophilic, meaning that they are attracted to both water and fatty substances. This property makes lecithin interesting for a wide array of technological requirements in the food industry as a natural emulsifier. It can serve as an excellent alternative to synthetic emulsifiers and enzymes.

SUMMARY

TYPE OF MATERIAL

Soya, sunflower, rapeseed

SCALE OF OPERATIONS

Unknown

APPLICATION

Emulsifier

END INDUSTRY USE

Food and beverage

Sternchemie - Lecithin

Technical Data:

Lecithin mixes with fats/oils and with water, acts as an emulsifier, and also allows immiscible substances such as water and oils to form stable emulsions. Depending on the application, lecithins can be used to produce water-in-oil emulsions (W/O emulsions) and oil-in-water emulsions (O/W emulsions).

Raw material sources:

Soya is the most frequent source of non-genetically modified (GM-free) lecithin worldwide. Sunflower is now the main alternative when it comes to soya- and GM-free lecithins. Due to its composition and functional properties, rapeseed lecithin is an additional raw material used. Through regional cultivation and cooperation with international raw ingredient producers in Europe and South America, uninterrupted supply is secured.

RAPESEED

SUNFLOWER

SOYA

Sternchemie - Lecithin

Applications:

Some application proposals are for instant products, instant noodles, confectionery and chocolate, margarine, fats and oils, release agents, nutrition, beverages, sauces and dressings, and vegetarian and vegan products.

REPORTED BENEFITS BY STERNCHEMIE

FOR INSTANT PRODUCTS:

- Fast penetration of liquid in the porous network of the agglomerated powder
- Improved disintegration of the agglomerated powder into primary components without stirring (or with only gentle stirring)
- Optimum mixing of the powder with water/milk
- Enhanced stability of the instant product following dissolution
- Purely plant-based emulsifier
- Cost savings thanks to ready-to-use solutions – and therefore fewer production steps

IN CONFECTIONERY & CHOCOLATE

- Shorter conching times
- Regulation of viscosity and yield value
- Cocoa butter saving of up to 8%
- More homogeneous chocolate mass
- Longer shelf life and improved stability when subject to temperature fluctuations
- Reduced fat bloom formation
- Improved texture
- Smooth surface
- Gentle melt

IN MARGARINE, FATS & OILS

- Improved spreadability
- Reduced spattering during frying
- Improved flavor release
- Longer shelf life thanks to the antioxidant effect
- Even dispersion of ingredients

References:

1. https://www.sternchemie.com

Solugen - BioPeroxide

At A Glance
www.solugentech.com
info@solugentech.com
HQ Houston, Texas
51-200 employees

BioPeroxide Overview:

BioPeroxide, a carbon-negative hydrogen peroxide product, is a non-toxic, environmentally friendly oxidizer that can be used ideally for water treatment and cleaning applications. It can remove the need for highly combustible and toxic petrochemical-based chemicals to clean water, as it is more efficacious, cheaper, safer to produce, and less hazardous for customers and their employees as well as fully biodegradable. To be obtained, an enzymatic technology converts plant sugars into hydrogen peroxide.

SUMMARY

TYPE OF MATERIAL

Plant starch

SCALE OF OPERATIONS

Pilot

APPLICATION

Oxidizer

END INDUSTRY USE

Water treatment for cleaning

Solugen - BioPeroxide

Technical Data:

Solugen's BioPeroxide is obtained through an enzymatic method and process for the continuous manufacturing of hydrogen peroxide at room temperature in a single, on-site, or stand-alone reactor or production chamber.

The method combines a cutting-edge enzymatic technology (via CRISPR/Cas9) with a reactor to create BioPeroxide. The method may comprise mixing an NQO1 enzyme, a compound or molecule activated by NQO1, and an NADH or NADPH cofactor with an aqueous solution, distributing the aqueous solution into or on a semi-permeable membrane. In addition, an oxidation-reduction reaction of the enzyme NQO1, the compound or molecule activated by NQO1, and the NADH or NADPH cofactor in the aqueous solution produces hydrogen peroxide at a concentration level.

The product is a clear and colorless liquid available in a range of concentrations from 3% to 50% active solution. It is odorless at low concentrations but at higher concentrations can emit a slightly pungent smell.

In the pilot plant, Solugen's R&D Engineering team deploy their Enzymology and Metal R&D teams' fundamental catalyst understanding in their reactor units to evaluate the technical feasibility of new chemical platforms and to generate samples. The department started out from a mostly empty warehouse and a decommissioned PVC enzyme reactor formerly run by the company's founders, and now the pilot plant has evolved.

Source: Solugen

Solugen - BioPeroxide

Recent announcements:

Partnership with Nanotronics: On March 25, 2021, Solugen announced a partnership with Nanotronics to enable hack-proof, automated biobased manufacturing mini-mills. Nanotronics is the developer of the world's most advanced robotic industrial microscope that combines AI, automation, and sophisticated imaging for industrial inspection. The partnership intends to ensure clean water production and safety and will address any risks associated with chemical contamination and prevent potential malicious activity by incorporating Nanotronics' proprietary Intelligent Factory Control during the production process. The partnership agreement is in the midst of a 2-year pilot program enabling autonomous chemical plants for Solugen, powered by Nanotronics.

Partnership with Singapore's state fund, Temasek: On April 27, 2021, Solugen announced a partnership with Temasek to manufacture carbon-negative chemicals and materials in the United States and Asia by leveraging Solugen's breakthrough synthetic biology platform. Through this partnership, Solugen will be expanding its footprint to include new R&D and production facilities in Southeast Asia to satisfy customer demand in the region across markets including clean water, agriculture, and food & beverage.

References:

1. https://www.solugentech.com/
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3. https://www.prnewswire.com/news-releases/solugen-launches-ode-to-clean-the-first-line-of-cleaning-products-made-of-bioperoxide-using-100-plants-300541766.html
4. https://patents.google.com/patent/WO2019156684A1/fr?inventor=Gaurab+Chakrabarti
5. https://finance.yahoo.com/news/solugen-temasek-partner-manufacture-carbon-050500603.html
6. https://www.businesswire.com/news/home/20210325005180/en/Solugen-and-Nanotronics-Partner-to-Enable-Hackproof-Automated-Biobased-Manufacturing-Mini-Mills

Beyond Surface Technologies - miDori

At A Glance
www.beyondst.com
+41 766 167749
HQ Muttenz, Basel Landschaft
11 - 50 employees

miDori Overview:

Beyond Surface Technologies is advancing green chemistry solutions for textiles. miDori is a brand of textile finishes sourced from renewable, natural raw materials. This formula achieves high levels of textile performance while radically lowering carbon emissions. All products are Global Organic Textile Standard (GOTS), USDA biobased, and GreenScreen certified. When compared to those not biobased, miDori shows the same or better performance, offering versatility for a range of fibers and effects and ease of integration at the textile mill.

SUMMARY

TYPE OF MATERIAL

Microalgae oil or plant seed

SCALE OF OPERATIONS

To be decided with manufacturing partner

APPLICATION

Textile finishes

END INDUSTRY USE

Garment industry and textiles

Beyond Surface Technologies - miDori

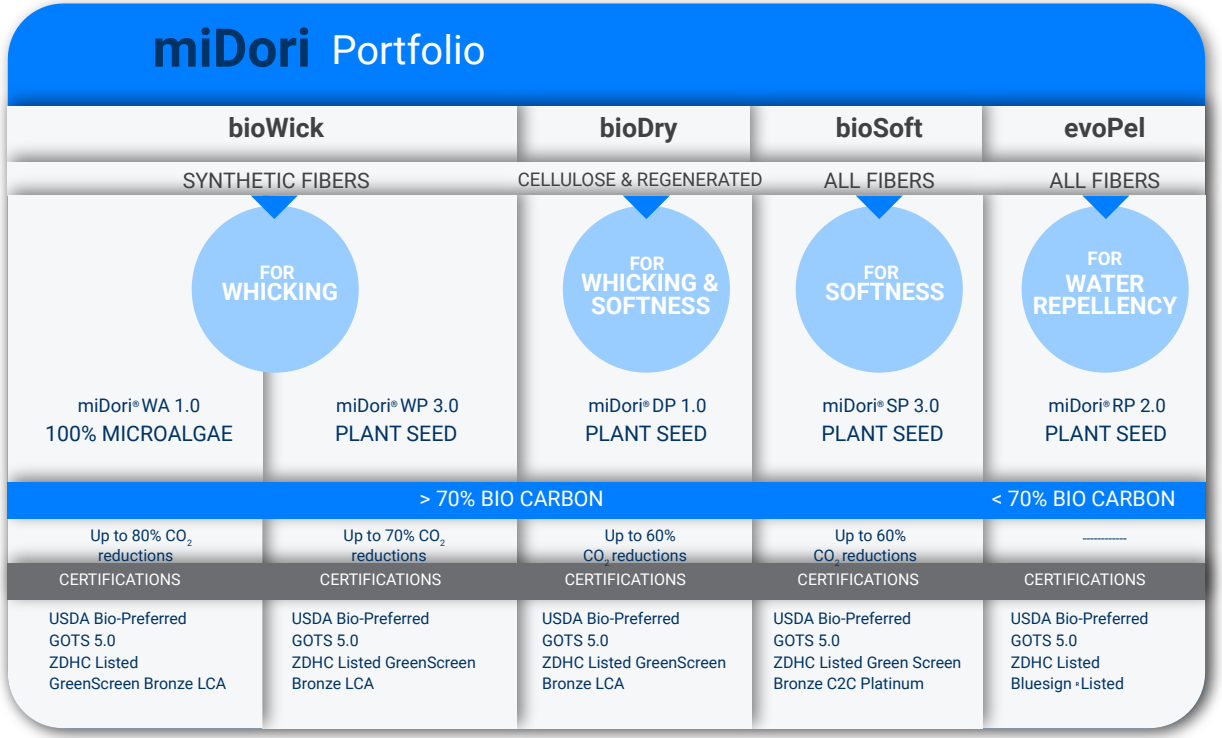
Technical Data:

miDori is a group of biotechnologies including bioWick, bioDry, bioSoft, and evoPel. Each one was developed for a different kind of textile (wicking, wicking and softness, softness, or water repellency).

- **BioWick is made of 100% microalgae oil** extracted from dried microalgae biomass that has been grown in controlled, sealed environments. The product's differential is a wicking finish for synthetic textiles. Its innovative formula provides excellent durability and fast-drying properties.
- **BioDry is an eco-friendly wicking finish for cotton** that is soft, cool, and re-hydrating. Made from plant-seed oils and palm oil, bioDry is free of active ingredients. It is a multipurpose fabric softener for denim, bottoms, knits, shirts, etc.
- **BioSoft is a soft and smooth finish for all fibers** made from plant seed–based active ingredients and components from the bio-waste stream. Lightweight bioSoft can enhance comfort and wear.
- **EvoPel is PFC-free (does not use perfluorinated chemicals), durable, and water repellent** — suitable for all types of fibers. This solution has high performance and durability that protects fabrics from rain and water-based stains. It is made from partially based plant seed, renewable solutions, and certified components.

Fill in

Beyond Surface Technologies - miDori



Fill in

Beyond Surface Technologies - miDori

Partnerships:

- C Brands like Patagonia, Adidas, Levi's, Aritzia, Banana Republic, Puma, Tommy Hilfiger, Tommy Sport, GAP, The North Face, InterSport, PVH, Odlo, Splash, Mammut, Karstadt Sports, Anta, Aday, Coyuchi, Tchibo, and Gant are partners with Beyond Surface Technologies.
- Patagonia has a Women's Active Mesh Bra with Beyond Surface Technologies' miDori bioSoft for added wicking and softness.
- Coyuchi uses miDori bioSoft green technology for processing its sheets.

Beyond Surface Technologies brand partners. Source: Beyond ST.

References:

1. https://www.beyondst.com/
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3. https://thesustainableangle.org/beyond-surface-technologies-swiss-company-replaces-petrochemicals-textiles-clothing-finishes-green-chemistry-innovation/

BioPowder

BioPOWDER.com

At A Glance
www.bio-powder.com
info@bio-powder.com
HQ Birkirkara, Malta
11 - 50 employees

BioPowder Overview:

BioPowder.com products are natural additives with high quality to be used in various industries. BioPOWDER.com converts excess organic material from the fruit industry into fully biodegradable ingredients that can be reused in other industries. The main proposal is not to produce the raw materials of its products, but to process those of agricultural by-products without competing with the food chain.

SUMMARY

TYPE OF MATERIAL

Powders of olive pits, fruit shells, and stones

SCALE OF OPERATIONS

Commercial pilot scale

APPLICATION

Filler to replace polyethylene, polypropylene and polyurethane microplastics; preserve and maintain equipment

END INDUSTRY USE

Paints, varnishes, coatings; sandblasting, polishing, cleaning of hard materials; personal care scrubs

Technical Data:

Olive pits, almond, pistachio, argan, and walnut shells, and peach, avocado, and apricot stones are examples of raw materials used for applications in personal care ingredients, household and detergent additives, food and feed ingredients, innovative biomaterials, fillers, binders, industrial abrasives, and other items. These materials are milled to the desired grain micron size, from 1,000 up to 50 um. Blends of different fruit stone powders are also possible.

OLIVE PIT POWDER

Olive Pit Powder is a biobased hydrophobic powder used as filler to **replace polyethylene, polypropylene, and polyurethane microplastics in formulations**.

It can be used in paints, varnishes, and coatings as **matting agents** replacing the conventional polyethylene as an effective texturizer for both solvent-based and solvent-free formulations. This product can also be used as an **epoxy resin filler** (fiber-reinforced composites, biobased coatings, or ecological adhesives).

The products are suitable for food packaging as well as high-performance plastics in the medical, automotive, aerospace, nautical, and consumer item industries.

Source: BioPowder.com

WALNUT SHELL

Its hardness of 3.5-4.00 on the Mohs scale makes walnut shells an **effective natural abrasive** in sandblasting, polishing, and cleaning of hard materials such as metal, carbon fiber, concrete, or hard plastic. This helps preserve and maintain industrial, medical, and automotive equipment.

Common examples of use can be found in **aviation**, where walnut shell granules are used for the cleanout of engines and turbines in an air jet blasting process.

Beyond the biodegradable aspect, grit reliably removes corrosion or any chemical coating from boats, planes, and buildings without the need for additives. It is also a bio-ingredient for **hygiene products** — especially in surface cleaners — above all graffiti removers.

PEACH STONE

The relatively high hardness (approx. 3.5 on the Mohs scale) makes granulated peach kernels a suitable biobased abrasive for polishing, cleaning, and sandblasting applications.

In contrast to walnut shells, peach stone powders do not contain any nut-related allergens, which makes them safe. For personal care products, the relatively homogeneous shape of peach stone granules ensures a soft but effective natural skin abrasion without the risk of causing micro-lesions.

Source: BioPowder.com

Applications:

In view of the natural powders with different grain sizes made available by the company, several applications are indicated depending on the required composition. Among them are applications in:

- Ultra hydrophobic material: Hydrophobic paint texture and additive, epoxy resin fillers, anti-slip additives for paints and coatings, paint bonding agent additives, and hydrophobic ceramic coating
- Additives for biobased composites: Wood, plastic, and textile composites, bio-additives for rubber composites, additives for biodegradable composites
- Artificial turf infill: Infill material for artificial grass, pet turf infill, landscaping, and leisure turf
- Personal care ingredients: Abrasives for hand cleaners, natural exfoliating beads and scrubs, natural base materials for cosmetics
- Industrial abrasives: Biobased abrasives as drying media, natural abrasive blasting media
- Food and feed ingredients: Spice mix extenders of food ingredients, natural thickening agents for food, smoke chips for sustainable food flavoring
- Architecture, design, and construction: Biobased insulation materials, biobased colors for decorative design, bio-additives for building materials
- Innovative biomaterials: Innovative sustainable polymers
- Household and detergent additives
- Fillers, binders, and carriers

References:

1. https://www.bio-powder.com/en/

Potential Next Steps

- ✔ PreScouter can help conduct a thorough and comprehensive search for green chemicals replacements based on your technical and business parameters. This can be done for chemicals that are already on the market, those close to commercialization and/or those in development.
- ✔ PreScouter can provide recommendations and down select to top candidates from the list obtained above.
- ✔ PreScouter can provide anonymous interviews with companies and researchers and also obtain samples.

SOME POSSIBILITIES THAT PRESCOUTER CAN OFFER FOR CONTINUATION OF OUR RELATIONSHIP

Authors

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Technical Director

Marija has been with PreScouter since January 2015. She has worked across topics such as product and process improvement and development, and sustainability throughout chemicals, materials and packaging industry. Marija completed her Master's degree in Chemical Engineering from Belgrade University and her PhD in Organometallic Chemistry and Catalysis at the Swiss Federal Institute of Technology (ETH Zurich). Prior to her PhD, Marija worked in the chemical industry on the synthesis of new textile dyes.

Gabriela Mattos

Researcher

Gabriela is a PhD student in the Chemical Engineering Program at COPPE at the Federal University of Rio de Janeiro (UFRJ, Brazil) with research focused on functionalized polymeric materials for biological applications. Gabriela completed her Master's degree in Nanotechnology Engineering at the Federal University of Rio de Janeiro (UFRJ, Brazil). During her undergraduate course in Nanotechnology and master's degree, she was involved in parallel projects related to green chemistry. Sustainability, circularity, reuse of plastic materials and replacement of oil by natural raw materials were the main objectives pursued in the projects.

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