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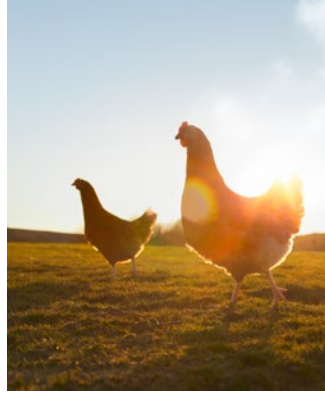


The future is circular and green

**The circular economy as the basis for
successful and sustainable operations**

Symrise applies the principles of the circular economy across all levels of the value chain. The circular economy is based on principles that we implement in various projects, products and processes at Symrise.

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The future is circular

It is no doubt clear to everyone by now that we're living beyond our means. Humanity consumes too many raw materials, creates too much waste for the planet, and doesn't even make good use of its resources. Production and consumption too often follow the same pattern: We extract hundreds of different raw materials, make them into more or less long-lasting consumer products, and dispose of them after use. Up to now, we have only been able to recycle and reuse a portion of them. This linear chain also applies to consumer goods that are manufactured by the industries in which we operate. We can see this in the food industry, for example, which currently loses or wastes one-third of global agricultural production along the food chain, and uses many natural raw materials too inconsistently. There are also challenges associated with disposal in the cosmetics industry. Because they land in the environment at the end of their useful lives, the products that we supply must be biodegradable and safe for nature.

It is high time to make changes since global business activities have significant consequences for people and nature. The mining and processing of raw materials is responsible for 50% of global greenhouse gas emissions and 90% of biodiversity loss. If we continue along this path, this level of material consumption could even double by 2060. This would have devastating consequences for the natural environment and the global ecosystem, which can neither fulfill this demand for raw materials over the long term nor cushion the environmental impact associated with disposal.

We want to focus on cycles as much as we can – by using 100 % of raw materials when possible, avoiding waste, and returning materials to processes.

To stop this development, we integrated sustainable activity into our business years ago. One of the many measures that we use to reduce our carbon emissions, minimize our consumption across all levels and optimize our processes is the circular economy, whose principles we apply to our full portfolio of raw materials and products. We want to focus on cycles as much as we can – by using 100 % of raw materials when possible, avoiding waste, and returning side-streams to processes. This allows us to meet production demands and continue to grow while decoupling resource consumption from growth, thus going far beyond traditional recycling.

Incidentally, these innovative concepts are part of our DNA. In 1874, chemists Wilhelm Haarmann and Ferdinand Tiemann produced synthetic vanillin for the first time, which they derived from the sap of conifers. They thus used materials that no one else needed, thereby reducing resource consumption in other areas. This would be referred to as valuable upcycling today. The company that Haarmann founded in 1875 laid the foundation for Symrise.

Resource efficiency, which goes hand in hand with the circular economy, is becoming increasingly important to Symrise, our customers, and investors – as well as policymakers and society. We work at more than 100 sites around the world and purchase over 10,000 raw materials, which we use to create more than 30,000 products. Nearly 90 % of these raw materials are now of natural origin, which comes with a great deal of responsibility. We must therefore be even more careful to acquire natural raw materials from sustainable sources, and to develop innovative solutions to use them even more effectively. We must also design our products in such a way that they can be disposed of, and their components returned to natural cycles, without harming the environment. This allows us to operate responsibly, sustainably and successfully.

Dr. Heinz-Jürgen Bertram
CEO of Symrise

Bernhard Kott
CSO of Symrise

A highly topical concept

How we see the circular economy at Symrise

The concept of the circular economy is not all that new. Terms such as “cyclical” production systems were first used in the 1960s, and the term “circular economy” was coined in the 1980s. The circular economy experienced a big breakthrough with the establishment of the Ellen MacArthur Foundation, which made the concept much more widespread in the early 2010s. The concept has since become mainstream; for example, the European Union described its own vision of the circular economy in 2014 and launched an action plan for 2020.

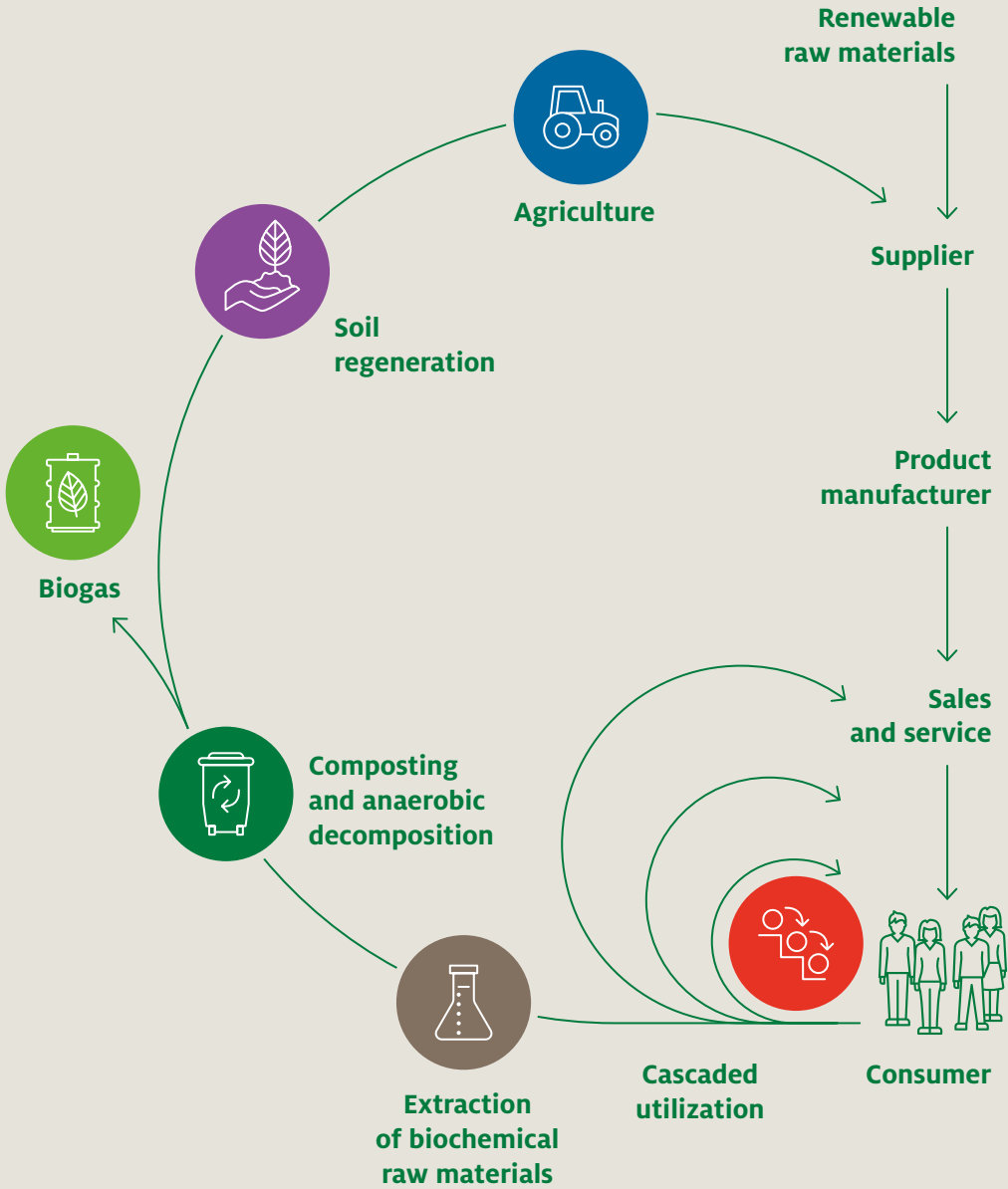
There are many definitions and variations of the circular economy, which is based on three fundamental principles: elimination of waste and environmental pollution, circulation of non-renewable resources in cycles, and sustainable extraction of renewable resources while simultaneously regenerating nature. This requires a transformation of the economic system. The path from raw material to product to consumption and disposal must function better in a cycle and should no longer be seen as a linear economic activity. Materials, designs and production methods for consumer goods should focus on durability, reprocessing and reparability. Consumer goods must be biodegradable.

The key element of this concept is thus to already use a sustainable design when developing products and processes, keeping an eye on all steps in the value chain as early as possible. The principles of the Ellen MacArthur Foundation and the World Business Council for Sustainable Development, which Symrise also increasingly uses as a guide, are also based on the cradle-to-cradle design made popular by US architect William McDonough and German chemist Michael Braungart.

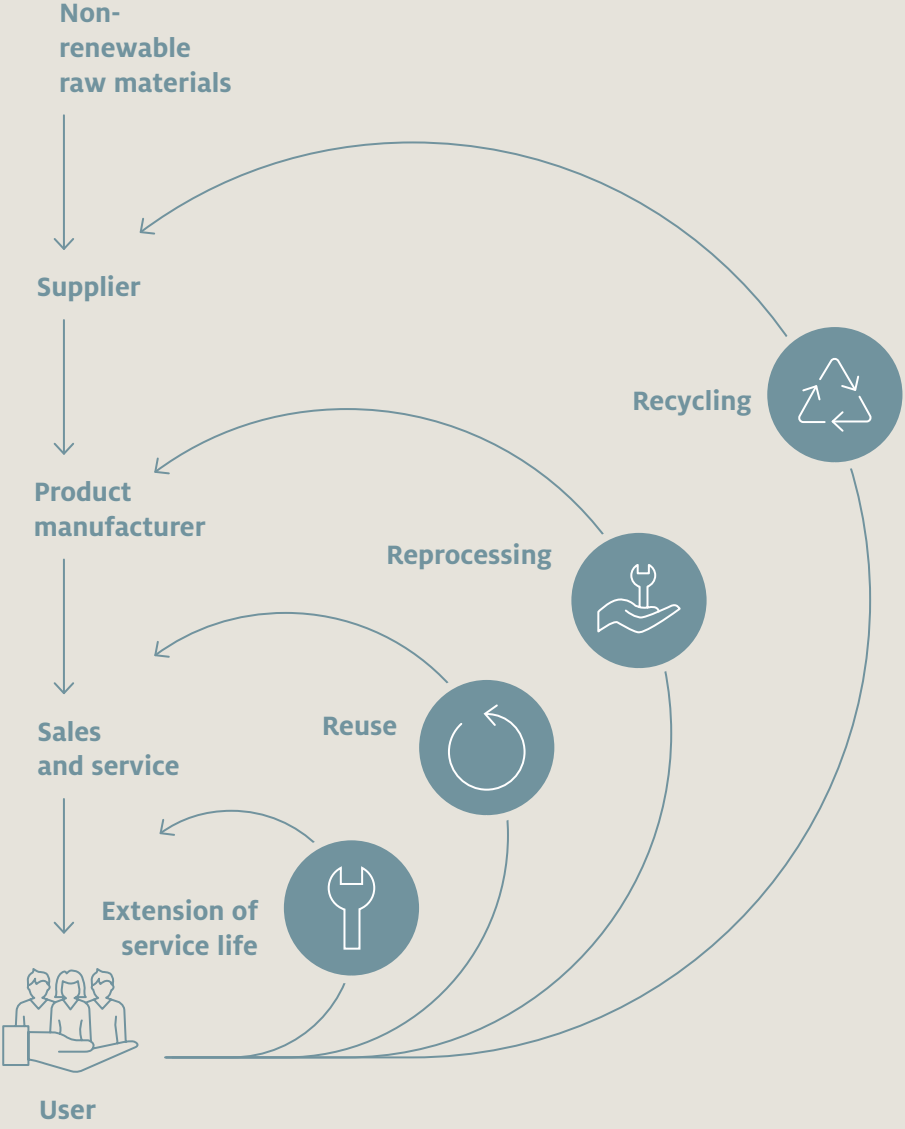
The concepts are applied to two cycles: the technical and the biological. In the first, consumer goods are circulated that were designed as resources for further uses. The materials are meant to be broken down into sorted base materials at the end of their life cycles and repeatedly reused. By contrast, the biological cycle is particularly relevant for the core business of Symrise, since all its products ultimately end up back in nature after use. The biological cycle describes those processes that initially extract raw materials and nutrients from the soil but return them, contributing to the regeneration of nature. This includes consumer goods such as foods and cosmetics, which are primarily made from natural raw materials or produced synthetically on the basis of fossil fuels.

The ambition for Symrise: All of the products that we manufacture ideally need to be fully biodegradable regardless of their origin, then further “metabolized” and, following use, safely returned to nature. The circular economy also calls for a shift in the energy supply from fossil fuels to renewable energy sources in order to decouple economic activities from the consumption of limited resources.

Biological cycle



Technical cycle



Best practices world-wide

From general to specific: examples taken from the Symrise Group

Symrise applies the principles of the circular economy across all levels of the value chain. The circular economy contains five key components that we can depict based on different Symrise projects, products and processes.



Regeneration

Rather than exploiting nature, we re-build natural capital. We promote agricultural practices that improve the soil and increase biodiversity. In this way, we strengthen the ecosystems' productive forces. Unlike traditional environmental management, which focuses on preventing negative environmental impacts, we aim to design economic activities that have a positive effect on nature.



Agriculture

We promote concepts such as regenerative agriculture, restorative aquaculture, agroecology, agroforestry and conservation agriculture throughout our value chains. This allows us to have a positive impact on nature. When cultivating natural raw materials, these practices allow us to restore healthy and stable soils and to achieve high levels of local biodiversity as well as good air and water quality. We also increase resilience in managed ecosystems and the surrounding countryside and preserve our company's natural capital.



Composting and anaerobic decomposition

Compost forms when organic substances such as food by-products and other biodegradable materials decompose. This not only improves the soil's nutrient balance but also returns valuable organic material to it. Unlike artificial fertilizer, it improves the soil structure and thus increases the productivity of agricultural areas. Even without oxygen (anaerobically), organic waste can be used when it is fermented by microorganisms. The fermentation residue can either be composted or distributed directly on the growing area to optimize the soil. The biogas formed during both processes can be used like fossil-based natural gas to generate energy.



Cascaded utilization

With cascaded utilization, raw materials are used across several levels. This means they are kept in the economic system for as long as possible through a variety of processes that take place within the biological cycle. This includes the intelligent use of by-products and waste streams in the agricultural or food industries and employment of innovative processes to transform them into valuable products. This reduces raw material consumption and enables exciting new products.



Extraction of biochemicals from by-products

After consumption, biological materials or by-products and waste form the source material with which small volumes of high-value chemical products such as biochemicals and nutraceuticals can be manufactured in biorefineries. These technologies can also be used to produce high-volume standard chemicals from organic materials.



Symtrap®

Symtrap® can concentrate natural scents once or thousands of times over.

■ The Symtrap® process, which the company developed in-house and patented, has helped Symrise manufacture hundreds of scents and fragrances. What makes the technology so special is the fact that it uses by-products that would otherwise go to waste. Symtrap® utilizes so-called aqueous phases that are left over from a variety of processes such as distillation.

This water still contains many scent or aroma molecules, which are extracted in a complex process. The liquid first passes through an adsorber column while maintaining specific temperatures or pressure levels. The molecules remain suspended in the equipment and are then dissolved out again by means of a food-grade and natural extraction agent. The result is a new product that differs slightly from essential oils in odor and is therefore ideally suited as an exclusive additional material.

In addition to using by-products, Symtrap® also increases sustainability by installing some of the devices where the aqueous phases occur. The advantage of this is that the large volumes of liquid no longer need to be transported around the world, which reduces emissions and costs.

Vanilla

■ Symrise is the only company in the industry with a continuous presence directly at the source of the vanilla in Madagascar. There in the SAVA region, where 80 % of the world's cultivated vanilla comes from, we create sustainable value for our partners in the value chain.

We've entered into direct partnerships with more than 7,000 vanilla farmers in 84 villages, providing Symrise and its customers with a high-quality, traceable and secure supply of vanilla. At the same time, the farmers and their families – more than 34,000 people – receive fair pay and a secure income.

In addition, we've introduced sustainable farming with reforestation programs, agricultural diversification and training for farmers in sustainable cultivation methods, which not only safeguards nature, but also helps regenerate resources.

>7,000

direct partnerships with vanilla farmers in
84 villages in Madagascar.







100%

traceable and certified organic:
ginger from Madagascar



Ginger



Ginger



Essential oils



SymVital®
Mada



Ginger
scent
extract

■ Symrise researchers and developers are looking for solutions for reuse of the valuable materials that are often left over from the purification of natural raw materials.

One example is the aqueous phases that occur during the production of essential oils and still contain fragrant substances. Symrise experts have found a solution with ginger from Madagascar, which is 100% traceable and certified organic. They use a supercritical carbon dioxide as a “green” solvent, which can flow through solids like a gas and dissolve materials like a liquid. In this way, Symrise extracts two products from the ginger root – SymVital® Mada, an ingredient with cosmetic properties, and an extract with a strong ginger smell that can be used like an essential oil.

In addition, the extracted biomass contains fibers from the roots, which can also be used for cosmetic applications. At the same time, farmers in Madagascar who have primarily planted vanilla can diversify their work and thus their income with the highly valuable ginger. Last but not least, varied cultivation makes it easier for soil to regenerate.



Patchouli

█ A majority of patchouli, which is one of the key raw materials in the perfume industry, is cultivated in Indonesia. The high-quality oil can be found in many fragrance blends. However, the agricultural industry there is not sufficiently sustainable.

Symrise and supplier Van Aroma have therefore founded a project on the island of Sulawesi that's dedicated to promoting eco-friendly cultivation of patchouli and securing the supply for the future. At the same time, the project improves living conditions for farmers.

The project also maintains soil fertility by producing compost from the rest of the patchouli harvest and other plant waste using organic decomposers. A particularly resistant patchouli variety has also been identified, and Symrise has provided the farmers with hundreds of thousands of the appropriate seedlings free of charge.

> 100,000

seedlings provided by Symrise to the farmers free of charge.





Clove



Clove



Clove oil



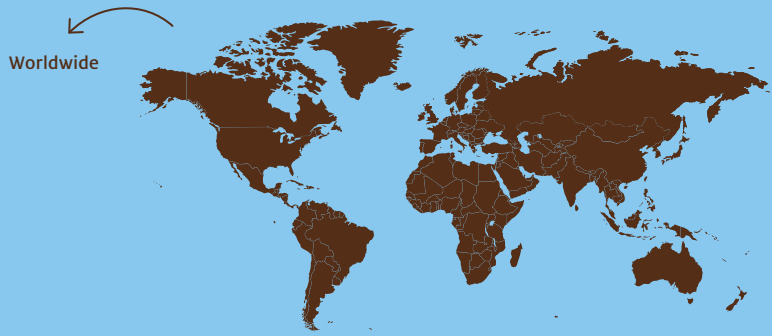
Oral care applications

— Symrise primarily purchases clove oils from the island of Sulawesi in Indonesia; these are used around the world in dishes and in oral care applications. We've also closely connected the supply chain with farmers and supplier Van Aroma.

Together, a cultivation process was developed that uses resources more efficiently. The project aims to provide farmers with the tools they need to earn money on a continuous basis and sustainably grow natural resources, ensuring we have a secure supply of raw materials.

For example, we've also provided the communities of farmers with training courses and invested in technical training that will allow people to further process cloves and many other products with their own distilleries.





Compost

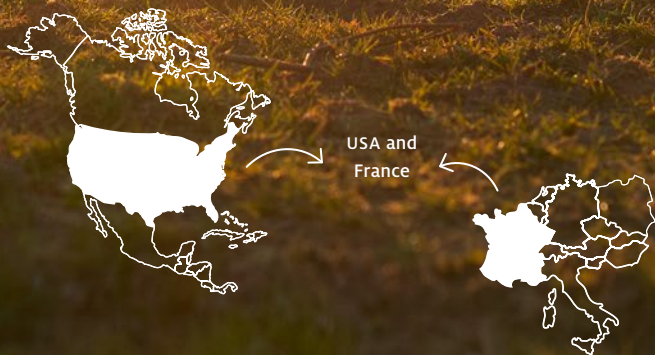
■ Symrise composts organic materials at various sites around the world. In 2021 and 2022, the company composted between 2,500 and 3,000 tons of operational waste and by-products at its headquarters in Holzminden and in Braunschweig in Germany; in France, Hungary and Spain in Europe; in Brazil, Colombia, Costa Rica and Ecuador in South America; as well as in Australia, the US and Thailand.

Moreover, during the same time period, between 2,300 and 3,000 tons of waste were disposed of in biogas plants in Germany, France, Australia, Hungary, South Africa and the US.

>3,000

tons of operational waste and by-products were composted by Symrise worldwide.





Chicken fat is derived from chicken skin and the fat of the meat



Chicken broth is produced from the animal's remains (back, frames and bones)

Chicken powder is produced from chicken backs & frames

Chicken

■ The circular economy and upcycling forms the core of the Pet Food division and Food & Beverage Naturals BU's business model. One example is the use of chicken by-products. Chicken parts left over from food production are sourced locally and processed as valuable ingredients with kitchen-like process such as various cooking technologies extraction, hydrolysis & drying. The result is palatants, broths, powders and purified fats that enrich thousands of food and petfood application, providing the desired mouthfeel or even the taste of meat and umami. The technologies and raw material extraction are continuously optimized to preserve great chicken taste and to select the best actives from nature.

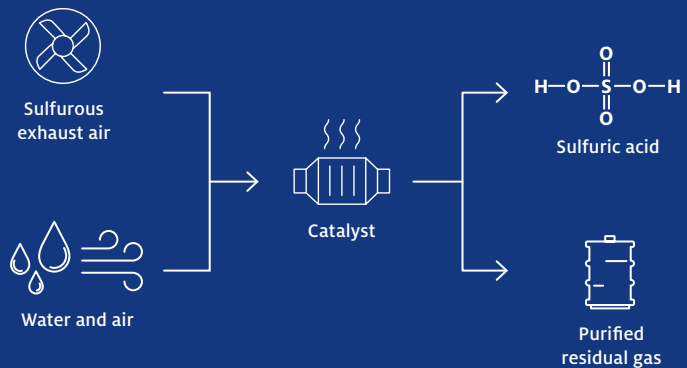
The Taste, Nutrition & Health segment has also identified many additional by-products. The researchers investigate their chemical and nutritional-physiological characteristics and check whether they are appropriate for upcycling. The end products are then used in the food and pet food industries; some are suitable for flavor creation and also used in the Symrise Cosmetic Ingredients business unit, for example.



Sulfuric acid

— Symrise introduced the Sulfacid® process at its plant in Jacksonville, Florida, and was the first company in the fragrance and flavor industry to do so.

The process desulfurizes exhaust fumes that occur during the process for manufacturing pinene, which is used in the production of pine wood fragrances, transforming these fumes into sulfuric acid. These can then be sold or reused directly in production at the site to manufacture dihydromyrcenol. We're the only company in the US to produce this fragrance from renewable raw materials. This process removes more than 99 % of the volatile sulfur components, which benefits the environment – and significantly reduces costs for Symrise.









Bananas

Symrise produces fruit and vegetable powders and flakes in Ecuador. To support the region's nature, people and communities, we take sustainability into account – from the plantations to production. The raw materials are traceable. After processing, the products can enter the global market as natural clean-label products.

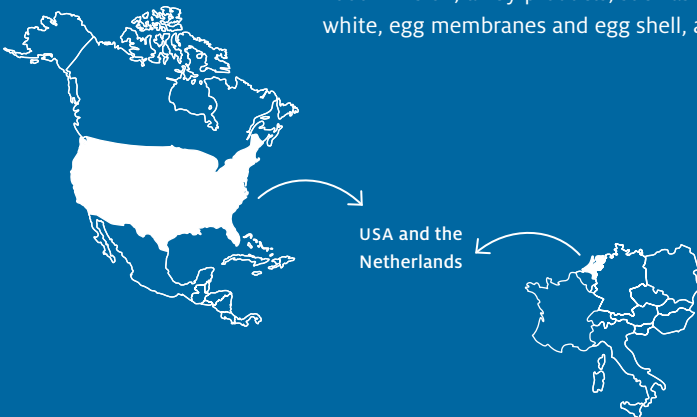
For example, we use bananas that have small spots or an undesirable curvature or size, and are therefore not suitable for the fresh fruit market. This represents approximately 10% of the harvest, which otherwise would not be used. The production of Symrise products also generates around 22,000 tons of banana peels each year, which still contain a lot of dietary fiber and health-promoting substances and can be utilized.

Eggs



— Eggs don't just taste good and fill you up — they also contain many different nutrients that are important for a healthy diet. They also provide many advantages for pets: They are a sustainable source of protein, support the immune system and have antimicrobial qualities. They can also be used in pet food as a binding agent and to improve texture.

Pet Nutrition sites in USA and the Netherlands have developed a range of processes over the last few decades to make even better use of the valuable raw material. In Barneveld, Netherlands, by-products of the egg trade, egg production and hatcheries are processed and recycled into high-quality ingredients for pet food. Under the name “Nutrios,” the nutrition brand of the Symrise Pet Food Division, all by-products, such as whole egg, egg yolk, egg white, egg membranes and egg shell, are used for this purpose.







Vegetables

— The raw materials used in perfume production have changed over the centuries. Natural ingredients such as blossoms and other flower and tree components which were originally used were increasingly accompanied by synthetic materials. Now the trend is going back to nature.

A collaboration across multiple divisions led to the creation of the unique, highly innovative Fine Fragrance Garden Lab, based on an idea conceived at the company's perfumery school. Symtrap® technology, which was developed in-house, serves as the foundation for this. It processes volatile aqueous phases from vegetable production in France. This resulted in exciting solutions: For example, a new geranium note that is mixed into many women's and men's perfumes has been developed from artichokes. Earthy and nutty notes are derived from asparagus, mossy and mineral notes from leek, and animalistic notes from cauliflower.





Oranges

— In the early 2000s, Symrise developed the Symtrap® technology, a green chemistry process that extracts much more flavor from fruits than was once possible.

This patented innovation uses the by-products from fruit processing. For example, when orange juice is concentrated, a highly aromatic liquid remains – the so-called aqueous phase that was once disposed of or used as water for cleaning the fruit. Symtrap® is able to capture aroma molecules that are not only especially flavorful, but also contribute significantly to the naturalness of the flavor compositions.

The technology can produce one kilogram of the highly concentrated flavor from several hundred kilograms of raw material, which reduces transport weight and thus plays a major role in improving the sustainability profile of the final products.







The trees absorb the CO₂ and use it to grow.



The ingredients are washed into the wastewater system via drains, like in the shower, and then flow to the treatment facility, where they are biodegraded in a short amount of time and transformed into CO₂.



Pine trees are grown sustainably in the USA. Once the trees have matured, the wood is sent to paper factories, where it is turned into pulp.



Pulp production creates raw sulfate turpentine oil, which then typically must be disposed of.



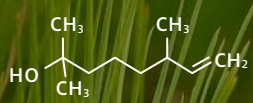
Symrise uses the raw sulfate turpentine oil and desulfurizes it.

A / B

The material is then distilled and broken down into alpha and beta-pinenes.

A + H₂O

The alpha-pinenes are hydrogenated and transformed into pinane.



The molecular structure of pinane is rearranged to form dihydromyrcene, which is then used to produce dihydromyrcenol, a biodegradable fragrance ingredient.



Manufacturers use dihydromyrcenol in shampoos, creams, perfumes and household cleaners.

30 %

of all fragrance blends
are manufactured with
terpene-based ingredients.



Pine

Terpene-based ingredients such as citronellol, geraniol, dihydromyrcenol and linalool are important raw materials used in an average of 30 % of all fragrance blends that Symrise sells to its customers.

One of the basic materials is raw sulfate turpentine oil, which is a byproduct of the paper industry. Symrise extracts the material, which is produced with a green chemistry process, using a complex procedure in the southeastern United States. This was the first liquid product to receive the globally recognized FSC forest protection certificate, which until then had only been applied to paper and wood products.

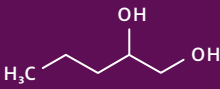




Sugar cane



Bagasse



Hydrolite® 5 green



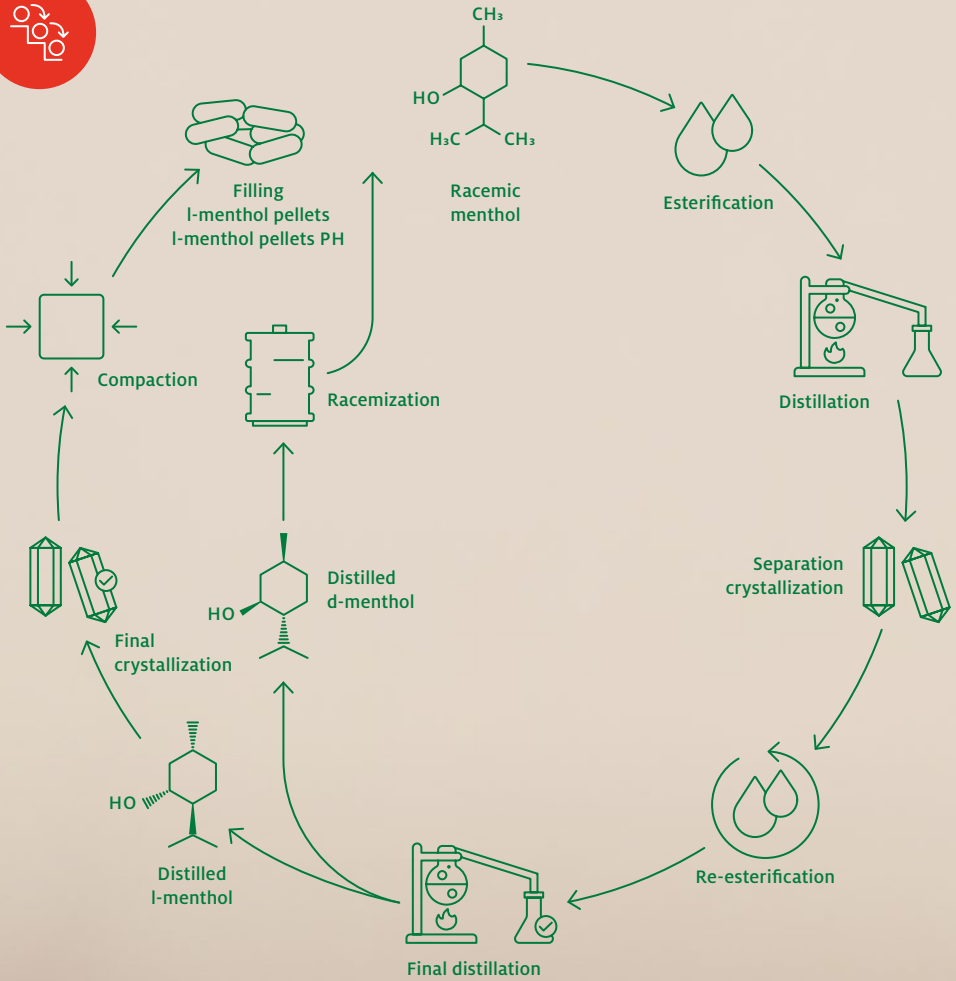
Cream

Sugar cane

For more than a quarter of a century, Symrise has sold the cosmetic ingredient Hydrolite® 5, a pentylene glycol that moisturizes skin in countless applications, increases the effectiveness of ingredients and improves the appearance, consistency and protection of the product itself.

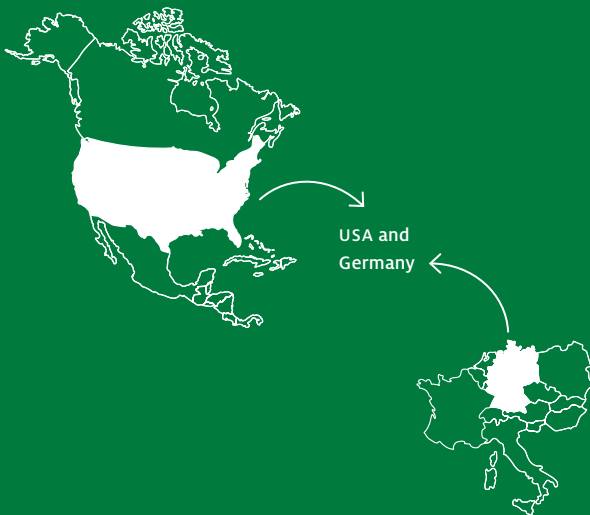
With Hydrolite® 5 green, the company now has an ingredient in its portfolio that can do the same things but is completely nature-based and sustainable. The substance is based on bagasse, a byproduct of sugar production from sugar cane. It is often burned directly in the sugar factories to generate energy, is used in the paper industry, or is processed further into animal feed.





Menthol

■ Symrise is a global market leader in menthols and its derivatives, which are used in oral care products such as toothpaste and mouthwash, sweets and chewing gum, shower gels and other cosmetic products. Menthol is extracted using a process developed by the company itself nearly 50 years ago that separates l-menthol from d-menthol in the last stage of enhancement, beginning with the raw material thymol. At different points during the procedure, intermediate products such as d-menthol are returned to the process. This form of the circular economy improves yield and reduces the amount of waste products.





Shrimps

■ Ecuador has the highest rates of shrimp farming in the world. The companies there are mostly producing for the US market. During production, shrimp heads — which are not used for human consumption — are left over. They still contain many valuable nutrients, however, which were previously just discarded.

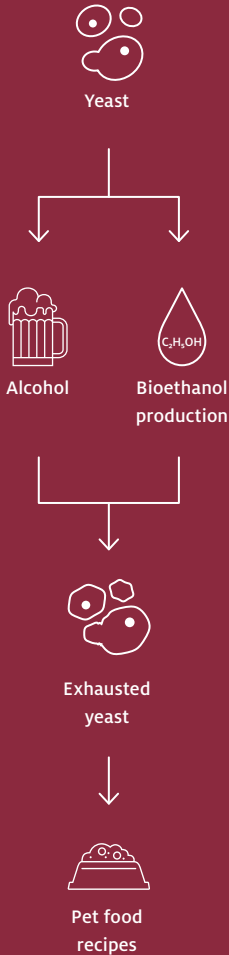
Symrise Aqua Feed in Ecuador buys around 20,000 tons of this byproduct of shrimp farming annually. Symrise processes these functional ingredients for fish feed in a facility directly next to the plants where shrimp are processed. The feed produced is mainly for salmon in aquaculture. The Symrise products improve feeding behavior and the overall health of the fish. Incidentally, by using by-products, fewer wild stocks need to be caught, which would otherwise have to be used in the fish feed.

100 %

of the raw material is left over from food production.







Yeast

■ The yeast *Saccharomyces cerevisiae* is one of the most important yeasts used in the food industry. It transforms sugar from biological raw materials into alcohol, for instance, in breweries and distilleries. It is also often used by bakers or in bio-ethanol production, where ethanol is made from sugar obtained from sugar cane, grains and beets.

Yeasts are versatile and powerful, but they are exhausted after a range of fermentation processes and no longer provide sufficient yields. This is where SPF comes into play. It's a brand from the Symrise Pet Food Division that aims to make pet food more palatable, in other words making it taste better to animals. The company collects dried exhausted yeasts to pet food recipes. The raw material is impressive not just for its unique taste qualities, but also for its protein, vitamin and oligo content.

Animal by-products

— To make pet food taste better for pets and so that they take in valuable nutrients, manufacturers like to use ingredients in their recipes that make food more attractive to pets. This is why SPF — the brand for palatability improvement from the Symrise Pet Food Division — used by-products from food production. 99 % of these come from sustainable sources: side streams of the meat and fish industries.

99 %

are sustainably sourced from side streams of the meat and fish industries.

SPF uses raw materials like livers, lungs, kidneys, spleens and hearts from chickens as well as fish leftovers like heads and bones, which would otherwise be discarded because they are not intended for human consumption. In doing so, the company considers regional differences and adjusts its recipes in each region based on the available raw materials. 82 % of animal by-products come from the same country where they are processed; 62 % are collected within a radius of less than 500 km.



* France, Spain, UK, Hungary, Russia, South Africa, China, Thailand, Australia, Brazil, Argentina, Mexico, Colombia, USA and Canada



This is just the beginning

The Symrise business model has always used by-products and products from other industries which are often viewed as waste to create new value.

Even today, we systematically apply the principles of green chemistry to tap sustainable sources of raw materials, develop process innovations and alternatives to raw materials, expand our portfolio with acquisitions, and increase the percentage of sustainable and circular raw materials in our portfolio. Yet we have no reason to be satisfied with what we have achieved so far. Nature and ecosystems continue to be exploited at an unsustainable level.

For this reason, we will continue along our current path and make other areas more sustainable as well. We largely banned the use of disposable plastic products in the company at the end of 2021, and will manage to only use sustainable materials by 2025.

For example, our employees had previously always used plastic cups and spoons to test new products such as the flavor solutions, purees and powders we produce from vegetables and fruit. In Holzminden, we now use small paper cups instead, which will replace 20,000 plastic cups a year. We recycle the paper cups that we're using in Germany in order to produce the paper on which this brochure and others are printed. There are similar projects in Brazil and France.

Another example: Service provider AFB regularly picks up computers and smartphones no longer in use at Symrise, repairs them, and sells around two-thirds of them as refurbished devices. This benefits the environment as well as people, since AFB is a company that focuses on



Paper cups instead of plastic cups in the laboratory



Paper cups are getting recycled



Circular Economy brochure is printed on this recycled paper

inclusion and creates hundreds of jobs for people with disabilities.

We plan to further reduce environmental pollution and costs in many areas. This is the only way that we can fulfill our customers' requests for sustainable product solutions and meet investors' demands for sustainable investments, thus ensuring that Symrise remains competitive and resilient even in times of global change.

