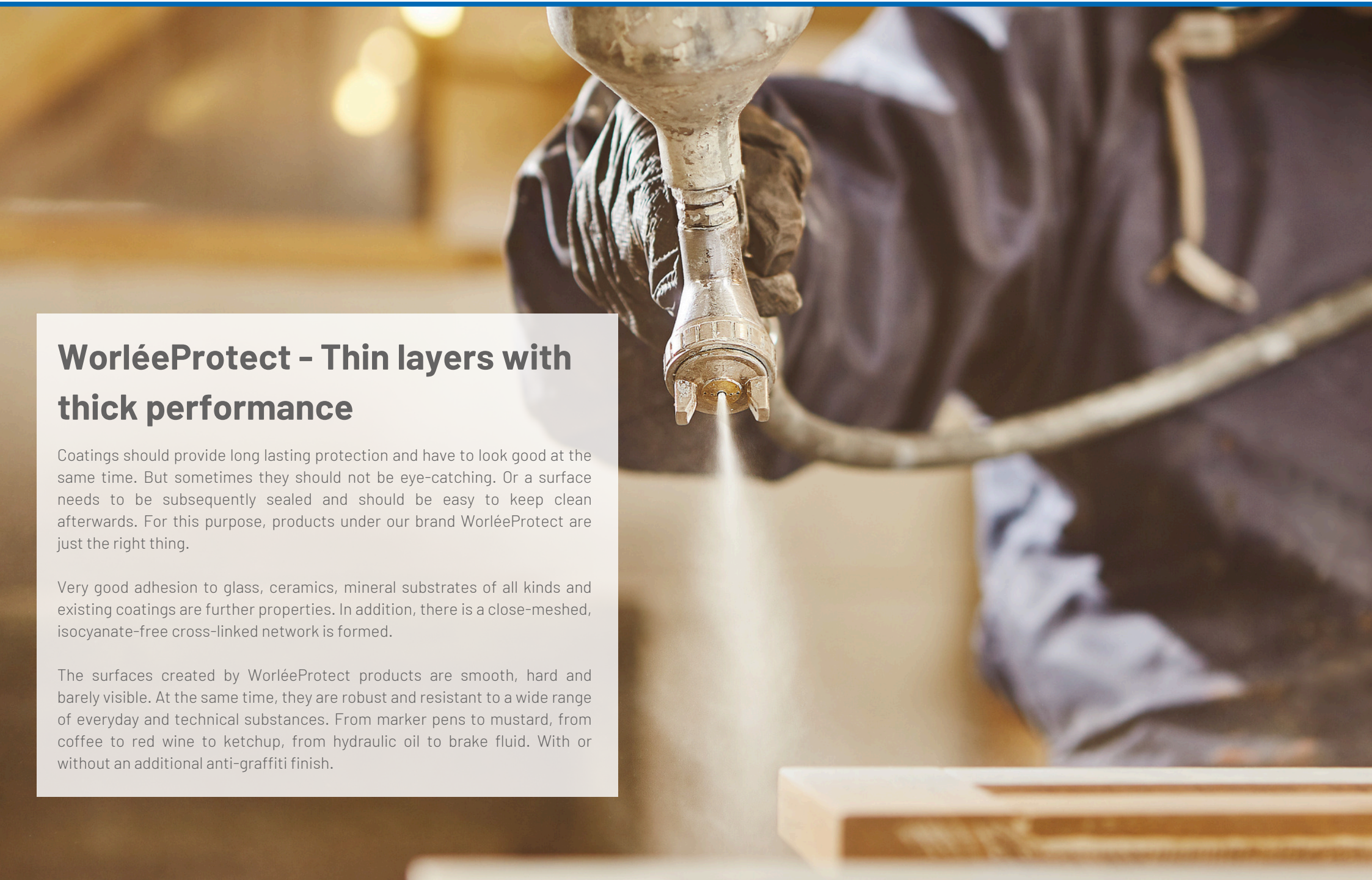


WorléeProtect – Thin layers with thick performance

Coatings should provide long lasting protection and have to look good at the same time. But sometimes they should not be eye-catching. Or a surface needs to be subsequently sealed and should be easy to keep clean afterwards. For this purpose, products under our brand WorléeProtect are just the right thing.

Very good adhesion to glass, ceramics, mineral substrates of all kinds and existing coatings are further properties. In addition, there is a close-meshed, isocyanate-free cross-linked network is formed.

The surfaces created by WorléeProtect products are smooth, hard and barely visible. At the same time, they are robust and resistant to a wide range of everyday and technical substances. From marker pens to mustard, from coffee to red wine to ketchup, from hydraulic oil to brake fluid. With or without an additional anti-graffiti finish.

Special coatings

Our products under the brand of WorléeProtect are characterized by a number of properties that set them apart from conventional binders (alkyds, acrylates, 2K formulations). This is due to their chemical structure and the additional components.

The polymer components have a linear structure and a high density of cross-linking groups. Drying is initiated by air humidity and takes place through a subsequent combined hydrolysis and cross-linking reaction. The addition of hardeners or catalysts is not necessary. The composition, especially of WorléeProtect VP-Z 3224/08 and WorléeProtect VP-Z 3224/09, ensures rapid curing. This enables high cycle rates for industrial applications or rapid further processing of the coated components for manual application.

In contrast to conventional binders, which are just one of several ingredients in the formulation, the products in the WorléeProtect range are largely formulated ready for use. The active ingredient content should be adjusted to the respective area of application by dilution during packaging.

You can learn more of our WorléeProtect range of products and their properties on the following pages. Let us convince you of the advantages:

- Thin layers lead to very economical consumption
- The coatings dry transparent-colorless
- The coatings are highly weather-resistant
- The coatings are resistant to a wide range of everyday and technical substances
- The coatings are easy to clean and only tend to stain to a small extent
- Renovation of load-bearing old coatings is possible without great effort

The products of the WorléeProtect series

WorléeProtect products are available in four standard variants. What they all have in common is a very low viscosity, a ready-to-use formulation apart from an adjustment of the active content if necessary and the achievement of high-quality, robust surfaces.

All products within the WorléeProtect range also have a high cross-linking density. This results from the chemical structure of the polymeric and molecular components.

Various silanes are also included as reactive thinners.

The products differ in their drying behavior and their layer thickness tolerance. WorléeProtect 1619 and WorléeProtect 1626 require 3 h to 4 h at room temperature until the surface appears tack-free; WorléeProtect VP-Z 3224/08 and WorléeProtect VP-Z 3224/09 achieve a tack-free state much faster in 1.5 h to 2 h. Particularly noteworthy is the resistance against ethanol achieved quickly with WorléeProtect VP-Z 3224/08 and WorléeProtect VP-Z 3224/09 which is within 24 hours. With WorléeProtect 1619 and WorléeProtect 1626 this is only the case after several days.

Product	Delivery Form	Drying to tack-free	Special features
WorléeProtect 1619	39% in n-Propanol	3 h to 4 h	up to 10 µm dry film thickness easy-to-clean
WorléeProtect 1626	40% in n-Propanol	3 h to 4 h	up to 10 µm dry film thickness
WorléeProtect VP-Z 3224/08	39% in n-Propanol	1,5 h to 2 h	fast drying up to 30 µm dry film thickness, easy-to-clean fast ethanol resistance
WorléeProtect VP-Z 3224/09	40% in n-Propanol	1,5 h to 2 h	Fast drying up to 30 µm dry film thickness Fast ethanol resistance

The drying data were determined in a standard climate (20 °C and 50 % humidity).

Instructions for use

In order to achieve the recommended thin dry film thicknesses of up to 10 µm or up to 30 µm, it is advisable to dilute the product up to 1:1 and apply it using a spray gun or a commercially available microfiber wipe. Application by dipping or flooding is also possible. The easiest way to adjust the active ingredient content is with n-propanol.

The tools used should be cleaned immediately after application. Our technical application department will be happy to provide advice on adjusting the spray gun.

Excessively thick layers, especially with WorléeProtect 1619 and WorléeProtect 1626, can lead to cracking as the coating ages. WorléeProtect VP-Z 3224/08 and WorléeProtect VP-Z 3224/09 are more tolerant in this respect.

WorléeProtect - a clean affair

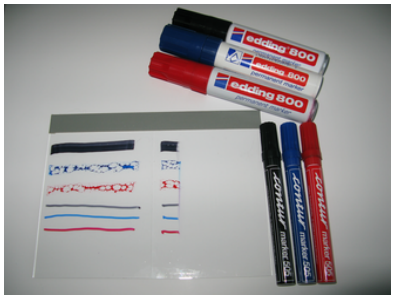
The key feature of the WorléeProtect series is the stain and dirt resistance of the surfaces. The WorléeProtect 1619 and WorléeProtect VP-Z 3224/08 variants also have a pronounced easy-to-clean feature.

The picture (on the next page) clearly shows how the surface of the WorléeProtect coating prevents absorption of the paint. Markings can be removed with a dry cloth or, in stubborn cases, with the aid of some ethanol.

WorléeProtect-coated surfaces are not only resistant to colored pencils. Even household and technical substances cannot harm the coating. These include

- Mustard
- Ketchup
- Red wine
- Coffee
- Hydraulic oil
- Brake fluid

The drying process is faster for WorléeProtect VP-Z 3224/08 and WorléeProtect VP-Z 3224/09 compared to WorléeProtect 1619 and WorléeProtect 1626, respectively. Additionally, resistance towards ethanol is acheived earlier for the former mentioned types. The described properties are retained even after more than 3000 hours of exposure to QUV-A radiation.



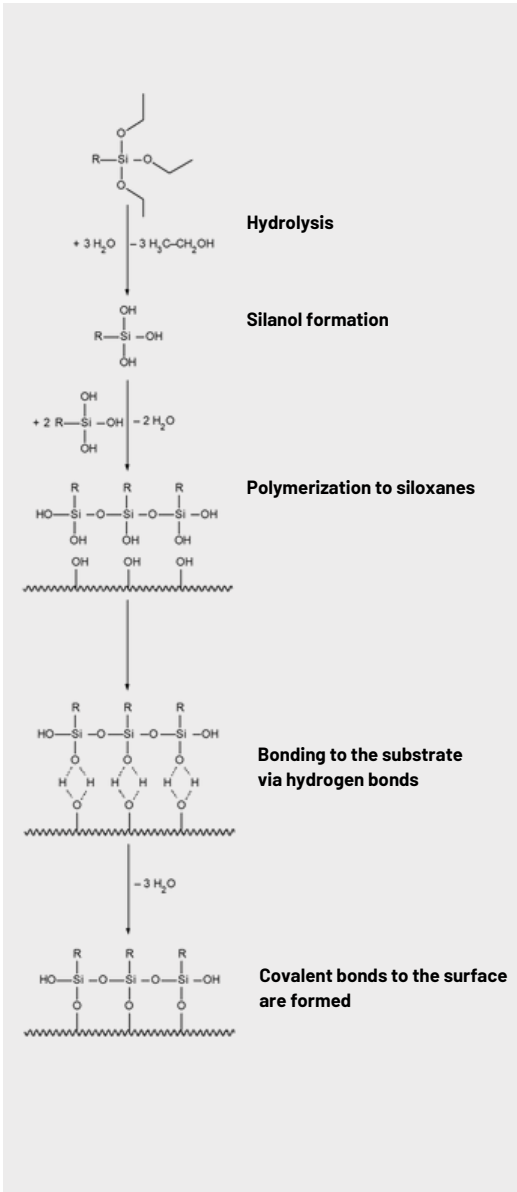
Illustrations: Permanent markers are easy to wipe off (left). Even after QUV exposure, tags and graffiti don't stand a chance (right).

A strong bond

The special properties of the WorléeProtect range of products are due to the close-meshed cross-linking of the components and the good adhesion of the coating to the underground.

Objects made of metal, glass and ceramics, for example, carry oxide or hydroxide groups on their surface. The air around us contains a certain amount of moisture.

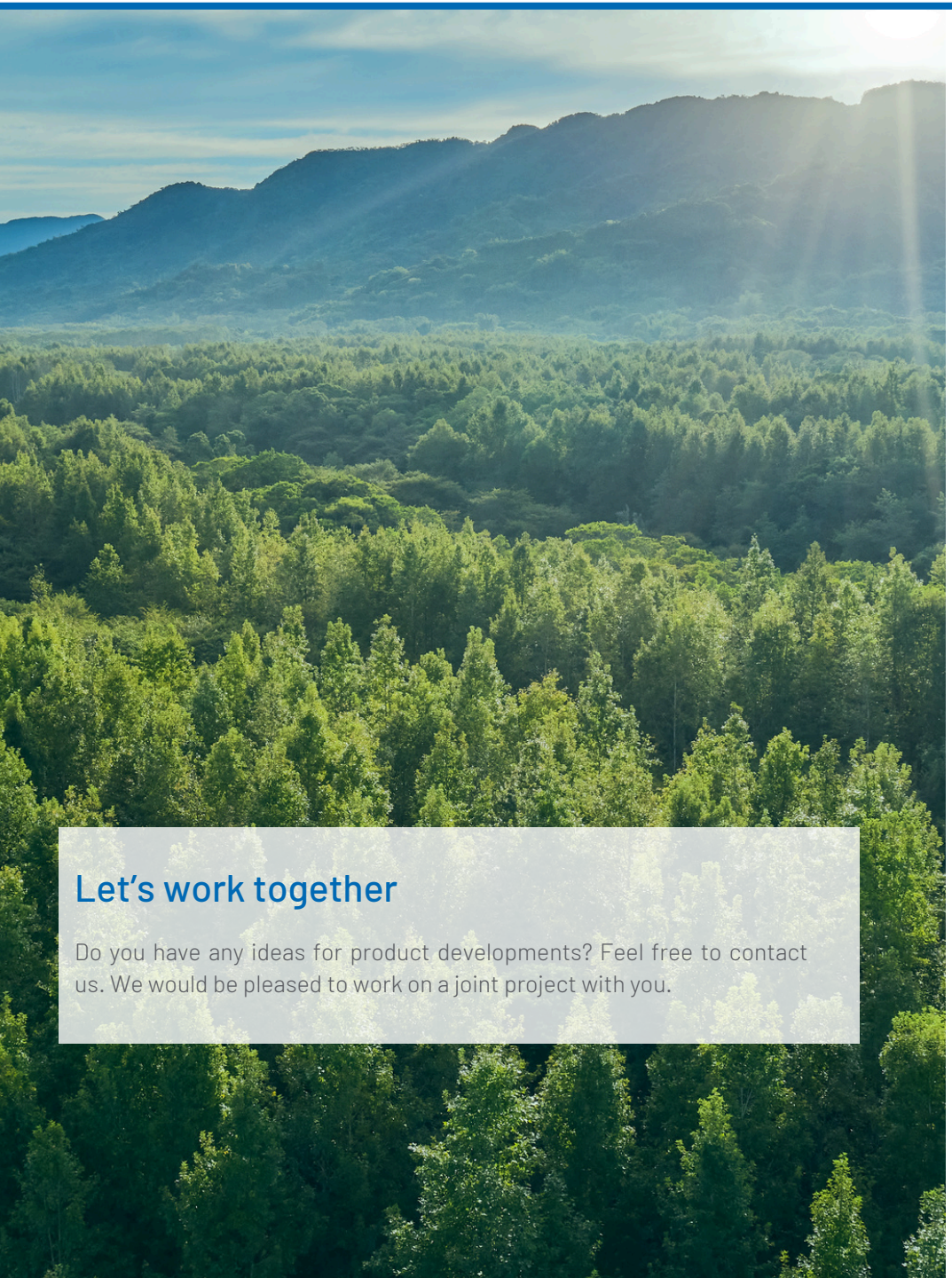
If a product from the WorléeProtect range is applied to a surface, some water will find its way into the coating film. The water reacts with the ethoxysilyl groups in the binder, resulting in the formation of unstable silanol groups while ethanol is liberated. The silanols condenses to form siloxanes and water. The resulting water leads to the hydrolysis of further ethoxysilyl groups, so the network formation progresses.



Parallel to the cross-linking reaction described above, a hydrogen bridge network is formed towards the surface of the substrate by the silanol units and functional groups created by hydrolysis. These hydrogen bonds lead to a preformation of the later covalent bonds between the surface and the coating. Here, too, water is released during bond formation, which sub-sequently contributes to the formation of further siloxane bridges.

As described above, the water produced during the curing process is repeatedly consumed by the ongoing reaction. The network formation therefore continues even after the formation of a closed surface.

The reaction described is illustrated in the diagram shown here (adopted from B. Arkles, Chemtech 1977, 7(12), 766-778). The combination of polymer components with a high amount of alkoxysilyl groups, reactive diluents and catalytically active units leads to a close-meshed network with high stability; siloxane bridges are among the strongest covalent chemical bonds known.



Let's work together

Do you have any ideas for product developments? Feel free to contact us. We would be pleased to work on a joint project with you.

Sustainable product development

The development of sustainable products has accompanied us for a very long time. Even without legal or societal pressure, it has always been our ambition to offer better and more durable products and solutions for a wide range of applications. Developing high-quality products in collaboration with our customers remains our primary focus.

Over the decades, we have gained a lot of experience in developing various resin technologies based on different raw materials to make products more sustainable from different perspectives. Sustainable product development must ultimately benefit the environment and society, but also take into account economic aspects.

The entire supply chain must benefit. Already in our proven developments, we can take many of these different aspects into account and make resins and additives even more sustainable. For example, we can determine factors such as the proportion of renewable raw materials, the proportion of secondary raw materials, regionality and longevity, the hazard potential of our products, and the competition of our raw materials with the food industry.

Technologically, we are well positioned with our creative departments in research, development and application technology to continue to move towards sustainable products in collaboration with our customers and partners. Every new development is related to sustainability factors such as climate change and resource conservation.