



## WorléePol 1181 – polyester polyols

For particularly high-quality solvent-based, solvent-free and also water-based coating systems, reactive one-component and two-component systems are usually used. These are, for example, isocyanate or melamine-cross-linking systems. These coating systems are often based on polyacrylates, polyurethane dispersions, polyesters and also other binder systems. Depending on the different applications, it may be necessary to modify the developed coating systems with regard to certain properties. In order to avoid a completely new development, specially formulated polyester polyols of the WorléePol 1181 series, among others, are suitable here.



## Special polyester polyols for the modification of versatile reactive coating systems

Polyester polyols are produced by esterifying polyhydric alcohols with polyhydric carboxylic acids.

The structure of the starting materials (aliphatic, cycloaliphatic, aromatic), their mixing ratio and the type and number of functional groups (e.g. hydroxyl or acid groups) determine the properties of the polyester resin.

Polyester polyols for modification are mostly linear or only slightly branched and have a high proportion of reactive hydroxyl groups.

The very broad selection of aromatic, aliphatic and cycloaliphatic monomers enables the targeted control of a wide range of properties.

The special composition of the polyester polyols of the WorléePol 1181 series makes it possible to optimise the following properties, for example, even with only small additions:

- Elasticity
- Scratch and abrasion resistance
- Gloss and filling properties
- Processing and levelling properties
- UV and weather resistance
- Chemical resistance
- VOC content

## The two available products cover a wide range of applications

Both WorléePol 1181/03 and WorléePol 1181/09 are characterised by a very low viscosity and a very high hydroxyl content. The compatibility of both products is given in different paint systems. They are therefore suitable for use not only in solvent-based, solvent-free paint systems but also in water-based paint systems.

Both products improve the mechanical properties in the coating systems to a similar extent. WorléePol 1181/09 does not contain any aromatic components and is therefore more suitable for systems that must have particularly good UV resistance.

Both products are available almost everywhere in the world. However, the WorléePol 1181/03 is easier to use from a regulatory point of view in applications involving direct or indirect food contact.

Product	Delivery form	Technology	OH content
WorléePol 1181/03	solvent-free	saturated and low-viscosity polyester polyol with very low aromatic modification	10%
WorléePol 1181/09	solvent-free	saturated, low-viscosity and pure aliphatic polyester polyol	10%

Table 1: The WorléePol product range



## WorléePol 1181/09 improves the properties of two-component high-solid polyurethane coatings

High-solid acrylates are produced by lowering the average molecular weight while maintaining the same viscosity. In doing so, an attempt is made to reduce the higher molecular weight portion, as this has a particular influence on viscosity. On the other hand, this high molecular content also ensures a certain viscoplasticity of the corresponding binders. In addition, high-solid acrylates should also dry quickly and have a high degree of hardness. The corresponding composition of the monomers and modification is essentially responsible for this. Today, it is thus possible today to produce acrylates that dry very well and are rich in solids, and which can however also be modified with regard to some of their properties.

Smaller additions of WorléePol 1181/09 are suitable to round off the properties of such coating systems.

For example, replacing only 5% of the main binder with WorléePol 1181/09 can significantly optimise the properties of, for example, a high-quality clear coat (Table 2).

Raw material	1	2
WorléeCryl VP A 2645 (79% in Butyl acetate)	76.00	72.00
WorleePol 1181/09	-	3.00
Dowsil 205 SL	0.15	0.15
K-Kat XK 661	0.50	0.50
Methoxypropyl acetate	7.00	7.00
Butyl acetate	8.35	9.35
Solvesso 100	8.00	8.00
Tolonate HDT-LV	33.00	34.00

Table 2: Lacquer formulation

The first differences become apparent after the isocyanate-added coating has been adjusted to the desired processing viscosity (Table 3). The coating modified with WorléePol 1181/09 has a measurably higher non-volatile content and thus a lower VOC content at the same viscosity.

Property	1	2
Viscosity 4 mm, 20°C	18 sec	18 sec
Non-volatile portion	57.7%	62.7%
Density, 20°C	1.027 g/cm <sup>3</sup>	1.028 g/cm <sup>3</sup>
VOC content	428 g/l	384 g/l

Table 3: General technical data

The modification with WorléePol 1181/09 leads to a noticeably higher hardness with forced drying. The initial slightly lower hardness when drying at room temperature levels out completely in the course of the drying time (Table 4).

Pendulum hardness	1	2
30 min 60°C + 1h RT	35 sec	56 sec
+ 24h RT	101 sec	135 sec
+ 1 week RT	167 sec	205 sec
24 h RT	83 sec	72 sec
72 h RT	105 sec	112 sec
1 week RT	115 sec	115 sec

Table 4: Pendulum hardness 60°C and room temperature

The clear coat examined is certainly suitable for painting cars, for example. Scratch resistance is an important criterion when painting such objects. The lacquer is permanently exposed to bushes, fingernails, stones and dust. To assess scratch resistance, the clear coats were painted on a blue base coat and left to dry for a fortnight at room temperature. After the drying time, the surface was scratched with a Scotch-Brite sponge and a Crockmeter with 20 double strokes. The gloss level was determined before and after exposure. Likewise, such paint systems are subject to a certain recovery. The gloss levels sometimes recover somewhat over time, as the binders are subject to a slight reflow effect. This recovery was considered at room temperature and 60°C. When a car is parked in the sun, for example, such temperatures can be reached.

The addition of WorléePol 1181/09 reduces the loss of gloss due to scratching and also improves recovery at room temperature. In contrast, there is no advantage when stored at 60°C. The polyacrylate used alone shows a good recovery effect here (Table 5).

Gloss level 60° measuring angle	1	2
Before the load	93 GU	93 GU
Immediately after load	39 GU	57 GU
+ 24 h RT	48 GU	69 GU
+ 30 min 60°C	89 GU	90 GU

Table 5: Scratch resistance and reconstruction of gloss

Due to its composition, WorléePol 1181/09 is very UV-resistant. This property is of course important for all varnishes used outdoors. The two clear coats were compared in an alternating climate test with UV-B radiation (QUV B 313 rapid weathering). This rapid test includes an alternation of irradiation with UV-B radiation and a condensation phase without radiation. Even without light stabiliser, the base binder used achieves good resistance. The small addition of WorléePol 1181/09 improves this even further (Table 6).

Gloss level 60° measuring angle	1	2
Start	96 GU	96 GU
100 h	95 GU	95 GU
300 h	94 GU	95 GU
520 h	78 GU	87 GU

Table 6: QUV B 313 Rapid weathering

## It also improves some properties in waterborne two-component polyurethane coatings

Emulsified hydroxy-functional acrylates can have a significantly higher molecular weight than high-solid acrylates. A variety of products with different hydroxyl contents are available here.

With a hydroxyl group content of 6%, WorléeCryl VP A 2160 W enables the formulation of particularly high-quality top coats, which are characterised by a high gloss, but especially a high hardness and very good chemical resistance. Thus, the product achieves excellent resistance to a wide range of chemical substances, such as Skydrol.

The high cross-linking density in particular ensures that the flexibility is sufficient in many cases, but could certainly be improved. On the other hand, it is important that the chemical resistance in particular is affected as little as possible, as this is what distinguishes the binder.

With an increasing addition of WorléePol 1181/09, an improved flexibility is observed (Table 7). This can already be seen in the results of the Erichsen Cupping, but especially in the impact test. There are also advantages in terms of adhesion, especially to steel.

	1	2	3
WorléePol 1181/09 share on master lacquer	0.0%	2.5%	5.00%
Erichsen Cupping	7.8 mm	8.1 mm	8.4 mm
Impact test direct	60 cm	70 cm	>100 cm
Impact test back	<10 cm	10 cm	40 cm
Adhesion cross-cut on steel	2-3	1	1
Adhesion cross-cut on steel on aluminium	2-3	1-2	1

Table 7: Influence of WorléePol 1181/09 on mechanical properties

Soft-touch lacquers are often based on water-based polyurethane dispersions that are cross-linked with isocyanates. The use of such products is often where these lacquers come into contact with a wide variety of common household substances. Good resistance is therefore required. In addition, modifying binders must of course not influence the desired soft-touch effect.

Even small additions of WorléePol 1181/09 are sufficient to improve the already good chemical resistance of a polyurethane dispersion to some substances (Table 8). On the other hand, the soft-touch effect is not influenced.

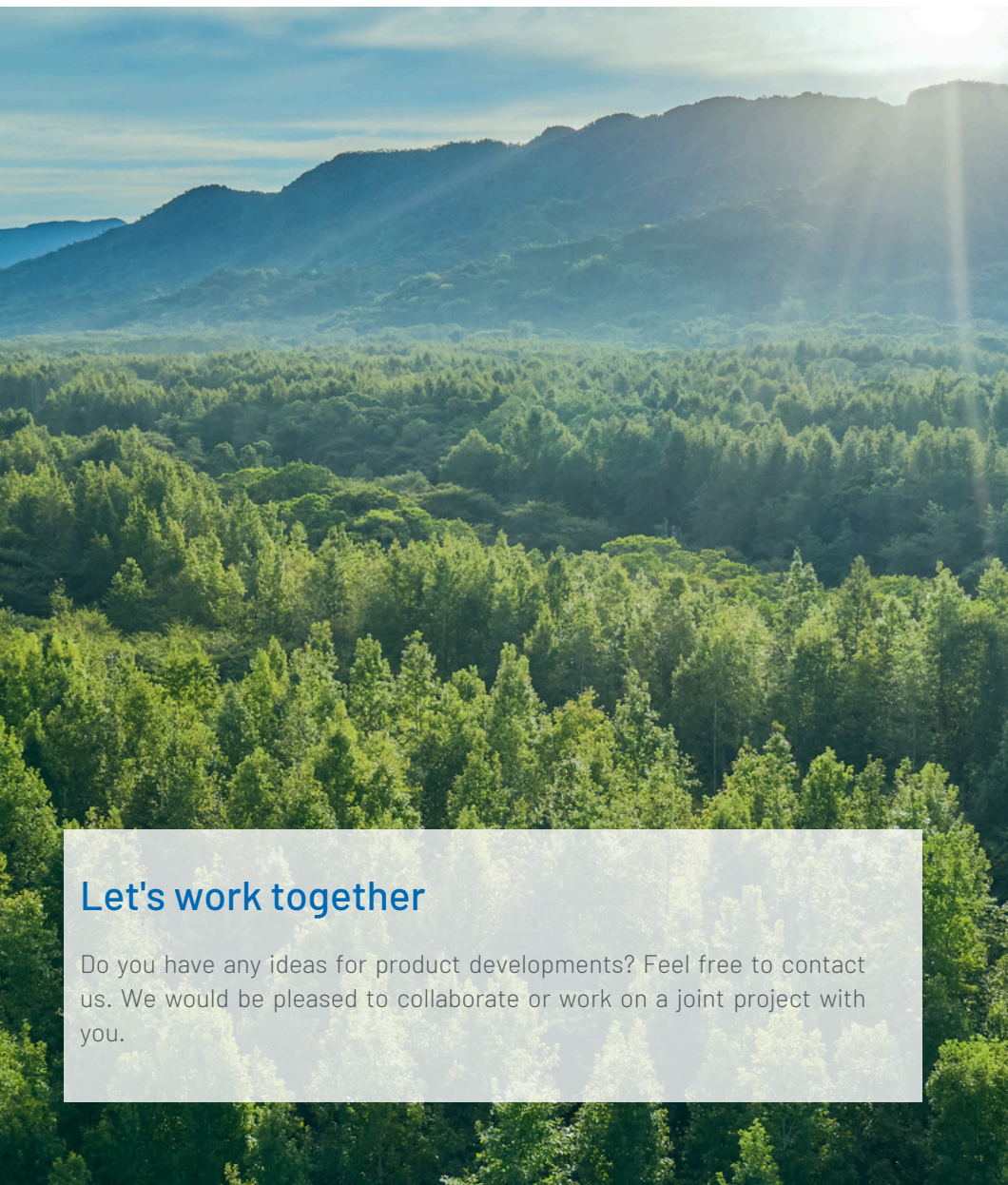
## Testing of furniture lacquers according to DIN 68861 - 1B

		Exposure time	Set points	Without	5%*	10%**
1	Acetic acid 3%	1 h	5	5	5	5
2	Citric acid 10%	1 h	5	5	5	5
3	Sodium carbonate 10%	2 min	5	5	5	5
4	Ammonia 10%	2 min	5	5	5	5
5	Ethanol 23%	1 h	5	4	5	5
6	White, Red, South Wine	6 h	5	2	2	2
7	Beer	6 h	5	5	5	5
8	Cola	16 h	5	5	5	5
9	Powdered coffee	16 h	5	4	5	5
10	Black tea	16 h	5	5	5	5
11	Blackcurrant juice	16 h	5	1	1	1
12	Condensed milk	16 h	5	5	5	5
13	Water	16 h	5	5	5	5
14	Petrol	16 h	5	5	5	5
15	Acetone	10 sec	2	2	2	2
16	Ethyl/butyl acetate	10 sec	2	1	2	2
17	Butter	16 h	5	4	5	5
18	Olive oil	16 h	5	4	4	4
19	Mustard	6 h	5	1	1	1
20	Table salt 5%	6 h	5	4	5	5
21	Onion juice	6 h	5	4	5	5
22	Disinfectant	10 min	5	3	4	4
23	Stamping ink	16 h	2	1	1	1
24	Cleaning agents	1 h	5	5	5	5

Table 8: Chemical resistance on wood

\* 5% addition of WorléePol 1181/09 . \*\* 10% addition of WorléePol 1181/09





## Let's work together

Do you have any ideas for product developments? Feel free to contact us. We would be pleased to collaborate or 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 ever 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.

## Our corporate values by which we act

Since our founding in 1851, the principle of sustainability with its three core themes of economy, ecology and social issues has been at the heart of our corporate philosophy. As a family business, Worlée-Chemie is committed to social responsibility and fair dealings with business partners and employees. We are committed to forward-looking and prudent environmental protection as well as preventive and comprehensive occupational health and safety as a corporate goal.

We are convinced that the natural resources of water, air and soil must be treated with care as part of our responsible actions. In this way, the ecosystem of which we are a part can be preserved as the basis of our living conditions for future generations. This also applies in particular to the economical and efficient use of energy and natural resources.

We stand by our responsibility for safety in production, storage and transport. We ensure that our products are handled conscientiously along the entire value chain.

Compliance with human rights due diligence is part of our company's self-image. Integrity, fairness, responsibility and a high degree of transparency are the basis for a trusting and long-term business relationship. We expect our suppliers to adhere to these principles in the wider supply chain and to recognise our Supplier Code of Conduct or provide an equivalent guideline.

### Solvent-based binders

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Modules to your Success

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