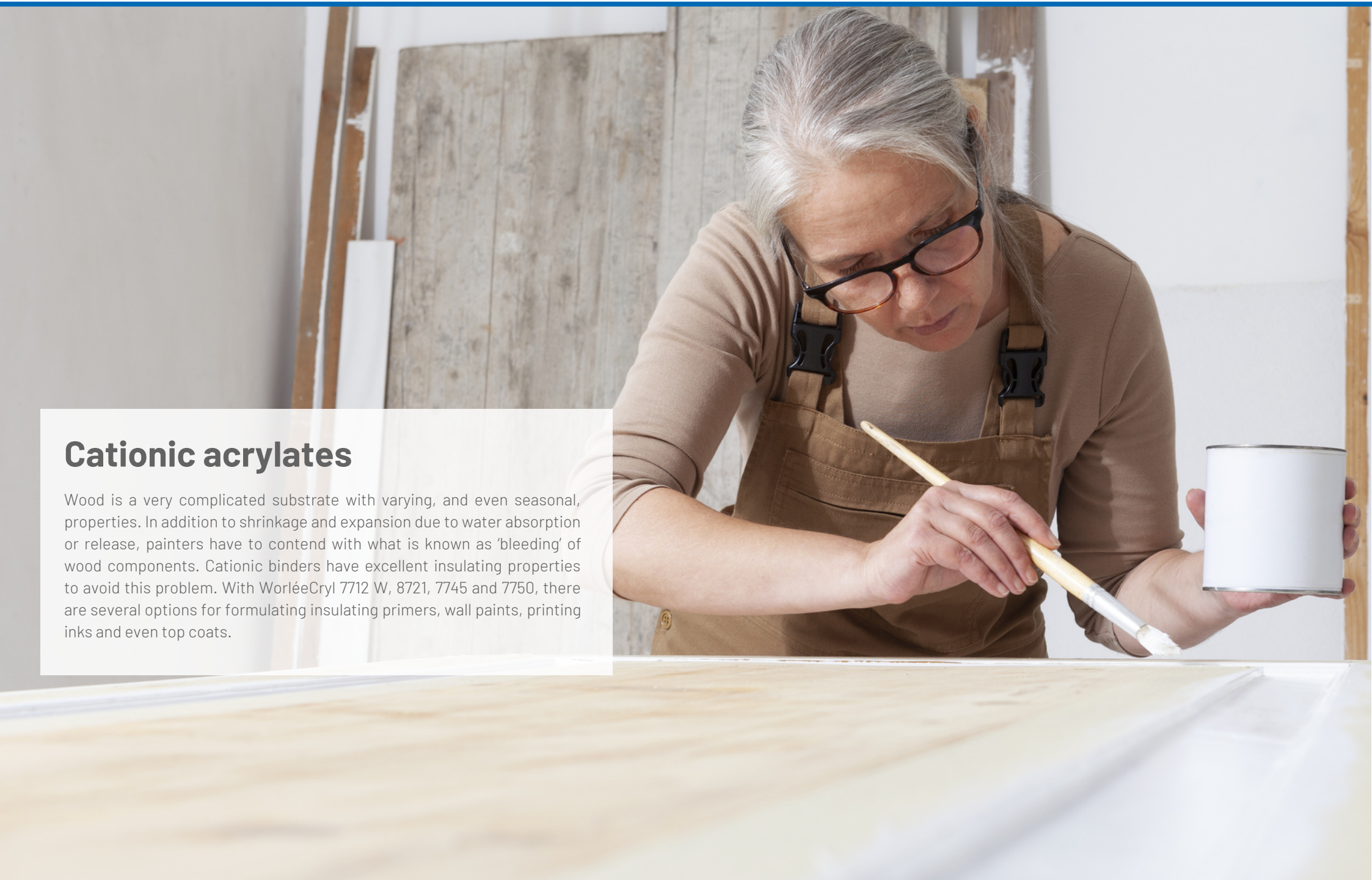


Cationic acrylates

Wood is a very complicated substrate with varying, and even seasonal, properties. In addition to shrinkage and expansion due to water absorption or release, painters have to contend with what is known as 'bleeding' of wood components. Cationic binders have excellent insulating properties to avoid this problem. With WorléeCryl 7712 W, 8721, 7745 and 7750, there are several options for formulating insulating primers, wall paints, printing inks and even top coats.

Chemical principles of cationic acrylates

The stability of commercially available anionic acrylate copolymers in water is improved by neutralising existing acid groups (e.g. acrylic acid) with alkaline-neutralising agents such as ammonia. The addition shifts the pH from the acidic to the basic alkaline range.

The stability of cationic acrylates is also improved, but the charges are reversed - basic monomers such as dimethylaminoethyl acrylate are used instead of acrylic or methacrylic acid. These are then neutralised with an acid such as formic acid. Neutralisation thus shifts the pH from the basic to the acidic alkaline range.

Accordingly, cationic acrylates differ from anionic acrylates in the charge of the polymer chain. The positive charge also leads to the main advantage of this binder group: the excellent insulating properties against wood ingredients and other anionic contaminants.

Areas of application

- Paint and architectural coatings
- Printing inks

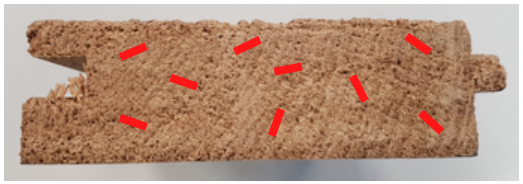
Insulating effect

There are 25,000 different species of wood in the world, hundreds of which are regularly traded. Wood has many characteristics - it 'works' (shows shrinkage/expansion due to water absorption or release); it has different proportions of hardwood and softwood; it must be protected from infestation; and it contains different wood constituents. Some of these wood ingredients are water-soluble and are dissolved by the immigrating water when coated with waterborne coating systems. When the water evaporates during the drying process, it transports the dissolved contents to the paint surface. Because some of these ingredients are coloured, the surface turns yellowish or reddish. This process is called 'bleed-through'.

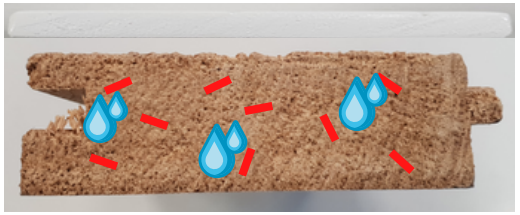
The type and quantity of water-soluble wood ingredients varies greatly. Tropical woods in particular contain very high amounts. In Europe, oak is one of the wood species with a very high content.

The main wood constituents are the tannins, some of which have an acidic character and can thus form a negative charge or partial charge. A cationic binder provides an electrostatic barrier for these anionic molecules. Thus, the colourant molecules do not reach the coating surface and discoloration is prevented.

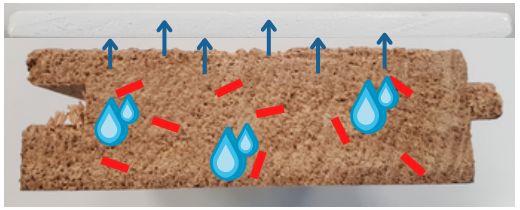
The mechanism of insulation described allows a visible insulating effect to be achieved as early as the application of the first coat, whereas aqueous anionic insulating coatings require at least two coats. The mechanism of action of alkyd resins/emulsions, for example, is good penetration and thus impregnation - the water of the second coating no longer reaches the tannins.



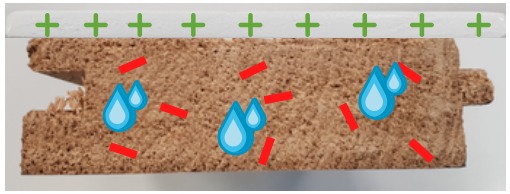
Wood contains water-soluble components



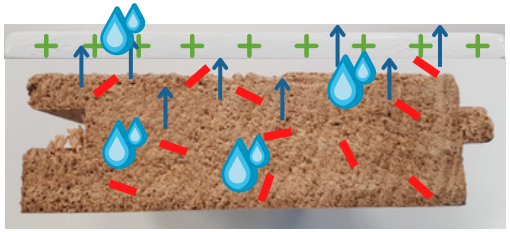
By applying a waterborne paint, water migrates into the wood



The evaporating water transports water-soluble ingredients to the surface - this leads to discolorations



The positively charged parts of the cationic layer form a barrier



This barrier retains the mostly negatively charged wood constituents

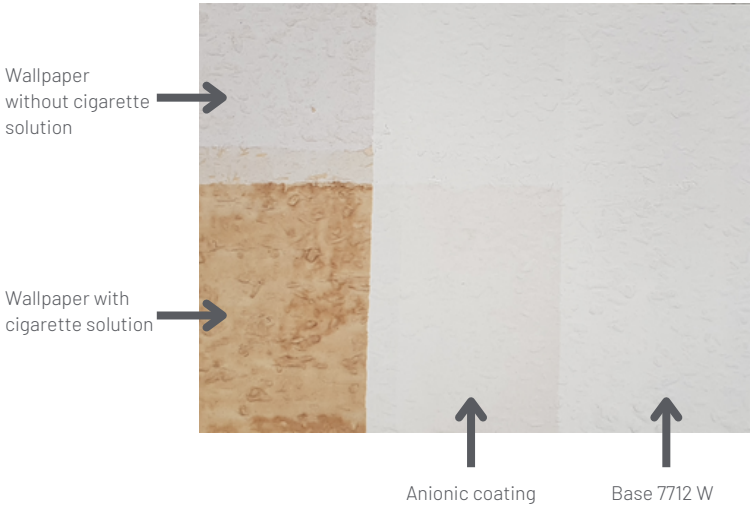
Cationic acrylate solutions

WorléeCryl 7712 W and WorléeCryl 8721

These two products are cationic acrylate solutions. The good water compatibility or hydrophilicity of the polymer is achieved by an increased amount of cationic groups. This also improves the insulating effect, because more cationic monomers also means that there is a denser electrostatic barrier. Unfortunately, the high hydrophilicity also results in poorer water resistance of the films. With this property profile, WorléeCryl 7712 W is very suitable for insulating primers on wood (see starting point formulation 4.9773-26).

WorléeCryl 8721 is suitable for the formulation of printing inks with good adhesion to plastics (e.g. polystyrene) and aluminum. Application in printing inks or overlays for soap boxes or household wipes is possible as well as application as a grinding binder for organic and inorganic pigments.

Both types are prepared in isopropanol and, after distillation, are transferred to water, leaving a small amount of isopropanol. They dry up clear very quickly and achieve a high hardness. Since they are dissolved polymers, the use of film-forming aids is not necessary. WorléeCryl 7712 W is superior to WorléeCryl 8721 in terms of water-resistance.



Starting point formulation 4.9773 - 26

Insulating primer

White, cationic, insulating

Pos.	Product	Delivery form	%	Function
1	**WorléeCryl 7712 W**	26% in water	24.10	Binder
2	Disperbyk 184		1.90	Dispersing agent
3	**WorléeAdd 6226**	100%	0.20	Defoamer
4	Water		1.10	Dilution
5	Minex 4		19.20	Filler
6	Kronos 2190		19.20	Pigment
7	**WorléeCryl 7712 W**	26% in water	33.70	Binder
8	**WorléeAdd 6226**	100%	0.10	Defoamer
9	Tafigel PUR 44		0.50	Thickening agent
	Total		**100.0**	

Technical data

Property		
Viscosity	Brookfield SP4 20 rpm, 20°C	approx. 3500 mPas
Non-volatile portion	1h 125°C	ca. 55%
Density	20°C	1.390 g/cm3
VOC content	calculated	approx. 12 g/l
Pendulum hardness according to König	after 2h 50°C	approx. 87 s
Gloss level	60° / 85°	approx. 12 / 44 GU

Cationic acrylic dispersions

WorléeCryl 7745 and WorléeCryl 7750

These two types are acrylate dispersions with a very low particle size of 60 - 70nm. Due to the lower content of cationic monomers, they are significantly more water-resistant compared to the cationic acrylate solutions. Full water-resistance is achieved after a few days, when neutralising agents and any film-forming aids used have evaporated.

Although the insulating effect of the dispersions is somewhat less pronounced than that of the solutions, it is nevertheless very good, so that the main field of application is insulating coatings.

The very good water-resistance allows for the use in outdoor applications (e.g. as in starting point formulation 4.9630-31). For this purpose, it is recommended to combine the two dispersions, as a desired hardness can be set with the very hard WorléeCryl 7745 and the very soft WorléeCryl 7750. When using WorléeCryl 7745 as a sole binder, the use of film-forming aids is required.

Some specks are product-specific and do not prevent the formulation of glossy coatings. The two dispersions do not require the addition of biocides.

Figure: Redwood (cationic coating on the left and anionic coating on the right)

Starting point formulation 4.9630 - 31

Top coat

White, insulating, cationic

Pos.	Product	Delivery form	%	Function
1	Water		5.30	
2	**WorléeDisperse VP 8405 W**	40% in water	1.90	Dispersing additive
3	Agitan 315		0.30	Defoamer
4	Kronos 2190		21.20	Pigment
5	**WorléeCryl 7750**	45% in water	45.20	Binder
6	**WorléeCryl 7745**	45% in water	22.60	Binder
7	Ethyldiglykol		1.00	Film forming aid
8	Water		1.00	
9	Byk 022		0.20	Defoamer
10	**WorléeAdd 3440**	100%	0.40	Substrate wetting
11	Tafigel PUR 44		0.50	Thickener
12	Tafigel PUR 85		0.40	Thickener
	Total		**100.0**	

Technical data

Property		
Viscosity	Brookfield SP4 20 rpm, 20°C	approx 3.770 m.Pas
pH value		approx. 5.2
Non-volatile portion	1h 125°C	approx. 54.0%
Density	20°C	1.247 g/cm3
VOC content	calculated	approx. 30 g/l
Pendulum hardness according to König	after 2h 50°C	approx. 24 s
Gloss level 20° / 60°	after 2 h 50°C	approx. 65 / 89 GU

Tips for raw material selection

When selecting raw materials, the cationic character of the binders must be taken into account. Since opposite charges attract each other, anionic raw materials cannot be used. In most cases, the combination with anionic raw materials leads to coagulation.

This mainly concerns cobinders and dispersing additives. When selecting the dispersing additive, non-ionic types should be used, for example, WorléeDisperse 8405 W.

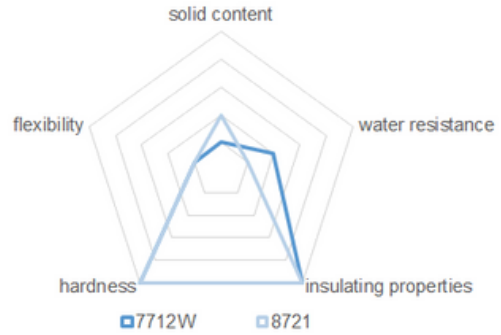
When using thickeners, the pH-dependence must be taken into account, so only thickeners that are effective in the acidic range should be used. These include many PU thickeners and, for example, cellulose derivatives.

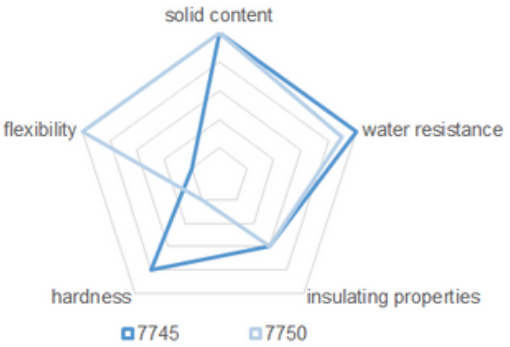
When selecting fillers and pigments, the formic acid used as a neutralising agent must be taken into account. Thus, carbonates, which react with acid and thereby split off carbon dioxide, should be avoided.

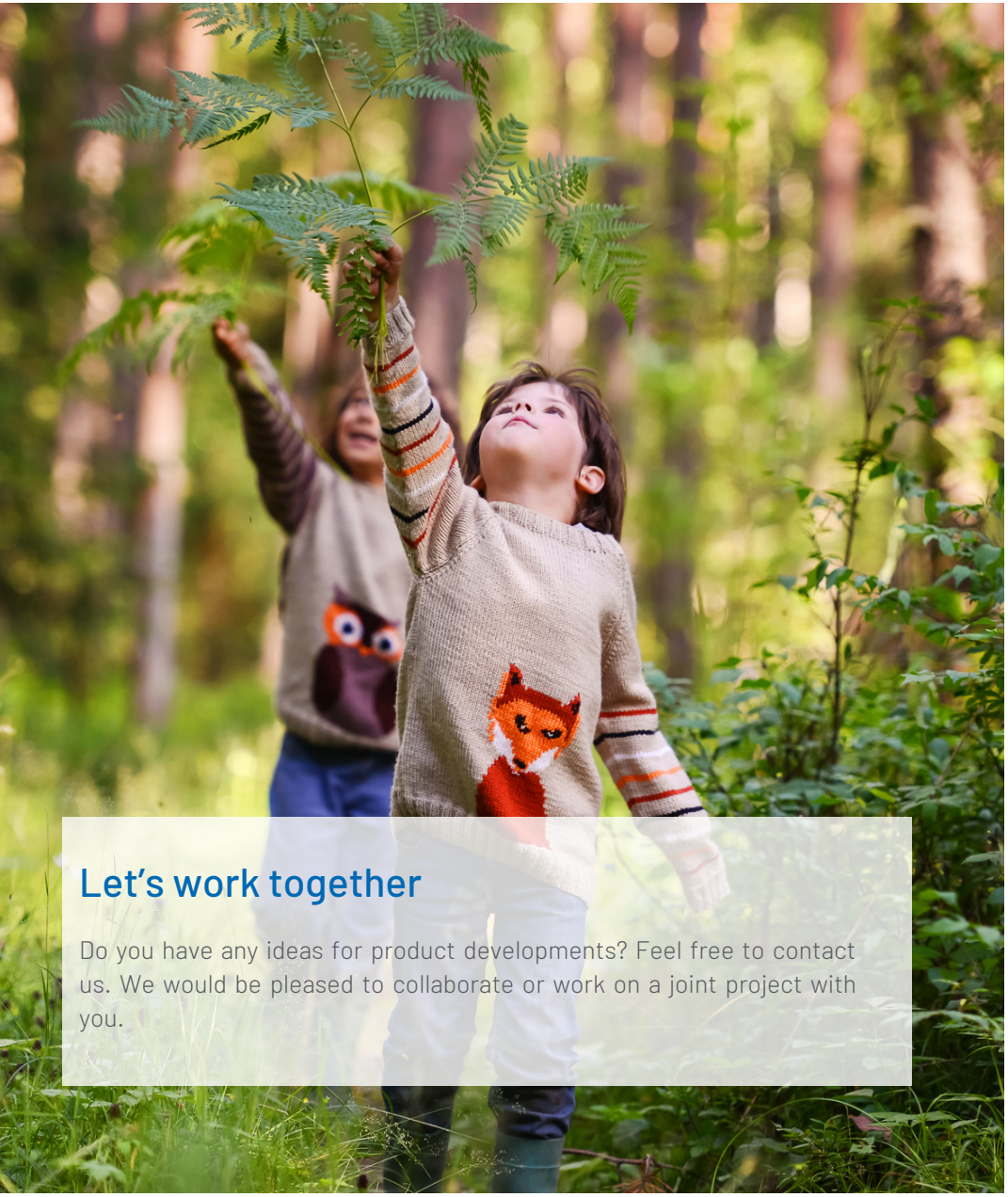
Due to the cationic character, there are no limits in the selection of defoamers.

Property overview of our cationic acrylic solutions and acrylic dispersions

	nvc [%]	pH	MFFT [°C]
WorléeCryl 7712 W	26	4.5 - 5.5	< 1
WorléeCryl 8721	30	5.2 - 5.8	< 1
WorléeCryl 7745	45	4.0 - 5.0	approx. 14
WorléeCryl 7750	45	4.0 - 5.0	< 1







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.

Waterborne systems
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