

New Polyurethane modified Alkyd Resins for Waterborne Paints and Varnishes.

Worlée Chemie GmbH produces already for more than 50 years an extensive range of alkyd resins for the printing, paint and coatings industry. Since 20 years it offers additionally a wide range of waterborne alkyd resins. This to enable its customers the possibility of offering products which comply with the latest worldwide, European and/or Southern Californian VOC regulations.

Already in the 80's, Worlée reacted responsibly towards the upcoming VOC regulations, resulting in an enhanced development of waterborne resins like acrylic dispersions and alkyd emulsions. Presently the company offers a full spectrum of environmentally friendly resins for the coatings industry.

With the new WorléeSol Emulsion Technology Worlée Chemie GmbH offers an interesting range of internally emulsified alkyd emulsions for low or no VOC paints.

Presently, the performance of water based coatings is still compared with the performance level of conventional solvent based alkyd paints and varnishes, which on certain points is excellent and therefore difficult to beat. But the WorléeSol E-types do get really close to this level of performance and offer additionally a low or no VOC level. Since acrylic dispersions also offer the possibility of achieving low VOC levels, they are included in the following comparison of different performances indicators.

- Application with a paint brush or a roller is with WorléeSol E as easy as with conventional solvent based alkyds.
- The open time of a WorléeSol E-type based paint is shorter than of conventional alkyd paint but longer than of acrylic dispersion paints.
- The throughdrying of a WorléeSol E-type is much faster than of solvent based paint.
- It is possible to get the same high gloss and flow with a WorléeSol E-type as with solvent based alkyd resins.
- Naturally, both a solvent based alkyd and an alkyd emulsion are based on an alkyd resin, and therefore both show dark yellowing. Absolute whiteness can only be achieved with an acrylic system.
- Adhesion and wood penetration of a WorléeSol E-type is as good as for solvent based alkyd resin.
- While the water resistance of WorléeSol E-type paints is comparable to that of conventional systems, the weather resistance shows a better performance
- Insulation against tannin our other water soluble stains is better with WorléeSol E-type products than with conventional systems or waterborne acrylics.
- Paints based on WorléeSol E-types offer good sandability and are resistant against plasticiser migration.
- The whole WorléeSol E-range can be used without addition of an anti-skinning agent like MEKO.

The chemistry (and chemical physics) of the afore mentioned products is significantly different.

Waterborne acrylic dispersions contain particles in the nanoscale range (20-200 nm) dispersed in water with a molecular weight of up to 200000. Whereas conventional alkyd resins are solventborne alkyd solutions with a molecular weight of around 4000. Within the waterborne alkyd range one can distinguish between alkyd solutions, externally and internally emulsified systems. The molecular weight of watersoluble alkyds is around 2500. External alkyd emulsions are alkyd droplets dispersed in water with a molecular weight of around 8000. Internally emulsified alkyd systems can have molecular weights of up to 100000.

For an alkyd solution first an alkyd resin is prepared by polycondensation of polyols, dicarboxylic acid components, oil (or fatty acids). Special modifications can take place as well. The final alkyd resin, with an acidvalue of around 35-45, is neutralised with amines (e.g. ammonia) and diluted with water. To achieve better water solubility often a co-solvent needs to be used.

For an externally emulsified alkyd system also an alkyd resin is prepared as described above. This hydrophobic resin is emulsified in water with the use surfactants which collect mainly at the interface between alkyd and water. Because of this interface distinct particles are formed which are usually distributed between 300 and 1100 nm. The hydrophilic part of the surfactants, normally contain ethyleneoxide units and /or neutralised acid functionalities (e.g. carboxylic acid, phosphates, sulphonates). The hydrophobic part may consist of fatty alcohols or other long chain (branched) alkanes (C12-C14). Since the surfactants usually have a negative influence on some of the properties this needs to be compensated for in the alkyd resin.

Internally emulsified alkyd resins (like the WorléeSol E-types) are prepared through a completely different process. Here a specially prepared hydrophilic alkyd resin is reacted, through solvent based polyurethane coupling chemistry, with a hydrophobic alkyd resin. This produces a higher molecular weight, pre-crosslinked system with an acid value of 20-30, which is partially water soluble. After removal of the solvent the remaining alkyd emulsion is opaque due to the absence of a distinct water-alkyd interface. Although particle sizes are thought to be in the order of 50-250 nm, they can not be measured accurately. It is this absence of a clear phase boundary or partial water solubility, together with the higher molecular weight due to pre-crosslinking that accounts for the favourable application properties.

The design of both the hydrophilic and hydrophobic alkyd component, together with the degree of polyurethane crosslinking, determines the properties of the various grades of WorléeSol E-types.

WorléeSol E 150 W offers the largest application field.

It has good drying properties, even under very unfavourable weather conditions (35-41°F), good brush application, high gloss and good gloss stability, little dark yellowing, fast hardness development, early water resistance, weather resistance and insulating properties.

It is used in primers, pre-coats, semi and high gloss paints, clear coats and stains.

WorléeSol E 530 W, with a higher polyurethane content, is mainly used for wood lacquers. It has a very fast hardness development, 3-7 layers can be coated in one day, and only low levels of driers are necessary.

WorléePur E 927 W with the highest polyurethane content, it is mainly used in clear coats and varnishes. It develops an extremely good hardness, also here 3-7 layers can be coated the same day and only low levels of driers are required. Furthermore a fast sanding is possible, and it can also be used in combination with acrylic dispersions.

By special modifications of the building blocks further products have been developed:

WorléeSol SE 420 W is a silicone modified version for architectural outdoor paints. It shows a very good water repellency and heat resistance.

WorléeSol E 330 W is a specially modified development with good affinity for metal. Because of the high salt spray resistance, it is especially thought of as anti corrosion primer, but also high gloss top coats can be formulated.

WorléeSol E 280 W is an unique alkyd emulsion with excellent yellow resistance and low odour. Due to the choice of fatty acids an addition of driers is not necessary.

The use of drier is not for every application necessary. After one week the grades with the higher polyurethane content reach about the same hardness level as without drier. If driers are used a low dosage is already efficient.

A further neutralisation of a formulation based on WorléeSol E-type resins is normally not necessary. The emulsions are shear stable so pigment grinding is usually possible. A higher gloss can be achieved by a low dosage of glycols or formulation with a watersoluble WorléeSol. The viscosity can be adjusted with PU thickeners and no anti-skinning agents are necessary.

The internally emulsified WorléeSol E-type resins enable the paint maker to formulate waterborne low VOC paints and lacquers. The special design of the building blocks, the different degrees of polyurethane pre-crosslinking and the absence of surfactant make different applications on a high performance level possible.

On the paint brush it feels like the good old conventional paint, but without solvent smell. Try it!

Lauenburg, 26.03.08
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