Alkoxylates

Promoting superior performance

Our range of versatile liquid polyols

- Promote superior end-product performance in radiation curing
- Enhance properties of polyurethane elastomers and foams
- Tailor ideal additives for a wide variety of applications
- Create new opportunities through product development

Perstorp

WINNING FORMULAS

The elements of success

You need a partner who can see the big picture when it comes to your products, your processes and your customers. Our experience and expertise in the special niches of organic chemistry, process technology and application development are at your service, providing you with a complete chain of solutions to enhance quality and profitability at every step.

Our versatile intermediates, an essential element of your winning formula, are specifically designed to add value and enhance end-product performance. Your solution to meeting the increasing demands for safer, lighter, more durable and environmentally friendly end-user products, begins here.

Innovation in everything we do

Innovation distinguishes every aspect of our business process. Developing smarter and safer solutions creates real value in new chemical applications. Focused innovation instills leadership and purpose in our business activities, improves internal processes and increases application and product competitiveness.

Delivering our promises globally

Our global presence provides you with reliable solutions and processes, consistent high quality, security of production and supply and delivery with precision. This commitment also means rapid response when product or application support is required and the very best in technical support.

Putting the care into chemicals

We take our responsibilities to heart and are committed to attentive, sustainable business practices. We minimize risks for our customers, our employees and the environment by working proactively to ensure safe products and processes.

Promoting superior performance

Radiation curing and polyurethane performance

Our polyether polyols, alkoxylates, comprise a range of liquid polyols containing primary and secondary hydroxyls derived from ethylene and propylene oxide respectively. Our alkoxylates are ideal for radiation curing diluents for printing inks and industrial coatings. Another main application is as cross-linkers in polyurethane foams and elastomers to promote superior end-product performance.

Ideal additives

In addition, our alkoxylates can be used in a wide number of other applications such as in polyol esters for synthetic lubricants and as PVC stabilizers. Derivatives can be made to allow their use as surface-active agents like defoamers. Polyol 3165 with a low OH number and high MW can be used when additives are needed for water compatibility, for example emulsifiers for rosin esters. Polyol 3990 is employed as a liquid trifunctional starter for polyether polyols, polyesters and polyurethanes with primary OH groups. Alkoxylates can also facilitate the surface modification of pigments where the surface characteristics can be altered and are useful in oilfield chemicals, in esters for metalworking and as various additives in paints and coatings.

Our new products in this area, including the hexafunctional Polyol R6405, continue to develop the spectrum of applications where alkoxylates can enhance product performance.

We welcome your questions. More detailed information and specifications of each product are available on www.perstorp.com or through your Perstorp sales representative.

Enhancing radiation curing

Our unique range of alkoxylated polyols with different hydroxyl functionalities is ideal for radiation curing products. Their use in industrial coatings for wood and plastics, in printing inks and varnishes for graphic arts, and in electronics and adhesives applications promotes superior end-product performance. The improvement of the health and safety profile of acrylate monomers for radiation curing is a major achievement over the past two decades. Our alkoxylates are developed to address this issue and are specially designed to comply with current requirements such as very low levels of critical impurities. The qualification of the diluents as non-irritants has increased use of this technology in coating, ink, adhesive and electronic markets.

Compared to traditional solvent borne coating technologies, radiation curing offers several advantages such as environmentally friendly solvent-free systems, high productivity and excellent coating, ink and adhesive performance. Radiation curing also reduces investment and energy costs, takes less production space and you benefit from the good availability of raw materials for various application fields.

Essential to coating properties

Alkoxylated polyols serve as key precursors to acrylate monomers used as reactive diluents and are usually the main part of formulations. Diluents for radiation curing reduce the viscosity of the formulated system in order to obtain the desired processing conditions and are essential for obtaining the required properties of the end product. Coating properties like wetting, adhesion, toughness and resistance to abrasion and chemicals can all be influenced by the diluent so the choice of alkoxylate is critical as it strongly influences all of these properties.

Unique oligomers

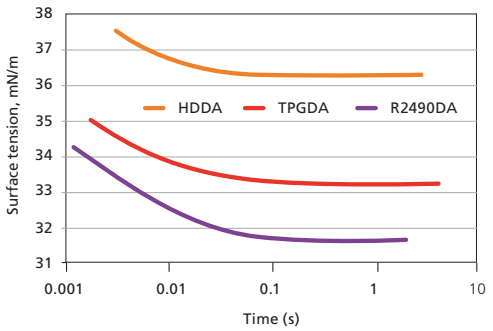
In addition to the use of these alkoxylates in reactive diluents, they can also be used to develop unique polyester, urethane and aminoacrylate oligomers. Thanks to our large product portfolio, an almost infinite derivatization of oligomers can be made, suitable for any end application and performance. Moreover, Perstorp has extensive expertise in the field of radiation curing and in assisting our customers in getting the most out of our product range.

Stronger, safer
& better elements

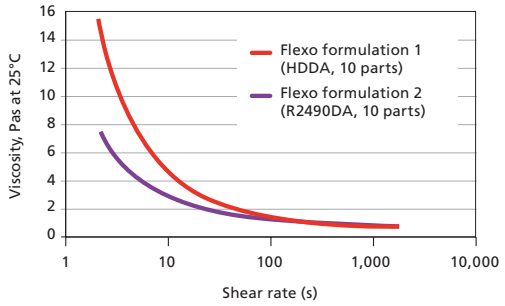
Difunctional polyols – safety & performance

We now offer Polyol R2490 as an alternative to typical difunctional polyols hexane diol (HD) and tripropylene glycol commonly used as starters for acrylate diluents. The acrylate of R2490 is a difunctional monomer that provides a number of advantages over hexane diol-based acrylates. As a non-irritant product it allows Xi-free labeling of formulations and is much less air inhibiting during free radical polymerization thanks to abstractable alpha-hydrogens.

The lower surface tension of Polyol R2490 diacrylate better facilitates the pigment wetting required for ink stability. Its improved flow also results in better ink transfer during printing, enhancing print quality. Low shrinkage, good flexibility and excellent adhesion to difficult substrates make this product the reactive thinner of choice for high-speed processes involving UV flexographic inks for labeling and packaging. An additional difunctional polyol now available for wider application, R2395, is based on the versatile diol Butyl Ethyl Propanediol (BEPD) and is intended partly as an alternative to hexane diol ethoxylates and propoxylates.



Much lower surface tension for better wetting of low surface energy substrates and pigments with R2490DA vs. hexane diol diacrylate (HDDA) and tripropylene glycol acrylate (TPGDA)

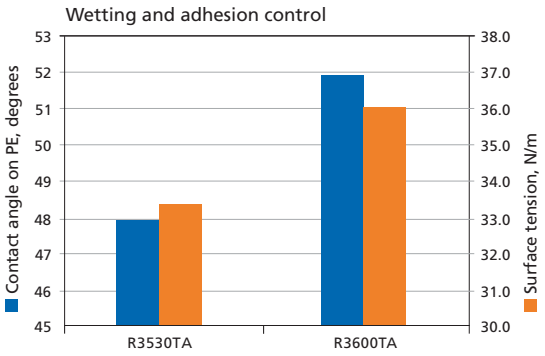


Lower viscosity at lower shear rate for improved flexo ink transfer and flow with R2490DA vs. HDDA

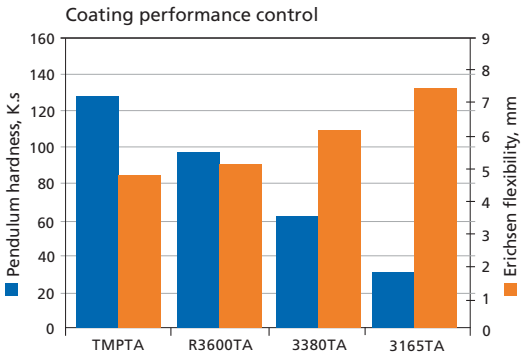
Precisely tailored end-product properties

Trifunctional polyols – optimal performance

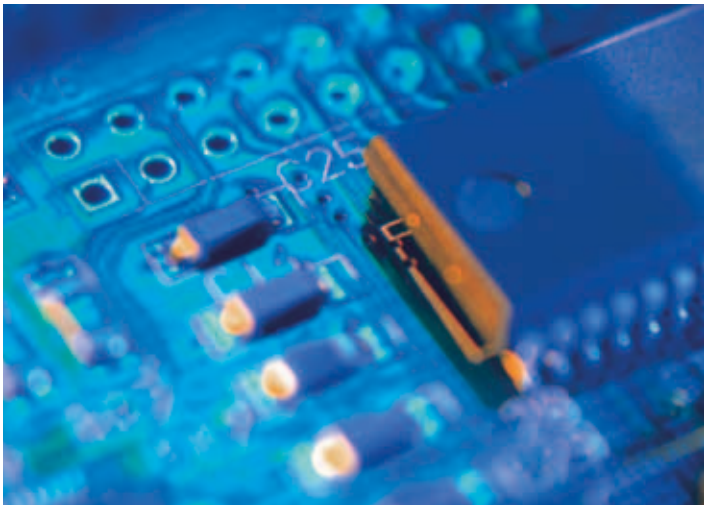
Our wide range of trifunctional polyols, alkoxylates of Trimethylolpropane (TMP), are tailored to meet your demands for surface tension, reactivity, solubility and mechanical properties of the acrylate monomer. The diluents are non-irritating to the skin and eyes. Polyol R3600 is a common multipurpose polyol that exhibits good reactivity, hardness and flexibility, solvency of the majority of acrylate oligomers and high chemical resistance. Both Polyol 3380, a more flexible polyol lowering shrinkage, and Polyol R3530, which lowers surface tension, create opportunities for demanding coating, ink and adhesives manufacturers to achieve specific performance benefits including improved wetting and adhesion to difficult substrates. Acrylates of our trifunctional polyols, Polyol R3215 or 3165, are partially soluble in water or compatible with waterborne coatings, making them suitable as cross-linkers for waterborne UV coatings.



The surface tension and contact angle on PE of the acrylates of trifunctional polyols R3530 and R3600



The hardness and flexibility of the acrylates of trifunctional polyols TMP, R3600, 3380 and 3165



Optimized performance and efficiency

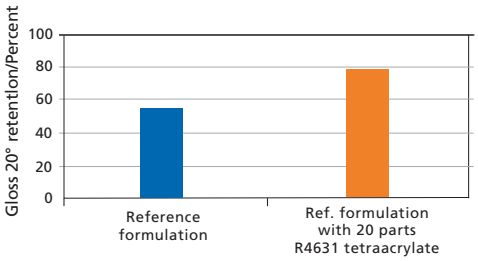
Tetrafunctional polyols – optimal curing speed

The reactive diluent obtained through acrylation of tetrafunctional Polyol R4631 is a non-irritant but with higher viscosity than difunctional or trifunctional acrylate. Nevertheless, it is very effective in increasing curing speed, chemical resistance, and abrasion resistance while decreasing the amount of unreacted monomer.

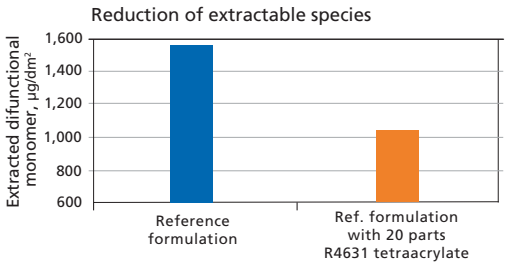
Polyol R4631 acrylate is the product of choice for:

- Wood coatings where abrasion resistance is required
- Furniture coatings where low extractable level in the cured coatings is demanded
- Flexographic inks where high-speed printing is needed

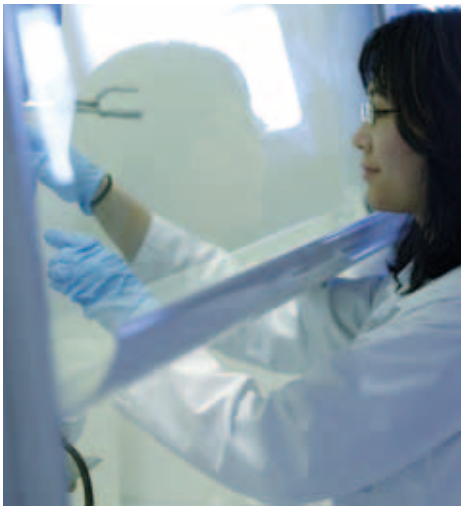
A more flexible acrylate, obtained using Polyol 4290, still maintains excellent surface cure rates. Our commitment to supporting the development of radiation curing technology for entering new markets has lead us to develop special grades of multifunctional polyols for radiation curing, such as R4630, that satisfy requirements for very low impurities in applications such as food packaging.



Gloss 20° retention after 200 scrub scotch-brite test showing improved scratch resistance with the acrylates of polyol R4631



Decreased unreacted difunctional acrylates in the UV-cured coatings



Fine-tuning with polyols

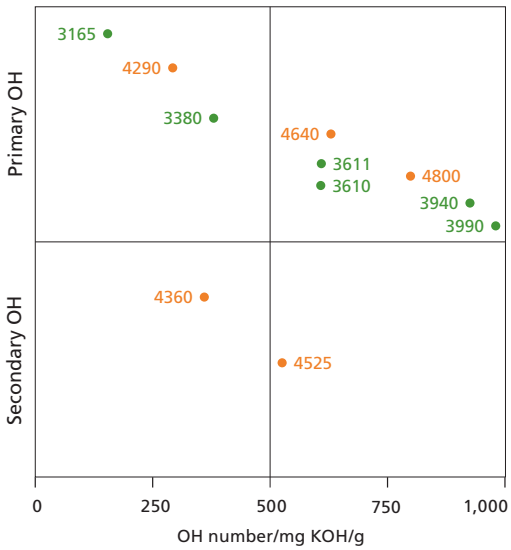
Enhancing polyurethane elastomers & foams

Polyol 3990 – liquid TMP for ease of handling

To facilitate the handling of TMP by our customers and improve the hardness/flexibility of elastomers, we have developed a TMP grade with a low degree of alkoxylation – Polyol 3390, a liquid product with primary alcohol groups that eliminates the need for heating.

Polyol 3610 & Polyol 4800 – tailored toughness

Polyol 3610 and 4800 are two grades suitable for elastomers that provide ways of controlling the cross-link density and maintaining the resilience and toughness of polyurethanes. Polyol 3610 can also be used to increase hardness in flexible foam.



Perstorp alkoxylates for use in polyurethanes plotted as primary and secondary OH vs. OH numbers

Formulation	Shore D	Ball rebound, %
BDO/TMP 4/0.3	50	50
BDO/TMP 3/1.3	53	49
Polyol 3990	58	45
Polyol 3610	56	49
Polyol 3380	56	54
Polyol 3165	53	61
Polyol 4800	60	45
Polyol 4640	57	44
Polyol 4360	57	49

Developing product potential

New opportunities

Polyol R6405 – improving stability

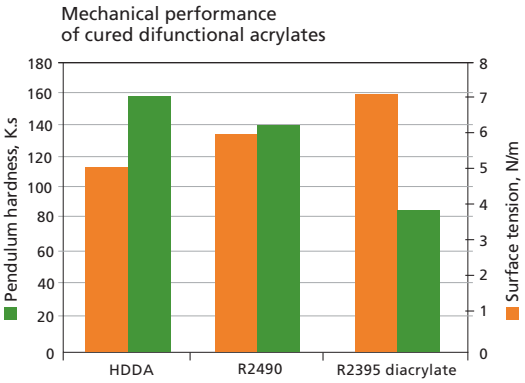
Our 6-functional alkoxylates are now available and provide high thermal and chemical stability unlike sugar-based polyols. Polyol R6405, which meets the EU polymer definition, is a chemical building block and is used to make acrylic esters and cross-linkers.

Polyol R2395 – developing application potential

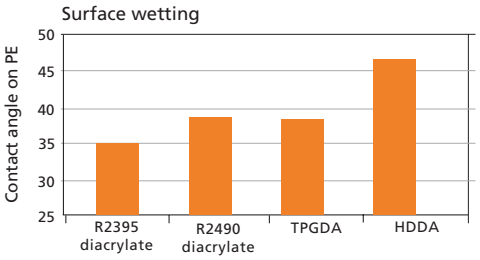
This new product enables the production of esters with better hydrolytic stability and lower surface tension. R2395 acrylate is a highly flexible difunctional monomer rated as the superior difunctional monomer in terms of wetting low surface tension substrates. Moreover, a wider application potential exists with flexible materials, including very particular types of substrates and conditions of evaluation. Mapping the product versus TPGDA and HDDA provides advantages for the customer compared with these commonly used alternatives.

Polyol R4630 – the first of a new generation

We focus on developing products that contain low amounts of undesired glycols. Polyol R4630 is the first of a new generation of alkoxylates and is designed to support the penetration of radiation curing coatings and printing inks in applications where residual low molecular weight acrylates is a key issue. Low impurity levels enable use of UV acrylates in applications where the lowest skin irritation and low migration are of highest importance. R4630 has an even lower level of impurity than our original R4631 and further improvement is the focus of our product development.



Highest flexibility with R2395DA compared to alternative difunctional monomers



Best wetting of non-polar surface as 100% on corona treated PE with R2395DA compared to any other difunctional monomers – higher non-polar dispersing surface energy

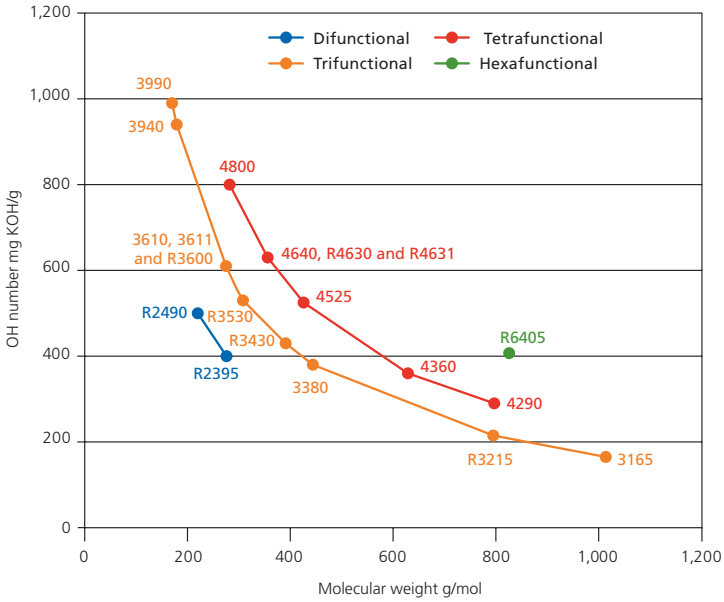
	R4631	R4630
Free polyol	0.2	<0.1
Sum EGs	<0.2	<0.1
Sum PGs	1.5–2.5	<0.1
Other low Mw impurities	3	<0.1

Alkoxylate portfolio product names

Our alkoxylated polyols cover a functionality of 2, 3, 4 and 6, and with OH values of 150–1000 mg KOH/g suitable for specific application demands. They are logically named to help you quickly identify and select those of interest. Each name consists of Polyol XY, where X = functionality and Y = OH value.

For example, Polyol 4640 is a tetrafunctional alkoxylated polyol with an OH value of 640. This product is used widely as a cross-linker in polyurethane formulations. Many of these products have a low water and/or ash content making them especially suitable for polyurethanes.

Perstorp has developed alkoxylated products specifically for use in radiation curing indicated in the product name with an R. These products have very low amounts of free glycols and unreacted starting polyol. They also cover a broad scope of functionality, hardness/flexibility and hydrophobicity/ hydrophilicity.



Perstorp alkoxylates plotted as molecular weight vs. OH numbers

Product data summary

Name	Functionality	Hydroxyl number (mg KOH/g)	Molecular weight (g/mol)	Viscosity (mPas, 23 °C)	Recommended applications		
					General	Radcure	Polyurethane
Polyol R2490	2	490	220	170		•	•
Polyol 3165	3	165	1,014	350	•		•
Polyol 3380	3	380	444	360	•		•
Polyol 3610	3	610	275	700			•
Polyol 3611	3	611	275	700			•
Polyol 3940	3	940	179	4,000			•
Polyol 3990	3	990	170	4,500	•		•
Polyol R3215	3	215	795	340	•	•	
Polyol R3430	3	430	398	400		•	
Polyol R3530	3	530	308	2,000	•	•	•
Polyol R3600	3	600	275	700		•	
Polyol 4290	4	290	797	450	•		
Polyol 4360	4	360	629	1,300			•
Polyol 4525	4	525	426	2,600			•
Polyol 4640	4	640	355	1,100			•
Polyol 4800	4	800	282	2,200			•
Polyol R4630	4	630	350	1,500		•	
Polyol R4631	4	631	356	1,500		•	
Polyol R6405	6	405	827	1,900	•	•	•



Your winning formula

The Perstorp Group, a trusted world leader in specialty chemicals, places focused innovation at your fingertips. Our culture of performance builds on over 125 years of experience and represents a complete chain of solutions in organic chemistry, process technology and application development.

Matched to your business needs, our versatile intermediates enhance the quality, performance and profitability of your products and processes. Present in the aerospace, marine, coatings, chemicals, plastics, engineering and construction industries, they can also be found in automotive, agricultural, food, packaging, textile, paper and electronics applications.

Our chemistry is backed by reliable business practices and a global commitment to responsiveness and flexibility. Capacity and delivery security are ensured through strategic production plants in Asia, Europe and North America, as well as sales offices in all major markets. Likewise, we combine product and application assistance with the very best in technical support.

As we look to the future, we strive for the development of safer products and sustainable processes that reduce environmental impact. This principle of innovation and responsibility applies not only to our own business, but also to our work with yours. In fulfilling it, we partner with you to create a winning formula that benefits your business – as well as the people it serves.

Discover your winning formula at www.perstorp.com

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