



Voxtar™

Pure advantage

Voxtar™ renewable pentaerythritol platform

- Cuts carbon footprint by up to 75% with renewable raw materials and energy
- Differentiates your offer and adds value throughout the value chain
- Meets the growing demand for renewable alternatives
- Ensures the same efficiency, security and performance as our trusted Penta and Di-Penta

The pure advantage of higher value & lower impact

The world's first & only renewable pentaerythritol platform

As a leading global supplier of pentaerythritol and its derivatives and in our commitment to developing solutions that combine high performance and low environmental impact, we are proud to present Voxtar™ – our newest product line and the world's first pentaerythritol platform based on renewable raw materials and energy.

Voxtar™ renewability is independently certified and shrinks carbon footprint by up to 75% compared to conventional Penta and Di-Penta, all while providing the same trusted efficiency, security and high performance. With Voxtar™ we have just made it ingeniously simple to cut your environmental impact, differentiate your offer, sharpen your competitive edge, and demonstrate your commitment to your customers' success – both in today's competitive business environment and in helping them meet the challenges of tomorrow.

Further maximizing your value, Voxtar™ products help you capitalize on the growing demand for renewable alternatives in a number of applications. It enhances performance and minimizes environmental impact in a wide range of end products including high performance alkyd paints and coatings, synthetic lubricants, cosmetic emollients, adhesives and printing inks.

What's more, Voxtar™ shares all these advantages, adding value all the way through the value chain to the end user. It all adds up to a winning formula for pure advantage.

Our Voxtar™ range:

Voxtar™ M100, Bio-based Penta Mono, from fully renewable sources

Voxtar™ M50, Bio-based Penta Mono, from partially renewable sources


Voxtar™ T100, Bio-based Penta Tech, from fully renewable sources

Voxtar™ T50, Bio-based Penta Tech, from partially renewable sources

Voxtar™ D100, Bio-based Di-Penta, from fully renewable sources

Voxtar™ D50, Bio-based Di-Penta, from partially renewable sources





“Voxtar™ makes it ingeniously simple to minimize environmental impact, differentiate your offer, sharpen your competitive edge, and demonstrate your commitment to your customers’ success.”

SUSTAINABLE DEVELOPMENT

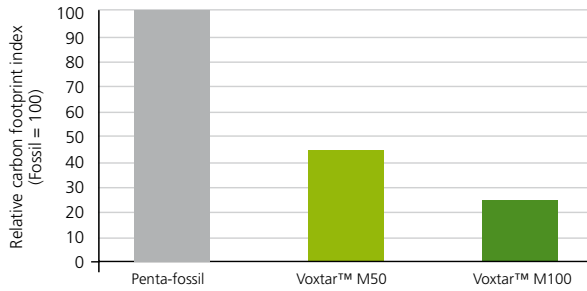
Seeing the bigger picture & acting on it

We believe in improving everyday life – making it safer, more convenient, more fun, and more environmentally sound for millions of people all over the world. And we achieve this through innovative chemistry. It is how we provide you with solutions that maximize performance and minimize environmental impact all at once, enabling you to create greater value for your business, your customers, their customers, and all the way through to end users. Here are some of the things we are doing to ensure it:

- ▶ A major part of our R&D work is focused on developing more efficient and environmentally sound products and processes, enabling cuts in environmental impact.
- ▶ We are in the process of systematically mapping the carbon footprints and lifecycle impact of our main products. Voxtar™ is just the first of about 15 products that we will provide complete carbon footprint information on by 2011.
- ▶ Renewable energy has been powering parts of our production since 1991. In 2008, for example, 58% of the fuel for steam production at our Perstorp, Sweden site, came from renewable sources.
- ▶ Our production sites in Sweden supplied a combined 169 GWh of energy back into the district heating grid in their respective municipalities in 2008.
- ▶ We actively search for sustainable alternatives to conventional technology.
- ▶ Many of our products replace or reduce the use of harmful substances, such as bromide in flame retardants, and lead in PVC products, and solvents in many applications. With Voxtar™ we take another step closer to our vision of sustainable solutions.

Minimizing impact, maximizing value every step of the way

Effect on carbon footprint (cradle to grave) when comparing Voxtar™ M100 & M50 with fossil-based pentaerythritol



Relative cradle to grave carbon footprint comparison between Voxtar™ M100, M50 and fossil-based Penta

$$CO_{2e} \text{ (cradle to grave)}^* = CO_{2e} \text{ (cradle to gate)} + \frac{CO_{2c} \times n_{\text{fossil}}}{n_{\text{tot}}}$$

Where:

- CO_{2e} = Carbon dioxide equivalent of a product, expressed in kg/kg
- CO_{2c} = Carbon dioxide released at full combustion
- n_{fossil} = Number of fossil carbons in molecule
- n_{tot} = Total number of carbons in molecule

*Transports and down-stream processing excluded from the cradle to grave estimate

Reduce carbon footprint by up to 75%

A carbon footprint is a declaration of a product's impact on climate change, calculated in terms of the greenhouse gases produced throughout its lifecycle. Carbon footprints are key environmental indicators to understand both how you impact climate change and how to reduce that impact. While our Penta is a product with a reasonable environmental profile compared to many chemicals, we have now improved it even further. One of the most effective ways to shrink the carbon footprint of a product is to replace fossil-based raw materials and energy with renewable alternatives. This is precisely how Voxtar™ cuts carbon footprint so significantly, by up to 75% compared to conventional Penta.

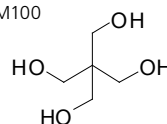
We are strongly committed to providing sustainable solutions that limit environmental impact and climate change. And with Voxtar™ we help enable a greener future. Further, carbon footprint declarations are quickly becoming a 'license to operate' in some markets. And proven reductions in carbon footprint can give you a clear advantage over competitors, let you sell your products at a premium, potentially save you money on carbon emission credits and even allow you sell surplus emission credits for a profit.

Renewable raw materials & energy inside

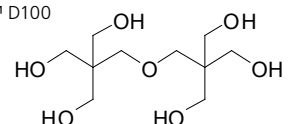
The raw materials we use to produce our Voxtar™ products are based fully or partially on renewable resources, depending on the grade. Naturally, our suppliers are certified according ISO 14040 and ISO 14020 environmental standards.

All grades are produced with the renewable energy that has been powering parts of our production since 1991 at our Perstorp, Sweden site.

Voxtar™ M100



Voxtar™ D100





Green credibility

Cradle to gate & an example of cradle to grave with Voxtar™

Today, we know that the cradle to gate carbon footprint of Voxtar™ is significantly smaller than that of fossil-based pentaerythritol. That covers upstream lifecycle, from extraction of natural resources and raw material production, down to all the energy production and transportation required until the final Voxtar™ product leaves our gate. The Voxtar™ carbon footprint is well documented according to international standards and certified by a third party. And the underlying Life Cycle Assessment (LCA) has been prepared according to the ISO standard for environmental product declarations.

We care about minimizing the environmental impact of our products and their environmental impact in downstream usage. We look forward to supporting you to reduce your carbon footprint.

Independently certified renewability

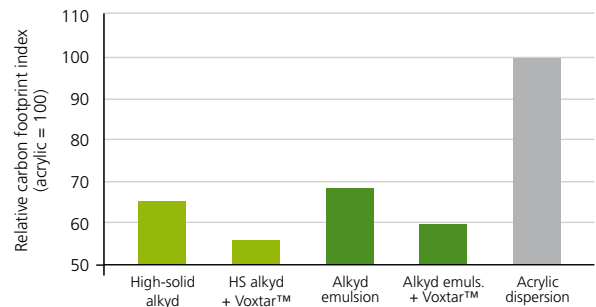
Our certification process will guarantee the renewability and full traceability of all Voxtar™ products. We understand that independent certification is vital to meeting your demands and the growing demands of your customers and the entire value chain for credible, traceable, renewable alternatives.

Voxtar™ segments in focus

The new benchmark in environmentally sound, high performance paints

The main application area of the Voxtar™ M series, like Penta, is as a branching monomer for alkyd resins used in paints, typically for architectural and joinery applications. With Voxtar™ technology, the renewable content of an alkyd resin can be even greater. Furthermore, waterborne alkyds based on Voxtar™ M100 or Voxtar™ M50 offer truly environmentally friendly paint, combining low VOC with exceptional renewable content. High-solid alkyds and alkyd emulsion paints based on Voxtar™ secure superior environmental performance with an even greater reduction in carbon footprint compared to traditional petroleum-based latex paints.

Relative carbon footprint comparison between high-solid alkyds & alkyd emulsion paints vs. acrylic dispersion paints



Carbon footprint comparison of high-solid alkyds- and alkyd emulsion paints compared to acrylic dispersion paints¹⁾ plus Voxtar™ effect estimates

¹⁾ Data based on Surface Coatings International, 1998, 10, 491-494



In line with our vision for sustainable solutions, we work hard at reducing environmental impact for coatings without compromising on performance. As complement to our Voxtar™ range, we have developed specialty resin additives that can help partially or fully replace solvent with water in alkyd resins. Visit www.perstorp.com for more information on these solutions.



Voxtar™ D100, our renewable Di-Penta, is a hexafunctional compound with primary hydroxyl groups. The high hydroxyl density and compact structure provide outstanding properties. This enables the production of high-solid alkyd paints with excellent balance between drying speed, viscosity, water resistance, and now even better environmental performance as well. Further, combined with water, a renewable Voxtar™-based resin is clearly unparalleled in terms of environmental performance.

Enhancing synthetic lubricants, cosmetic emollients & more

Voxtar™ products bring unique advantages to the production of fatty acid esters for synthetic lubricants and cosmetic emollients. They now enable the formulation of renewable synthetic lubricants for CFC-free cold storage and refrigerators, as well as for jet engines – all applications with a high focus on reducing environmental impact.

In the personal care segment, cosmetic formulators are now systematically working to replace all fossil-based ingredients with renewable alternatives, to meet the rapidly growing demands of consumers. That puts pressure on ingredient suppliers to find renewable raw materials for producing renewable ingredients. Cosmetic emollients specifically, typically make up 5 to 15% of an end product and Voxtar™ now enables ingredient suppliers to make high-performing emollients fully based on renewable materials.

Voxtar™ further enhances end-product performance and reduces environmental impact in a wide range of applications such as rosin esters for printing inks and adhesives used for food packaging and hygienic applications.

Product data summary

Voxtar™ M-series							
Product	Appearance	Reactive group	Renewable content ¹⁾	Molecular weight (g/mol)	Hydroxyl number (mg KOH/g)	Melting point (°C)	Carbon footprint ²⁾ (cradle to grave) CO _{2e} (kg/kg)
Voxtar™ M100	Crystals	4 hydroxyl	100*	136.4	1,645	260	1.2
Voxtar™ M50	Crystals	4 hydroxyl	40**	136.4	1,645	260	2.1
Voxtar™ T-series							
Voxtar™ T100	Crystals	4 hydroxyl	100*	142.5	1,615	248	1.2
Voxtar™ T50	Crystals	4 hydroxyl	40**	142.5	1,615	248	2.1
Voxtar™ D-series							
Voxtar™ D100	Crystals	6 hydroxyl	100*	254.1	1,325	222	1.2
Voxtar™ D50	Crystals	6 hydroxyl	40**	254.1	1,325	222	2.1

¹⁾ For information only, not included in carbon footprint certification

* Allocated through mass balance and purchased certificates

** C₁₄-method (ASTM D6866)

²⁾ ISO 14,040, ISO 14,044 & ISO 14,067. Cradle to gate values in sales spec. upon purchase. Cradle to grave estimates acc. to equation on p. 4



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 130 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. This is how we enable you to meet market demands for safer, lighter, more durable and environmentally sound end-products – for the aerospace, marine, coatings, chemicals, plastics, engineering, and construction industries, as well as 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. Consistent high quality, 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 smarter and safer products and sustainable processes that reduce environmental impact and create real value in new chemical applications. This principle of proactive 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