

PLASTIC ADDITIVES
PLASTICIZERS



At a glance:

The products and their applications

	Products	PVC	Acrylate	Polyurethane	Polysulfid	Nitrocellulosde	Cellulose acetate	Epoxy resins	Chlorinated rubber	NBR	EVA	Peroxides	Aqueous systems
Adimoll®	DM Dimethyl adipate	●						●					
	DB Dibutyl adipate	●					●						
	DO Di-2-ethylhexyl adipate	●	●			●			●	●			
	DN Di-iso-nonyl adipate	●	●										
	BO Benzyl-2-ethylhexyl adipate	●		●					●	●			
Mesamoll®	Alkyl sulfonic ester of phenol	●	●	●						●			
	II Alkyl sulfonic ester of phenol	●	●	●						●			
Unimoll®	BB Benzyl butyl phthalate	●	●	●	●	●		●		●		●	
	66/66M Dicyclohexyl phthalate	●	●				●				●	●	
Ultramoll®	I Polyadipate	●	●	●						●			
	III Polyadipate	●	●	●						●			
	IV Polyadipate	●	●	●						●			
	VP SP 51020 NV Polyadipate	●	●	●						●			
	M/M NV Polyadipate		●	●									
	PP II Polyphthalate	●							●	●			
	TGN Polyphthalate									●			
	Triacetin Glyceryl triacetate		●			●	●						●
	Acetine TP BCH 51023 Acetylated glyceride	●	●			●	●						



The unique advantage:

Expertise of a strong partner

With decades of experience and customers spread across the globe, LANXESS is already one of the world's major chemical manufacturers. LANXESS was formed in 2004 through the carve-out of major portions of the chemical activities of the Bayer Group and parts of its polymer operations, which means it has many years of experience to look back on, with roots going all the way back to the founding of Bayer in 1863. This is the basis on which LANXESS now develops, produces and markets a portfolio consisting of basic and fine chemicals, color pigments, plastics, fibers, special-purpose rubbers, rubber chemicals, material protection and water treatment products and chemicals for the production of leather, textiles and paper. In so doing, LANXESS provides reliable solutions worldwide for a wide range of different applications.

LANXESS has the experience and sound market knowledge of an established global player, combined with the commitment of a new, young enterprise. This is a combination that makes LANXESS strong and active. We are ready to break new ground, when and wherever our customers ask us to go.

You want the very best - so do we. Together we can build on this common ground, because LANXESS offers you the best conditions for a continued and successful partnership. Our claim is to provide our partners with all-important stimulus through innovative concepts and a customer-focused and solution-oriented approach that allows you to develop unique products.

In the area of plastic additives this involves, above all, a consistent strategy to meet the market's commercial, technical and chemical demands, alongside a wide range of products. LANXESS taps extensive expertise and application-related experience for the development of modifiers, plasticizers, bonding agents and blowing agents, and as a customer you benefit from this. From the development of formulations and

individual customization to meet specific product requirements through to process optimization, knowledge from each individual area of application is used consistently to enable optimization in all related areas. In addition, LANXESS has a network of research and testing departments that ensures worldwide proximity to customers and an ability to respond quickly.

And last but not least, in all our activities, we focus on one thing, namely maintaining the ecological equilibrium by taking special safety measures and remaining aware of our responsibilities in the future. After all, LANXESS's solutions involve much more than just supplying raw materials. They are always the end product of well thought out, forward-looking development, adapted to meet your requirements.

Whenever plastics need to have high elasticity and flexibility, plasticizers provide the answer. But this is not their only benefit. They also optimize, for example, the processing properties of polymer materials, which leads to improved product quality or even new properties.

The choice of plasticizer depends on the demands placed on the finished product. These can include greater softness, elasticity, flame-retardant properties or resistance to chemicals, weathering and migration. The LANXESS plasticizer family covers a large number of different products meeting these varied requirements.

LANXESS offers a comprehensive family of special-purpose plasticizers for all sorts of applications.

Plastics are used in:

- Polyvinyl chloride
- Rubber
- Phenolic resins
- Polyurethane elastomers, foams, color batches and as cleaners for polyurethane machinery
- Thermoplastics
- Films, adhesives and sealants, peroxides

Monomeric plasticizers

Trade name	Chemical composition
Adimoll®	Adipic acid esters
Disflamoll®	Phosphoric acid esters
Mesamoll®	Alkyl sulfonic esters of phenol
Unimoll®	Phthalic acid esters
Triacetin	Acetic acid esters

Plasticizers are substances, mainly esters, which are added to a polymer in order to improve its flexibility and extendability. The addition of a plasticizer lowers melt viscosity, glass transition temperature and modulus of elasticity.

Several million metric tons of plasticizer are used worldwide each year, with most comprising phthalic esters. A sixth of this volume is made up of special-purpose plasticizers, many of which carry the LANXESS logo. These products always offer more than the basic requirements that a plasticizer is expected to meet, often providing the following additional features and benefits:

- High saponification resistance
- Improved weathering resistance
- Low flammability
- Low migration
- Improve cold flex temperature of a PVC-Compound

Polymeric plasticizers

Trade name	Chemical composition
Ultramoll®	Adipic acid polyesters
Ultramoll®/ Plasticizer CEL	Phthalic acid polyesters

Plasticizers allow the manufacture of a broad spectrum of different materials. At the same time, they create the conditions required for the application of a large number of mild and energy-saving processing methods.



Foodstuffs packaging film

Ensuring your product is ready to meet the most demanding challenges:

Plasticizers from LANXESS





Tailor-made compounds:

Plasticizers for PVC

Extruder

With plasticized PVC it is possible to produce compounds which are specially tailored to meet individual demands. The pie chart to the right summarizes the fields of application.

A variety of different processing methods can be applied: **extrusion, calendaring, compression molding and injection molding.**

Below is an explanation of these important melt-processing methods. These initially involve the application of heat and pressure to produce a melt, which is then molded and fixed through cooling.

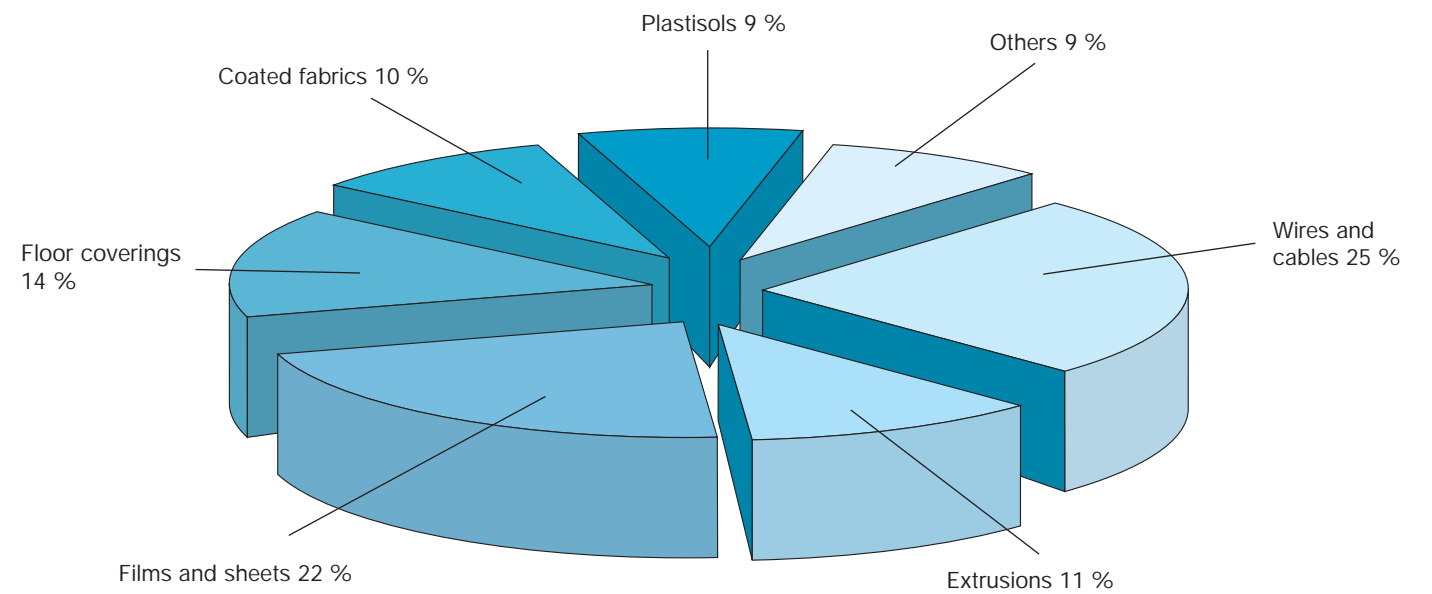
Extrusion:
Production of continuous lengths of plastic from plastic powder or granules using an extruder.

Calendering:
Formation of continuous thermoplastic sheeting by passing the material between two or more rollers.

Compression molding:
Filling of a pelletized, pre-heated or pre-plasticized molding compound into an open mold, which is then closed. Pressure and heat cause the material to completely fill the mold cavity.

Injection molding:
Injection of a molding compound pre-plasticized in an injection cylinder into a closed mold followed by cooling.

Plasticizer consumption in Western Europe according to field application



Source: ECPI (European Council for Plasticizers and Intermediates, 2001)

In thermoplastics processing, PVC pastes, also known as plastisols, are of particular interest. Molding here does not take place in the thermoplastic state but in the liquid phase, which is formed through the addition of a plasticizer. Solidification, known as gelling, does not occur until after molding when heat, but not pressure, is applied. The processing behavior of pastes depends primarily on their flow properties. These are determined by both the PVC grade and the plasticizers used.



The most important methods of shaping, i.e. the processing of pastes, are as follows:

Spread coating:

Continuous application of pastes to a substrate; the application thickness is regulated by adjusting the height of the knife above the contact surface (steel roller, rubber blanket etc.).

Milling:

Continuous feeding of pastes through rotating or counter-rotating rolls, e.g. reverse roll coaters.

Printing:

Continuous application of pastes with printing equipment, in particular by rotary screen printing.

Dip coating:

Dipping of a pre-heated object into a paste which gels when drawn out slowly and fuses into molded parts or coatings through further thermal treatment.

Casting:

Filling of a mold with paste which forms a gel when the mold is heated. The methods applied include full mold casting, hollow casting and rotational molding.

Spraying:

Spraying of pastes through fine nozzles at a high pressure, e.g. for underbody sealing or seam sealing in the automotive sector.

For demanding requirements:

Paste processing



Solutions:

Monomeric plasticizers

Monomeric plasticizers and their properties

Product	Application	Form supplied/ Appearance	Density at 20 °C (g/cm ³) DIN 51757	Viscosity at 20 °C (mPas) DIN 53015	Water content (%) DIN 51777	Pourpoint (°C) ISO 3016	Solution temp. (°C) DIN 53 408 (according to)	Boiling point (°C) at 5 hPa DIN 53171
Adimoll® DM Dimethyl adipate	suitable for epoxy resin systems	liquid	approx. 1.065	3	max. 0.05	-18	110	> 150
Adimoll® DB Dibutyl adipate	low-viscosity plasticizer for cellulose esters and PVC; suitable as a solvent	liquid	approx. 0.960	6	max. 0.1	-20	116	> 150
Adimoll® DO Di-2-ethylhexyl adipate	effective plasticizer for low-temperature-resistant plasticized PVC, especially for thin foodstuff packaging with high oxygen permeability	liquid	approx. 0.925	13	max 0.1	-65	146	215
Adimoll® DN Diisononyl adipate	plasticizer for low-temperature-resistant plasticized PVC with a higher degree of hardness	liquid	approx. 0.915	18	max. 0.1	-60	150	235
Adimoll® BO Benzyl-2-ethylhexyl adipate	plasticizer for low-temperature resistant plasticized PVC	liquid	approx. 1.0	16	max. 0.1	-60	131	220
Unimoll® BB Benzyl butyl phthalate	plasticizer with very good gelling properties for PVC systems, reduces the dirt pick-up of PVC floor coverings	liquid	approx. 1.123	62	max. 0.1	-40	112	200
Unimoll® 66/66M Dicyclohexyl phthalate	plasticizer for PVC, EVA adhesives and coatings; retarding agent for peroxides	solid	-	-	max. 0.1	-	114	225
Triacetin Glyceryl triacetate	plasticizer for the bonding of cellulose fibers in the manufacture of cigarette filters; carrier for fragrances; core binding agent	liquid	approx. 1.155	23	max. 0.1	-36	-	145
Acetine TP BCH 51023 Acetylated glyceride	plasticizer for PVC, particularly suitable for the production of everyday applications	pale yellowish liquid	approx. 0.974	approx. 40	max. 0.1	approx. -12	163	218
Mesamoll® Alkyl sulfonic ester of phenol	plasticizer with good gelling properties, saponification resistance and high compatibility for a large number of polymers (especially PVC and PU)	pale yellowish liquid	1.04-1.07	approx. 115	max. 0.05	-32	116	> 200
Mesamoll® II Alkyl sulfonic ester of phenol	plasticizer with good gelling properties, saponification resistance and high compatibility for a large number of polymers (especially PVC and PU)	pale yellowish liquid	1.04-1.07	approx. 135	max. 0.05	-32	118	> 200

Polymeric plasticizers and their properties

Product	Application	Form supplied/ Appearance	Density at 50 °C (g/cm ³) DIN 51757	Viscosity at 50 °C (mPas) DIN 53015	Water content (%) DIN 51777	Pourpoint (°C) ISO 3016	Solution temp. (°C) DIN 53 408 (according to)
Ultramoll® I Polyadipate	polymeric plasticizer for oil, grease and fuel-resistant applications of PVC and other polymers	high-viscosity liquid	approx. 1.08	2500	max. 0.1	approx. 0	154
Ultramoll® III Polyadipate	polymeric plasticizer for oil, grease and fuel-resistant applications of PVC and other polymers; particularly suitable for the manufacture of foodstuff packaging	medium-viscosity liquid	approx. 1.105	1150	max. 0.1	approx. -15	177
Ultramoll® IV Polyadipate	polymeric plasticizer for oil, grease and fuel-resistant applications of PVC and other polymers; particularly suitable for the manufacture of foodstuff packaging	medium-viscosity liquid	approx. 1.053	1000	max. 0.1	approx. -13	167
Ultramoll® VP SP 51020 NV Polyadipate	polymeric plasticizer for oil, grease and fuel-resistant applications of PVC and other polymers; particularly suitable for the manufacture of foodstuff packaging	low-viscosity liquid	approx. 1.110	200	max. 0.2	approx. -18	160
Ultramoll® M Polyadipate	reactive polyester for the manufacture of color pastes for PU systems; reaction with isocyanates produces sparkling colors	viscous liquid	approx. 1.125	425	max. 0.1	approx. -20	-
Ultramoll® M/NV Polyadipate	reactive polyester for the manufacture of color pastes for PU systems; reaction with isocyanates produces sparkling colors	low-viscosity liquid	approx. 1.125	205	max. 0.1	approx. -20	-
Ultramoll® PP II Polyphthalate	polymeric plasticizer for oil, grease and fuel-resistant applications of PVC and other polymers	low-viscosity liquid	approx. 1.049	150	max. 0.1	approx. -15	140
Ultramoll® TGN Polyphthalate	polymeric plasticizer for oil, grease and fuel-resistant applications of PVC and other polymers	low-viscosity liquid	approx. 1.125	190	max. 0.35	approx. -15	146
Plasticizer CEL Polyphthalate	reactive polymeric plasticizer for the production of PU coating systems	medium-viscosity liquid	approx. 1.269 (75°C)	approx. 410 (75°C)	max. 0.1	approx. 10	-

Diverse possibilities:

Polymeric plasticizers



Photographic film industry

Photographic films comprise flexible, transparent shatterproof film substrates and light-sensitive gelatin emulsions. The film for roll, 35 mm and studio film is made of cellulose triacetate. PET film is used for graphic films, repro materials and x-rays.

All cellulose triacetate films contain 8-10% triphenyl phosphate (Disflamoll® TP). This has little effect on their mechanical properties, but reduces flammability and water absorbency. In the case of color films, couplers are required for the light-sensitive gelatin emulsions. The hydrophobic couplers are dissolved in high-boiling solvents, which are not miscible with water such as plasticizers. Disflamoll® TKP, Adimoll® DN, Unimoll® 66 and Ultramoll® are used in such solutions.

Retardation of peroxides

Organic peroxides are reactive, thermally unstable compounds, which, through their decomposition, can cause the crosslinking of elastomers and polymers. They are used, for example, to cure coatings and resins.

Improved safety during storage, transport and handling can be achieved through the retardation of peroxides. This involves the addition of substances to the peroxide which are inert towards the peroxide concerned. Retarding agents can be both solid or liquid. Unimoll® 66 and Ultramoll® TGN are used for retardation.

Color pastes

Since dyestuffs are generally added in low concentrations, it is sensible to use color pastes. The corresponding substrate must be compatible with the polymers and should have a low surface tension since then the concentration of the dye compared with the carrier can be increased. Disflamoll® TOF is highly suitable for this application.

In the case of color pastes for reactive systems such as polyurethanes, polyesters containing hydroxyl groups are used. The substrate is built into the polymer system through reaction, with the result being brilliant colors. Ultramoll® TGN and Ultramoll® M are particularly suitable for this application.

Cigarette industry

Cigarette filters are manufactured from cellulose triacetate tow (minute fibers). For these to be bonded, triacetin is sprayed onto the fibers but not mixed in homogeneously. In this way, it is possible to achieve a particular hardness and a smooth filter surface.

Always providing the right answer:

Plasticizers have several roles



In the care role:

Plasticizers as cleaning agents for polyurethane machinery



Plasticizers fulfill a large number of functions in plastics and rubber chemistry in addition to influencing elasticity, viscosity, lightfastness, fire safety and other polymer properties. Although their main application is as a component in formulations, plasticizing substances are often used in the care and cleaning of units and machinery for producing plastic. A typical example is the use of Mesamoll® as a rinsing agent and sealing fluid in RIM machines for polyurethane production.



The machines comprise at least two separate storage tanks, pipelines, pumps and valves and a mixing head. Here, the two main components of polyurethane, polyol and isocyanate, meet. A polyaddition reaction turns them into macromolecules. The reaction mixture, still liquid, is discharged for further processing via an outlet and nozzle system. To clean the parts of the plant - mixing head, nozzles and metering pumps - for a change of starting product or when demanded by a routine maintenance plan, machinery manufacturers often recommend the use of LANXESS's Mesamoll® grades.

As a sealing fluid, the liquid alkyl sulfonate also fills the shaft sealing cavities of the metering pumps. If parts of the unit are to be transported or if the machine is out of action for a while, all paths along which polyol and isocyanate flow should be thoroughly cleaned with Mesamoll® and filled with the additive. Used correctly, Mesamoll® prevents the formation of isocyanate crystals, thus enabling units to retain their function and value much longer.

Bonding is one of the oldest processes for joining materials together. Particularly high-quality adhesive constructions are required in aeronautics and space technology. Adhesion has, however, also become firmly established in automotive engineering and construction. Depending on the combination of materials, different adhesives are used.

In the construction industry, joints can be fillable up to 6 mm. Here, adhesives with a high solids content are used. These are known as sealants. After setting they must be mobile and retain their elastic properties.

Plasticizers can affect the deformability and flow properties of adhesives and sealants. Because of their small molecules, they can penetrate a polymer network without participating in the curing process. They affect the rheological properties and allow the addition of fillers. The most important factor determining the choice of plasticizer is compatibility with the polymers.

Polyurethane-based adhesive and sealing systems, particularly one-component moisture-curing systems, often contain Mesamoll® and Mesamoll® II. Sealants containing Mesamoll® are used in particular in the construction industry. The good saponification resistance of Mesamoll® and Mesamoll® II is especially beneficial on the alkaline substrates that are frequently encountered.

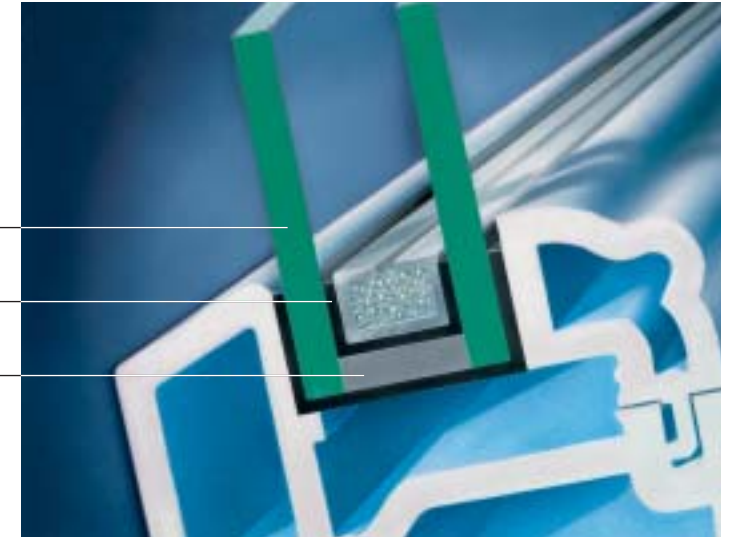
Unimoll® BB is equally compatible with polyurethane systems. This ester lowers viscosity among other characteristics. ALIPS (aliphatic polysulfides) are used in the manufacture of insulating glass. Unimoll® BB is an essential component in such a formulation. Ultramoll® TGN may be used in the cross-linked two-component system as a carrier for the crosslinking component.

Unimoll® 66 M is frequently used as an additive in heat-activatable adhesives. The plasticizer is, for example, incorporated into an acrylate dispersion. In order to fully bond the parts, which have been joined, the adhesive layer is heated above the melting point of Unimoll® 66.

Glass

Plastic seal

Elastic seal



Window



Established technology in combination with modern chemistry:

Plasticizers in adhesives and sealants

Central Europe:

**Germany, BeNeLux,
Austria, Switzerland**
LANXESS Europe GmbH & Co. KG
Konrad-Adenauer-Ufer 41-45
50668 Köln
Phone: +49-221-16 47-0
Fax: +49-221-16 47-331
www.lanxess-europe.com

UK, Ireland

LANXESS Limited
Strawbery Hill
Newbury, Berkshire RG141JA
United Kingdom
Phone: +44-163-563 259
Fax: +44-163-563 647
www.lanxess.com

France

LANXESS S.A.S.
49-51, quai de Dion Bouton
92815 Puteaux Cedex
Phone: +33-1-49 06-54 00
Fax: +33-1-49 06-54 21
www.lanxess.com

Portugal, Spain

LANXESS Chemicals S.L.
Moll de Barcelona, s/n.
08039 Barcelona
Phone: +34-93-341 52 00
Fax: +34-93-341 52 95
www.lanxess.com

Italy

LANXESS S.r.l.
Viale Certosa 130
20156 Mailand
Phone: +39-02-39 78 28 28
Fax: +39-02-39 78 45 28
www.lanxess.com

USA, Canada

LANXESS Corporation
100 Bayer Road
Pittsburgh, PA 15205-9741
U.S.A.
Phone +1-412-777-38 92
Fax +1-412-777-41 09
www.us.lanxess.com

Japan, Korea

LANXESS K.K.
4-10-8, Takanawa
108-8576 Tokyo, Minato-ku
Japan
Phone: +81-3-32 80-98 26
Fax: +81-3-32 80-98 29
www.lanxess.com

ASEAN, A/NZ

LANXESS Pte. Ltd.
No. 9 Benoi Sector
Singapore 629844
Phone: +65-67 25 58 88
Fax: +65-62 66 48 62
www.lanxess.com

All other countries: Please visit www.lanxess.com to find the contact for your region.

Forward-looking statements

This brochure contains forward-looking statements based on current assumptions and forecasts made by LANXESS Deutschland GmbH management. Various known and unknown risks, uncertainties and other factors could lead to material differences between the actual future consolidated

results, financial situation, development or performance of the company, and the estimates given here. The company assumes no liability to update such forward-looking statements or to adapt to future events or development.

This information and our technical advice – whether verbal, in writing or by way of trials – are given in good faith but without warranty, and this also applies where proprietary rights of third parties are involved. Our advice does not release you from the obligation to verify the information currently provided – especially that contained in our safety data and technical information sheets – and to test our products as to their suitability for the intended processes and uses. The

application, use and processing of our products and the products manufactured by you on the basis of our technical advice are beyond our control and, therefore, entirely your own responsibility. Our products are sold in accordance with the current version of our General Conditions of Sale and Delivery.
Edition: 2004-10
Order no.: LXS-FCC04E
Printed in Germany

LANXESS
Energizing Chemistry

LANXESS
Deutschland GmbH
BU Functional Chemicals
Chemiepark Leverkusen
51369 Leverkusen, Germany