

Technical Information

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Panthenol

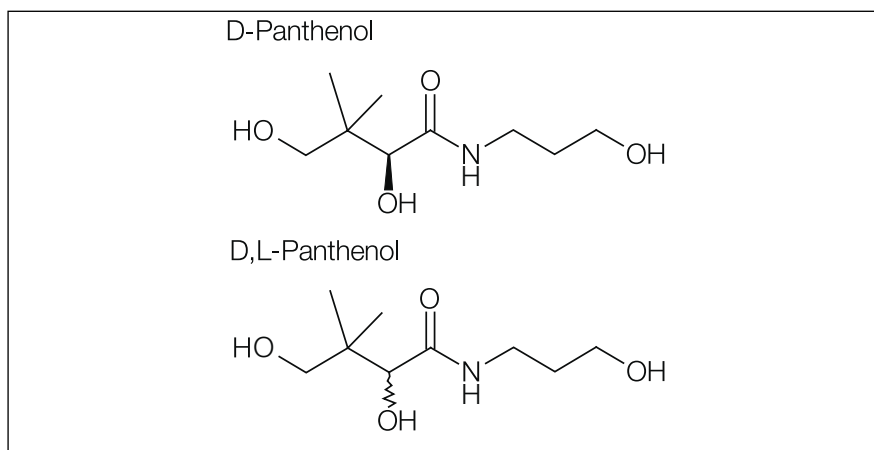
D-Panthenol USP, D-Panthenol 50 P, D-Panthenol 75 W, DL-Panthenol 50 W

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**Active ingredient for further processing in the cosmetics industry.
Improves the appearance of skin and hair.**

Cosmetic Solutions

- Hair Care
- Skin Care
- Oral Care

Structural formula**Synonyms**Panthenol, pantothenyl alcohol, provitmain B₅, dexpanthenol**Molecular formula** $C_9H_{19}O_4N$ **Molar mass**

205.3 g/mol

Grades available

D-Panthenol USP
 D-Panthenol 50 P
 D-Panthenol 75 W
 DL-Panthenol 50 W

INCI name

D-Panthenol USP	D-Panthenol 50 P	D-Panthenol 75 W	DL-Panthenol 50 W
Panthenol	Panthenol (and) Propylene Glycol	Panthenol (and) Water	Panthenol (and) Water

CAS-No.

81-13-0 (D- Panthenol)	81-13-0 (D-Panthenol), 57-55-6 (Propylene glycol)	81-13-0 (D-Panthenol), 7732-18-5 (Water)	16485-10-2 (DL-Panthenol), 7732-18-5 (Water)
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Specification**D-Panthenol USP**

Parameter	Specification Limits
Identification	Conforms
Assay	Minimum 98.0% Not more than 102.0%
Aminopropanol	Not more than 1.0%
Organic volatile impurities	Conforms
Appearance	Clear, viscous liquid
Refractive Index	Min. 1.495, max. 1.502
Specific Rotation	Min. +29.0, max.+31.5
Water Content	Max. 1.0%
Residue on Ignition	Not more than 0.1%

D-Panthenol 50 P

Parameter	Specification Limits
Identification	Conforms
Assay	Minimum 50% Maximum 55%
Aminopropanol	Maximum 0.5%
Appearance	Clear liquid

D-Panthenol 75 W

Parameter	Specification Limits
Identification	Conforms
Assay	Minimum 75%
Aminopropanol	Maximum 1.0%
Heavy Metals	Maximum 10 ppm
pH-value	5.5 to 7.0
Appearance	Clear liquid
Residue on Ignition	Maximum 0.3%

DL-Panthenol 50 W

Parameter	Specification Limits
Identification	Conforms
Assay	Minimum 50%
Aminopropanol	Maximum 2.0%
Heavy Metals	Maximum 20 ppm
Appearance	Clear liquid
pH-value	4.0 to 7.5
Residue on Ignition	Maximum 0.5%

Applications

Panthenol is an active ingredient for sophisticated cosmetic skin care and hair care products. It improves the appearance of skin, hair and nails. D-Panthenol is the provitamin of D-Pantothenic acid (Vitamin B₅). D-Pantothenic acid plays a key role in the human intermediary metabolism. It is a part of the Coenzym A. Deficiency of Vitamin B₅ results in many dermatological disorder.

Coenzym A is important for:

- structure and function of living tissue
- resistance of the mucous membrane
- growth and pigmentation of hair

Role in the skin:

- deep penetrating moisturizer
- stimulates epithelisation
- has wound healing effect
- has an anti-inflammatory effect

Role in the hair:

- long lasting moisturizer
- prevents hair damage
- thickens hair
- improves luster and sheen

Role in nail care:

- improves hydration
- imparts flexibility

Only the D-Panthenol is the provitamin of D-Pantothenic acid (Vitamin B₅), not the L-Panthenol.

The human body converts D-Panthenol to Vitamin B₅, which is D-Panthotenic acid. DL-Panthenol is a lit racemic mixture of D-Panthenol and L-Panthenol. Due to the fact that only D-Panthenol is converted to Vitamin B₅ and not L-Panthenol, the racemic DL-Panthenol has only half of the physiological activity of the D-Panthenol. These include stimulation of epithelisation, wound healing effect and anti-inflammatory effect.

But for all the none physiological activities like moisturizer effect, improvement of hair structure, giving luster and sheen to the hair D- and DL-Panthenol are equally active.

The D-Panthenol USP and 50 P are also applied in the pharmaceutical industry.

The main areas of pharmaceutical application are syrups, drops, ampoules, creams, gels and capsules. In liquid multi-vitamin and Vitamin B complex preparations D-Panthenol is nearly always preferred to the D-Pantothenates because it is usually considerably more stable at the pH values below 5 usually employed in these preparations.

Monographs

The D-Panthenol USP meets the requirements of the monographs of USP.

Recommended concentrations

		Panthenol, %
Skin care (D-Panthenol)		0.5 - 5.0
	Face creams	0.5 - 5.0
	Body lotions	0.5 - 2.0
	Hand cream	0.5 - 3.0
	Lipsticks	1.5
	After shave lotion	1.0 – 5.0
	Anti-perspirant	0.5 - 1.0
	Sun protection lotion	1.0 - 5.0
	After sun lotion	1.0 - 5.0
	Soap and bath preparations	0.5 - 3.0
Hair care (D-Panthenol or DL-Panthenol)		0.1 - 5.0
	Shampoo	0.1 - 5.0
	Hair spray	0.1 - 0.5
	Styling mousse	0.1 - 0.5
	Conditioner (rinse-off)	0.5 - 5.0
	Conditioner (leave-on)	0.1 - 0.5
Nail care (D-Panthenol or DL-Panthenol)		1.0

For skin care products the use of D-Panthenol is recommended. For hair care and nail care products both D- and DL-Panthenol can be used.

Solubility

Panthenol is readily miscible with water, ethanol, methanol and propylene glycol. It is insoluble in oils and fats.

Technical properties and handling

Panthenol can easily be incorporated in the water phase of cosmetic formulations.

The pure Panthenol (D-Panthenol USP) is highly hygroscopic.

The Panthenol solutions (D-Panthenol 50 P, D-Panthenol 75 W and DL-Panthenol 50 W) are very easy to handle, because they have a low viscosity.

	D-Panthenol USP	D-Panthenol 50 P	D-Panthenol 75 W	DL-Panthenol 50 W
Handling	Heat to reduce the viscosity	Easy to pump	Easy to pump	Easy to pump

Approval status

Panthenol has EINECS Numbers. The products have been approved for sale in Europe, Japan and the USA.

	D-Panthenol USP	D-Panthenol 50 P	D-Panthenol 75 W	DL-Panthenol 50 W
EINECS-No.	201-327-3 (D-Panthenol)	201-327-3 (D-Panthenol), 200-338-0 (Propylene glycol)	201-327-3 (D-Panthenol)	240-540-6 (DL-Panthenol)

Efficacy

The trend in modern cosmetology is towards formulas containing substances with proven therapeutic efficacy. The effects of topically applied Panthenol have been confirmed in a large number of studies.

D-Panthenol is an active, biologically stable form of Pantothenic acid, which is Vitamin B₅. It plays a fundamental role in the metabolism of all cells.

Topically applied Panthenol is absorbed by the skin and transformed into Pantothenic acid (G. Stüttgen, H. Krause, Arch. Klin. and Exp. Dermat, 209, 578-82 (1960)).

An ointment with Panthenol prevents erythema due to UV light (R. Lange, Med. Klin. 52,1379 (1957); H. Tronnier et al, Z. Haut- und Geschlechtskrankheiten 21, 224-32 (1956)).

A cream with 5% Panthenol accelerates the healing of superficial wounds by 30% (H. Weiser, G. Erlemann, Parfümerie und Kosmetik, 68, 425-428 (1987)).

A cream with Panthenol regularly applied to the skin improves the moisture content of dry skin significantly (E. Wagner, Panthenol und Phytantriol in der Kosmetik, Parfümerie und Kosmetik, 75, 260-267 (1994)).

A D-Panthenol ointment protects the lips against solar herpes (H. Stellmann, Ärztl. Praxis 7, 16 (1955)).

A shampoo with 0.5% Panthenol was diluted 1:10 with water and applied to the hair. A deposit of Panthenol up to 36.4 µg/g hair after one cycle and up to 115.7 µg/g hair after five cycles of treatment was determined. The penetration of Panthenol in hair was determined in the same way. After one cycle up to 7.5 µg/g hair and after five cycles up to 21.5 µg/g hair were measured (E.Wagner, Panthenol und Phytantriol in der Kosmetik, Parfümerie und Kosmetik, 75, 260-267 (1994)).

A rinse-off conditioner with 0.5% Panthenol applied once to the hair and rinsed off with water has a moisturizing effect on the hair for over 180 minutes. With water there is an effect for only 10 minutes (G.Erlemann, R.Merkle, Panthenol, Phytantriol, Vitamin E und Vitamin A in der Kosmetik, SÖFW, 117, 379-384 (1991)).

The high water content prevents damage to the hair caused by combing, brushing, blow-drying and perming.

Typical formulations**Skin care**

In all formulations D-Panthenol USP can be replaced with D-Panthenol 75 W or D-Panthenol 50 P.

After shave balm**No. 07/00030**

	%	Ingredients	Supplier	INCI name
A	0.25	Pemulen TR-1	(6)	Acrylates/C10-30 Alkyl Acrylate Crosspolymer
	10.00	Miglyol 812	(11)	Caprylic/Capric Triglyceride
	1.50	Vitamin E Acetate	(1)	Tocopheryl Acetate
	0.10	Bisabolol nat.	(1)	Bisabolol
B	15.00	Ethanol		Alcohol
	1.00	Cremophor® CO 410	(1)	PEG-40 Hydrogenated Castor Oil
	1.00	D-Panthenol USP	(1)	Panthenol
	5.00	Glycerin 87%	(20)	Glycerin
	0.05	Tylose H 4000	(28)	Hydroxyethyl Cellulose
	66.02	Water dem.		Aqua
C	0.08	Sodium Hydroxide	(20)	Sodium Hydroxide

Production:

Mix the components of phase A.
Allow phase B to swell and stir it into phase A whilst homogenizing. Neutralize with phase C and homogenize again.

Baby Cream**No. 54/00017**

	%	Ingredients	Supplier	INCI name
A	6.00	Cremophor® WO 7	(1)	PEG-7 Hydrogenated Castor Oil
	10.00	Vaseline		Petrolatum
	2.00	Bees Wax 3044 PH	(73)	Bees Wax
	1.00	Eucerinum Anhydricum	(55)	
	2.00	TeCero-Wax 1030 K	(73)	Microcrystalline Wax
	0.50	Aluminum Stearate	(10)	Aluminum Stearate
	0.50	Magnesium Stearate	(10)	Magnesium Stearate
	8.00	Luvitol® EHO	(1)	Cetearyl Ethylhexanoate
	0.20	Bisabolol nat.	(1)	Bisabolol
B	7.00	1,2-Propylene Glycol Care	(1)	Propylene Glycol
	4.00	D-Panthenol USP	(1)	Panthenol
	10.00	Zinc Oxide	(20)	Zinc Oxide
	q.s.	Preservative		
	48.80	Water, dem.		Aqua
C	q.s.	Perfume		

Production:

Heat phases A and B separately to about 85°C. Stir phase B into phase A and homogenize. Cool to 40°C, add phase C and homogenize again.

Properties:

Viscosity: approx. 25 000 mPa·s

Vitamin Body Lotion**No. 62/00078**

	%	Ingredients	Supplier	INCI name
A	2.00	Cremophor® A 6	(1)	Ceteareth-6, Stearyl Alcohol
	2.00	Cremophor® A 25	(1)	Ceteareth-25
	8.00	Paraffin Oil		Mineral Oil
	7.00	Luvitol® EHO	(1)	Cetearyl Ethylhexanoate
	3.00	Imwitor 960 K	(11)	Glyceryl Stearate SE
	1.00	Lanette O	(27)	Cetearyl Alcohol
	0.50	Abil 350	(44)	Dimethicone
	0.40	Phytantriol		Phytantriol
B	4.00	D-Panthenol 50 P	(1)	Panthenol, Propylene Glycol
	3.00	1,2-Propylene Glycol Care	(1)	Propylene Glycol
	q.s.	Preservative		
	5.90	Water, dem.		Aqua
C	1.20	Luvigel® EM	(1)	Caprylic/Capric Triglyceride, Acrylates Crosspolymer
D	2.00	Vitamin E Acetate	(1)	Tocopheryl Acetate
	q.s.	Perfume		

Production:

Heat phases A and B separately to about 80°C. Stir phase B into phase A whilst homogenizing. Stir phase C and homogenize. Cool to about 40°C, add phase D and homogenize again.

Properties:

Viscosity: approx. 18000 mPa·s Brookfield RVD VII+
pH value: approx. 6.0

After Sun Lotion**No. 50/00062**

	%	Ingredients	Supplier	INCI name
A	0.40	Carbopol 1342	(6)	Acrylates/C10-30 Alkyl Acrylate Crosspolymer
	15.00	Luvitol® EHO	(1)	Cetearyl Ethylhexanoate
	0.20	Bisabolol rac.	(1)	Bisabolol
	q.s.	Perfume		
	1.00	Vitamin E Acetate	(1)	Tocopheryl Acetate
B	1.00	D-Panthenol USP	(1)	Panthenol
	15.00	Ethanol 96%		Alcohol
	3.00	Glycerin 87%	(20)	Glycerin
	64.20	Water, dem.		Aqua dem.
C	0.20	Triethanolamine Care	(1)	Triethanolamine

Production:

Mix the components of phase A. Dissolve phase B and stir into phase A whilst homogenizing. Neutralise with phase C and homogenize again.

Properties:

Viscosity: approx. 7500 mPa·s
Haake Viscotester VT-02
pH value: approx. 6

Sun protection lotion, O/W**No. 53/00135**

	%	Ingredients	Supplier	INCI name
A	2.00	Cremophor® A 6	(1)	Ceteareth-6, Stearyl Alcohol
	2.00	Cremophor® A 25	(1)	Ceteareth-25
	3.00	Imwitor 960 K	(11)	Glyceryl Stearate SE
	0.20	Abil 350	(44)	Dimethicone
	2.00	Uvinul® M 40	(1)	Benzophenone-3
	3.00	Uvinul® MC 80	(1)	Ethylhexyl Methoxycinnamate
	0.50	Amphisol K	(25)	Potassium Cetyl Phosphate
B	2.00	D-Panthenol 50 P	(1)	Panthenol, Propylene Glycol
	2.00	Uvinul® P 25	(1)	PEG-25 PABA
	3.00	1,2 Propylene Glycol Care	(1)	Propylene Glycol
	q.s.	Preservative		
	66.40	Water, dem.		Aqua
C	0.30	Carbopol 934	(6)	Carbomer
	12.00	Miglyol 812	(11)	Caprylic/Capric Triglyceride
D	0.40	Triethanolamine Care	(1)	Triethanolamine
E	1.00	Vitamin E Acetate	(1)	Tocopheryl Acetate
	0.20	DL-Alpha-Tocopherol	(1)	Tocopherol
	q.s.	Perfume		

Production:

Heat phases A and B separately to approx. 80°C.

Stir phase B into phase A whilst homogenizing and continue homogenizing for a while. Stir in phase C, neutralize with phase D and homogenize again. Cool to about 40°C, add phase E and homogenize again.

Properties:

Viscosity: approx. 2000 mPa·s
pH value: approx. 7.0

Hair care

In all the formulations D-Panthenol can be replaced with DL-Panthenol 50 W.

Hair Setting Gel Super Hold with Luviskol® VA 64 W**No. 04/00076**

	%	Ingredients	Supplier	INCI name
A	0.50	Carbopol 940	(6)	Carbomer
	50.00	Water, dem.		Aqua
B	0.67	Triethanolamine Care	(1)	Triethanolamine
C	30.33	Water, dem.		Aqua
	1.00	Cremophor® CO 40	(1)	PEG-40 Hydrogenated Castor Oil
	5.00	Ethanol 96 %		Alcohol
	0.10	Perfume		
D	12.00	Luviskol® VA 64 W	(1)	VP/VA Copolymer
	0.40	D-Panthenol 50 P	(1)	Panthenol, Propylene Glycol
	q.s.	Preservative		

Production:

Allow phase A to swell and neutralize with phase B.
Solubilize phase C. Weigh phase D into phase C and dissolve clearly. Stir phase C+D into phase A+B.

Properties:

Viscosity: approx. 22000 mPa·s
Brookfield RVD VII+
pH value: approx. 6.9

Conditioner**No. 03/00117**

	%	Ingredients	Supplier	INCI name
A	2.00	Cremophor® A 6	(1)	Ceteareth-6, Stearyl Alcohol
	1.00	Cremophor® A 25	(1)	Ceteareth-25
	6.00	Lanette O	(27)	Cetearyl Alcohol
	6.00	Luvitol® EHO	(1)	Cetearyl Ethylhexanoate
	0.30	Phytantriol	(1)	Phytantriol
B	7.70	Luviquat® Care	(1)	Polyquaternium-44
	5.00	1,2-Propylene Glycol Care	(1)	Propylene Glycol
	2.00	DL-Panthenol 50 W	(1)	Panthenol, Aqua
	q.s.	Preservative		
	68.00	Water, dem.		Aqua
C	2.00	Cosi Silk Soluble	(54)	Hydrolyzed Silk
	q.s.	Perfume		
	q.s.	Preservative		

Production:

Heat phases A and B separately to about 80°C. Stir phase B into phase A whilst homogenizing and continue homogenizing for a while. Cool to about 40°C, add phase C and homogenize again.

Properties:

Viscosity: approx. 13200 mPa·s
Brookfield RVD VII+
pH value: approx. 6.4

Conditioner Shampoo**No. 08/00579**

%	Ingredients	Supplier	INCI name
40.00	Texapon NSO	(27)	Sodium Laureth Sulfate
5.00	Plantacare 2000	(27)	Decyl Glucoside
5.00	Tego Betain L 7	(44)	Cocamidopropyl Betaine
3.00	Luviquat® Care	(1)	Polyquaternium-44
0.50	D-Panthenol USP	(1)	Panthenol
q.s.	Perfume		
q.s.	Preservative		
q.s.	Citric Acid	(20)	Citric Acid
2.00	Sodium Chloride	(20)	Sodium Chloride
44.50	Water, dem.		Aqua

Production:

Weigh out the components and dissolve them clearly.
Adjust the pH value with citric acid to approx. 6-7.

Properties:

Viscosity: approx. 2500 mPa·s
Brookfield RVD VII+
pH value: approx 6.5

Clear shampoo for fine hair**No. 08/00594**

	%	Ingredients	Supplier	INCI name
A	12.00	Texapon N 70	(27)	Sodium Laureth Sulfate
	3.00	Amphotensid B 5	(159)	Cocamidopropyl Betaine
	5.00	Plantacare 2000	(27)	Decyl Glucoside
	q.s.	Perfume		
B	73.50	Water dem.		Aqua
	3.00	Luviquat® Care	(1)	Polyquaternium-44
	0.50	D-Panthenol USP	(1)	Panthenol
	q.s.	Preservative		
	q.s.	Citric Acid	(20)	Citric Acid
	1.00	Rewopal LA 3	(47)	Laureth-3
	2.00	Sodium Chloride	(20)	Sodium Chloride

Production:

Weigh out the components of phase A and mix them. Add the components of phase B one after another and dissolve them clearly. Adjust the pH value to about 5-6.

Properties:

Viscosity: 3890 mPa·s Brookfield RVD VII+
pH value: 6.0

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Stability and Storage

Panthenol is stable at room temperature. It is stable against light and air but not heat. Heat (above 70°C) can cause racemization to D-Panthenol and cleavage to aminopropanol and pantolacton for D- and DL-Panthenol. The recommended pH-value for Panthenol in cosmetic formulations is 4-8. The storage stabilities of the different Panthenol grades differ. If it is stored in the original sealed containers at 15 - 25°C it has at least the following shelf life:

	D-Panthenol USP	D-Panthenol 50 P	D-Panthenol 75 W	DL-Panthenol 50 W
Shelf life	36 months	36 months	12 months	12 months

Safety Data Sheet

Safety Data Sheets are available for all the Panthenol grades. They contain the main results of the toxicological studies. D- and DL-Panthenol are non-toxic and non-irritant.

Note

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