

# D-Panthenol

## Definition

Alcohol form of dextrotatory isomer of pantothenic acid, belonging to the group of water soluble vitamins, member of B-complex vitamins

## Synonymous names

Dexpanthenol,  
D-Pantothenyl Alcohol,  
Dextro-Pantothenyl Alcohol,  
D-Pantothenylol,  
D-Pantothenol,  
Old (obsolete) names from literature  
Pro-Vitamin B<sub>5</sub>,  
Vitamin B<sub>5</sub>,  
N-pantoyl-3-propanolamine

## Chemical names

( R )-2,4-dihydroxy-N-(3-hydroxypropyl)-3,3-dimethylbutyramide;  
( R )-butanamide, 2,4-dihydroxy-N-(3-hydroxypropyl)-3,3dimethyl;  
( R )-2,4dihydroxy-N-(3-hydroxypropyl)-3,3-dimethylbutanamide;  
D(+)-alpha, gamma-dihydroxy-N-(3-hydroxypropyl)-beta,  
beta-dimethylbutyramid

## Official adopted names and nomenclatures

CAS-No.: 81-13-0  
EINECS No.: 201-327-3  
IUPAC/IUP: Pantothenic Acid  
(CAS-No. 79-83-4)  
INN name (WHO): DEXPANTHENOL  
INCI name: Panthenol  
CTFA name: Panthenol  
CN Code: 2936 2400  
D- or DL-Pantothenic Acid  
Vitamin B<sub>5</sub> or Vitamin B<sub>5</sub>  
and ist derivatives



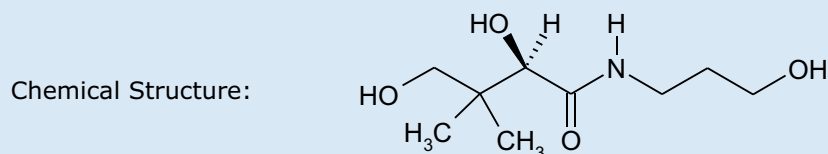
Producer: DAIICHI FINE CHEMICAL CO., LTD., Japan



Kyowa Hakko Europe GmbH  
Daiichi Fine Chemical Division

## SPECIFICATION\*

Chemical Name: ( R)-2,4dihydroxy-N-(3-hydroxypropyl)-3,3-dimethylbutyramide



Empirical Formula:  $C_9H_{19}NO_4$  Molecular weight: 205,3

Characters: A colorless or slightly yellowish, viscous hygroscopic liquid, very soluble in water, freely soluble in ethanol

Identification:  
A: Specific optical rotation  
B: IR absorption Spectrophotometry  
C: TLC Test  
D: Copper sulphate test

Appearance of solution: Clear and not more intensely colored than reference solution

pH-value of solution: Not greater than 10,5

Specific optical rotation:  $[\alpha]_D^{20} : +29^\circ \sim +32^\circ$

3-Aminopropanol: By thin layer chromatography, equivalent to not more than 0,5 %

Heavy metals: Not more than 20ppm

Water content: Not more than 1,0 %

Sulphated ash: Not more than 0,1 %

Assay: Not less than 98,0 % and not more than 101,0 %, calculated with reference to the anhydrous substance

\*meets the quality requirements of the Ph. Eur. Monograph for Dexpanthenol

## Other Physico-Chemical Properties

Boiling Point: 118 ~ 120 °C (0,02 mg Hg), it decomposes easily on distillation

Arsenic: Not more than 3 ppm

Refractive Index: 1.495 ~ 1.502 (20 °C)

Characters: Slightly bitter taste

## Storage and Packaging

Storage: Protect against moisture and heat, store in tight containers at room-temperature (JP: 1°C to 30°C), extremely long storage at low temperatures may cause crystallization

Crystallization: This is not a quality problem. Dexpanthenol liquefies again when heated at 70° C for several hours

Standard Packaging: PE-pail with 10 kg net  
PE-pail with 20 kg net  
PE-drum with 200 kg net

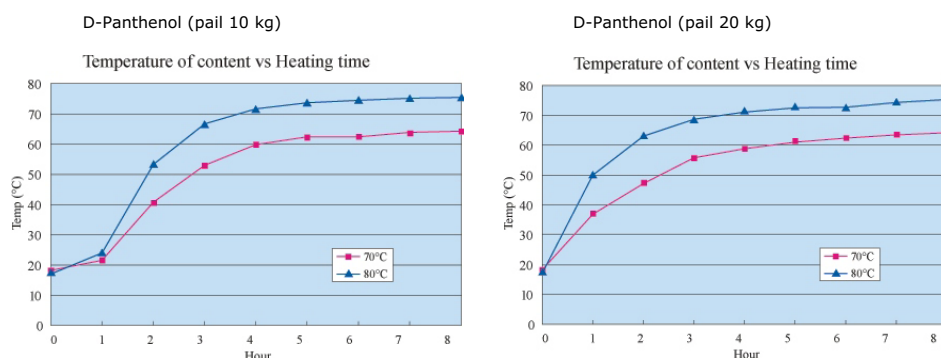
Expiry Date: In unopened original packaging and under adequate storage conditions minimum 3 years after production date

## Formulating

- Standardization:** Calculated on the different molecular weights the relations among the derivatives and pantothenic acid are as follows:  
1.000 g D-PANTHENOL is equivalent to  
1.068 g PANTOTHENIC ACID resp.  
1.160 g D-CALCIUM PANTOTHENATE
- Stability:** Relatively stable to oxygen and light typically sensitive to moisture by hygroscopicity and heat, stable in neutral or slightly acidic aqueous solutions (pH 4-6), less stable in acidic and alkaline aqueous solutions by hydrolytic cleavage, exposure to heat exceeding 70°-75° C may cause racemization.
- D-PANTHENOL is specially designed for cosmetical preparations which are mostly moving between pH 5 and pH 7. Within this range, D-PANTHENOL can be regarded as stable.  
Reasonably stable to usual sterilization time in aqueous solutions and before mentioned pH environment.
- Solubility:** Very soluble in water, readily soluble in alcohol, soluble in glycerol, slightly soluble in ether, insoluble in vegetable oils, mineral oils and fats,  
Isopropanol 99 % = 15 g/100 g  
Propylenglycol = 33 g/100 g
- Microorganisms:** Bacteria count not more than 100/g  
Funghi not more than 10/g  
Pathol. causative organisms like pseudomonas aeruginosa, staphylococcus aureus, candida albicans, escherichia coli are not traceable.

## Handling

- Properties:** D-PANTHENOL is a viscous solution (about 10500 c Pas/30°C). To make it easy to handle and free-flowing, it could be mixed 50 : 50 with warm water, but also exposed to heat in a water bath.  
The warm-up time in original packagings is shown in the following tables:



In industrial microwave heating systems with temperature control temperatures of 60° C to 70° C can be reached within few minutes

- Relative Density:** 1.2 (at 20°C)

## Applications

- Pharmaceuticals:** Liquid parenteral feeding formulations, ointments/creams against skin affections, aqueous solutions to improve healing of wounds/scars, postoperative atony of intestine and to bland structural lesions of skin/mucosae caused by radiotherapy
- Veterinary field:** Liquid formulations for preventive treatment of liver dysfunctions and care in stress situations
- Cosmetics:** Lotions, rinses, creams, ointments to promote cell regeneration of the skin. Applied effectively in hair care, baby care formulations and sun care formulations

## PHYSIOLOGICAL FUNCTIONS IN SKIN, SCALP AND MUCOSAE

D-PANTHENOL is a viscous liquid derivative of pantothenic acid and has been specially developed for topical application. Many researchers report that this alcoholic form is easily penetrated into skin, hair and finger nails. It is converted into pantothenic acid working mainly as a constituent of the coenzyme A which is present in all living tissues ("pantons" meaning "found everywhere"). Obviously, the basal metabolism of the coenzyme A in the skin is relatively high. Environmental disturbances and lesions may cause a local limited deficiency of pantothenic acid.

### Cosmetical Efficacy:

D-PANTHENOL is regarded as multi-active ingredient for cosmetics thanks to its physio-chemical properties in

- penetrating relatively deep into the skin
- water binding and/or water retention
- being transformed to pantothenic acid in skin and hair after topical administration creating pro-vitamin B5 activities



D-PANTHENOL may be regarded as ideal cosmetic ingredient which may improve skin and hair care as well as protect against environmental stress.

The cosmetological actions of D-PANTHENOL are based on following findings:

- improvement of the mitotic activity (cell regeneration)
- acceleration of epithelisation and granulation after burns, eczemas ulcerations, radiotherapy and plastic surgery
- improving symptoms of inflammations
- alleviating itching
- strengthening of hair roots and hair shafts
- pigment stimulation
- protection against ammonia produced napkin rash

### Recommendations for cosmetic use:

According to international accepted formulators, the following D-PANTHENOL supplementations are recommended:

Product	D-Panthenol in %
Day/night cream	0,5 - 5,0
Sun care	1,0 - 5,0
After sun care	1,0 - 5,0
Hair lotion	1,0 - 2,0
Shampoo	1,0 - 2,0
Conditioner	1,0 - 2,0

Product	D-Panthenol in %
Baby care formulations	1,0 - 5,0
Foam bath	0,5 - 3,0
Hand cream	0,5 - 2,0
After shave lotion	0,5 - 2,0
Face lotion	0,5 - 2,0
Body lotion	0,5 - 2,0

### Therapeutical use

The before mentioned cosmetological effects are also basically applied in medical care by topical treatment of skin and mucosae lesions. However, in therapy of serious injuries comparable higher dosages or more intensive penetrations are recommended. This correlates with the phenomenon of local increased vitamin requirements.

#### topical:

in case of

- burns and scalds to promote forming of epithelisation
- irritation, inflammation and injuries of mucosae, callosity and cornea
- obstructive lung disease, an aerosol therapy with D-PANTHENOL is reported (Hertle 1981)
- onkological radiotherapy, lesions of skin and mucosae are treated with D-PANTHENOL solutions

#### systemic:

Basically D-PANTHENOL is used for prevention and prophylaxis in serious cases causing vitamin deficiency which cannot be cured by normal nutrition: malabsorption, maldigestion, malutilisation, malnutrition, chronic dialysis, risky pregnancies

### Safety:

Pantothenic acid and its derivatives are reported to be atoxic.

The LD50 are as follows: mice: 6,25 g/kg rabbits: 3,00/kg

High dosages of 10 g/day to humans over long periods caused no serious symptoms

**Literature:** K.-H. Bässler, I. Golly, D. Loew, K. Pietrzik: Vitamin-Lexikon für Ärzte, Apotheker und Ernährungswissenschaftler (1997). P. Berry Ottaway: The Technology of Vitamins in Food (1993). Dr. H. Eggensperger: Multiaktive Wirkstoffe für Kosmetika (1994/1995). Bundesanzeiger Nr. 179 dd. 93/09/23: Monographie Pantothenic Acid, systemic use; Nr. 24 dd. 93/02/05: Monographie Pantothenic Acid, systemic use; Nr. 24 dd. 93/02/05: Monographie Pantothenic Acid, topical use.

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