

- 9 Silverberg NB, *et al.* Childhood molluscum contagiosum: experience with cantharidin therapy in 300 patients. *J Am Acad Dermatol* 2000; **43**: 503–507.
- 10 Brock W, Cullen SI. Triamcinolone acetonide in flexible collodion for dermatologic therapy. *Arch Dermatol* 1967; **96**: 193–194.
- 11 Alkrad JA, *et al.* The release profiles of intact and enzymatically digested hyaluronic acid from semisolid formulations using multi-layer membrane system. *Eur J Pharm Biopharm* 2003; **56**: 37–41.
- 12 Yamauchi A, *et al.* Membrane characteristics of composite collodion membrane IV. Transport properties across blended collodion/Nafion membrane. *J Memb Sci* 2000; **170**: 1–7.
- 13 Babycos CR, *et al.* Collodion as a safe, cost-effective dressing for central venous catheters. *South Med J* 1990; **83**: 1286–1288.

## 20 General References

## 21 Author

C Cable.

## 22 Date of Revision

4 May 2017.

# Pyrrolidone

## 1 Nonproprietary Names

BP: Pyrrolidone

PhEur: Pyrrolidone

## 2 Synonyms

$\gamma$ -Aminobutyric acid lactam; 4-aminobutyric acid lactam;  $\gamma$ -aminobutyric lactam;  $\gamma$ -aminobutyrolactam; butyrolactam;  $\gamma$ -butyrolactam; 2-ketopyrrolidine; *Kollisolv* PYR; 2-oxopyrrolidine; 2-Pyrol;  $\alpha$ -pyrrolidinone; pyrrolidin-2-one; 2-pyrrolidone;  $\alpha$ -pyrrolidone; pyrrolidonum; *Solphor* P.

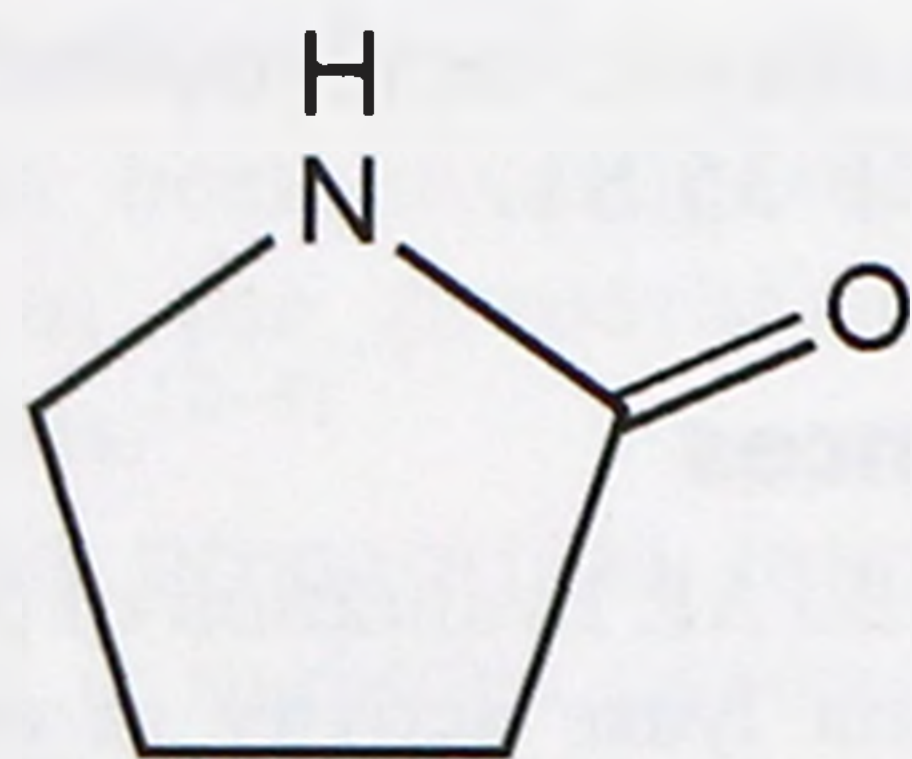
## 3 Chemical Name and CAS Registry Number

2-Pyrrolidinone [616-45-5]

## 4 Empirical Formula and Molecular Weight

C<sub>4</sub>H<sub>7</sub>NO 85.11

## 5 Structural Formula



## 6 Functional Category

Penetration enhancer; plasticizing agent; solubilizing agent; solvent.

## 7 Applications in Pharmaceutical Formulation or Technology

Pyrrolidone and *N*-methylpyrrolidone (*see* Section 17) are mainly used as solvents in veterinary injections. Pyrrolidone has been shown to be a better solubilizer than glycerin, propylene glycol, or ethanol.<sup>(1)</sup> They have also been suggested for use in human pharmaceutical formulations as solvents in parenteral, oral, and topical applications. In topical applications, pyrrolidones appear to be effective penetration enhancers.<sup>(2–6)</sup> Pyrrolidones have also been investigated for their application in controlled-release depot formulations.<sup>(4,7)</sup>

## 8 Description

Pyrrolidone occurs as a clear, colorless or slightly grayish liquid, as white or almost white crystals, or colorless crystal needles. It has a characteristic odor.

## 9 Pharmacopeial Specifications

*See* Table I.

**Table I:** Pharmacopeial specifications for pyrrolidone.

Test	PhEur 9.2
Identification	+
Characters	+
Appearance	+
Alkalinity	+
Related substances	+
Water	≤0.1%
Sulfated ash	≤0.1%
Melting point	≈25°C
Boiling point	≈245°C
Relative density	1.112–1.115
Refractive index	1.487–1.490

## 10 Typical Properties

**Acidity/alkalinity** pH = 8.2–10.8 for a 10% v/v aqueous solution.

**Antimicrobial activity** Pyrrolidone has also been shown to possess strong antimicrobial activity against Gram-positive and Gram-negative bacteria, and mold.

**Boiling point** 245°C

**Dipole moment** 2.3 Debye at 25°C

**Enthalpy of vaporization** 48.21 ± 3.0 kJ/mol

**Flash point** 129°C (open cup)

**Refractive index**  $n_D^{25} = 1.480–1.490$

**Solubility** Miscible with ethanol (95%), propan-2-ol, and water. Also miscible with other organic solvents such as aromatic hydrocarbons including benzene, carbon disulfide, chloroform, ether, and ethyl acetate.

**Specific gravity** 1.11 at 25°C

**Viscosity (dynamic)** 13.3 mPa s (13.3 cP) at 25°C