

Cetylpyridinium Chloride

1 Nonproprietary Names

BP: Cetylpyridinium Chloride
PhEur: Cetylpyridinium Chloride
USP–NF: Cetylpyridinium Chloride

2 Synonyms

C16-alkylpyridinium chloride; *Cepacol*; *Cepacol Chloride*; *Cetamiun*; cetylpridini chloridum; cetyl pyridium chloride; *Dobendan*; hexadecylpyridinium chloride; 1-hexadecylpyridinium chloride; *Medilave*; *Pristacin*; *Pyrisept*.

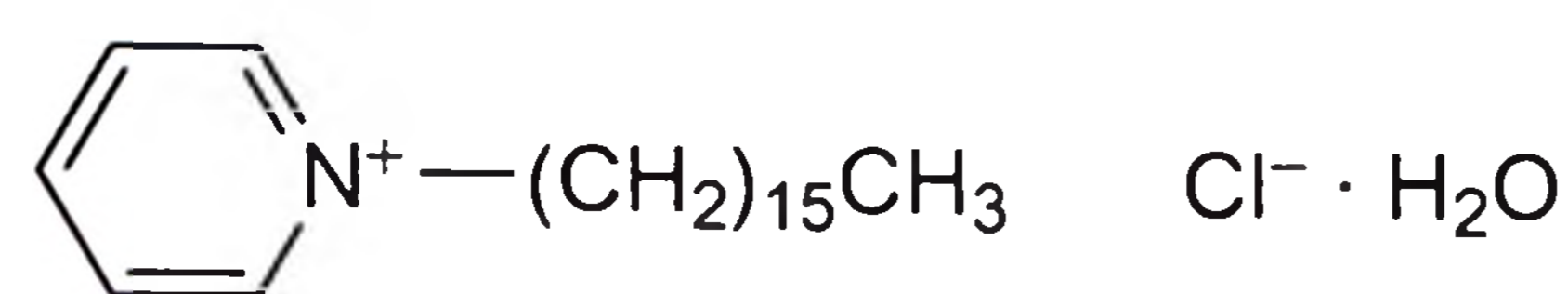
3 Chemical Name and CAS Registry Number

1-Hexadecylpyridinium chloride [123-03-5]
1-Hexadecylpyridinium chloride monohydrate [6004-24-6]

4 Empirical Formula and Molecular Weight

$C_{21}H_{38}ClN$ 339.9 (for anhydrous)
 $C_{21}H_{38}ClN \cdot H_2O$ 358.1 (for monohydrate)

5 Structural Formula



6 Functional Category

Antimicrobial preservative; cationic surfactant; penetration enhancer; solubilizing agent.

7 Applications in Pharmaceutical Formulation or Technology

Cetylpyridinium chloride is a quaternary ammonium cationic surfactant, used in pharmaceutical and cosmetic formulations as an antimicrobial preservative; *see* Section 10.

Cetylpyridinium chloride is used in nonparenteral formulations licensed in the UK, and in oral and inhalation preparations at concentrations of 0.04–1.5 mg (*see* Section 16).

Cetylpyridinium chloride is also used in transdermal drug delivery preparations, and has been shown to enhance the topical penetration of meloxicam⁽¹⁾ and doxorubicin.⁽²⁾

8 Description

Cetylpyridinium chloride is a white powder with a characteristic odor, and is slightly soapy to the touch.

9 Pharmacopeial Specifications

See Table I.

10 Typical Properties

Antibacterial activity Bactericidal to Gram-positive bacteria; relatively ineffective against some Gram-negative bacteria.⁽³⁾

Cetylpyridinium chloride is also antibacterial against a number of oral bacteria;⁽⁴⁾ *see* Table II.⁽⁵⁾

Critical micelle concentration 0.034% w/v aqueous solution (25°C).^(6,7)

Melting point 77–83°C

Table I: Pharmacopeial specifications for cetylpyridinium chloride.

Test	PhEur 9.2	USP 40–NF 35 S1
Identification	+	+
Characters	+	–
Acidity	+	+
Amines and amine salts	+	–
Appearance of solution	+	–
Heavy metals	–	≤0.002%
Organic impurities	–	+
Residue on ignition	–	≤0.2%
Sulfated ash	≤0.2%	–
Water	4.5–5.5%	4.5–5.5%
Assay	96.0–101.0%	98.0–102.0%

Table II: Minimum inhibitory concentrations (MICs) for cetylpyridinium chloride.⁽⁵⁾

Microorganism	MIC (μg/mL)
<i>Staphylococcus aureus</i>	<2.0
<i>Bacillus subtilis</i>	<2.0
<i>Salmonella typhimurium</i>	8.0
<i>Pseudomonas aeruginosa</i>	16.0
<i>Streptococcus pyogenes</i>	<2.0

Solubility Freely soluble in water; very soluble in chloroform; very slightly soluble in ether; insoluble in acetone, acetic acid, and ethanol.

Spectroscopy

IR spectrum *see* Figure 1.

Raman spectrum *see* Figure 2.

11 Stability and Storage Conditions

Cetylpyridinium chloride is stable under normal conditions. It should be stored in well-closed containers.

12 Incompatibilities

Cetylpyridinium chloride is incompatible with strong oxidizing agents and bases. It is also incompatible with methylcellulose.

Magnesium stearate suspensions in cetylpyridinium chloride have been shown to significantly reduce its antimicrobial activity. This is due to the absorption of cetylpyridinium chloride on magnesium stearate.⁽⁸⁾ The cetylpyridinium chloride ion also interacts with gelatin, resulting in reduced bioavailability.⁽⁹⁾

13 Method of Manufacture

Cetylpyridinium chloride is prepared from cetyl chloride by treatment with pyridine.

14 Safety

Cetylpyridinium chloride is used widely in mouthwashes as a bactericidal antiseptic. It is generally regarded as a relatively nontoxic material when used at a concentration of 0.05% w/v, although minor adverse effects such as mild burning sensations on the tongue have been reported.⁽¹⁰⁾

At higher concentrations, cetylpyridinium chloride may damage the mucous membranes in the mouth. It is harmful when ingested or