

STUDY OF HETEROCYCLIC COMPOUND PIPERIDINE

Dheeraj Kumar¹ and Vijay Singh²

¹Research Scholar, Deptt. Of Chemistry, Singhania University, Rajasthan.

²Associate Professor, Deptt. Of Chemistry, Govt. P.G. College, Narnaul, Haryana

¹EMAIL I.D: dheerajadav30@gmail.com

ABSTRACT

A **heterocyclic compound** is a cyclic compound that has atoms of at least two different elements as members of its ring(s). The counterparts of heterocyclic compounds are **homocyclic compounds** although heterocyclic compounds may be inorganic, most contain at least one carbon. Since in organic chemistry non-carbons usually are considered to replace carbon atoms, they are called heteroatoms, meaning 'different from carbon and hydrogen' (rings of heteroatoms of the same element are homocyclic). The IUPAC recommends the Hantzsch-Widman nomenclature for naming heterocyclic compounds. Heterocyclic compounds can be usefully classified based on their electronic structure. The saturated heterocycles behave like the acyclic derivatives. Thus, piperidine and Tetrahydrofuran are conventional amines and ethers, with modified steric profiles.

Key Words: Acyclic derivatives, piperidine and Tetrahydrofuran, amines and ethers

INTRODUCTION

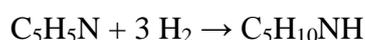
Heterocyclic chemistry is the branch of chemistry dealing with synthesis, properties, and applications of heterocycles **Classification based on electronic structure.** The study of heterocyclic chemistry focuses especially on unsaturated derivatives, and the preponderance of work and applications involves unstrained 5- and 6-membered rings. Included are pyridine, thiophene, pyrrole, and furan. Another large class of heterocycles are fused to benzene rings, which for pyridine, thiophene, pyrrole, and furan are quinoline, benzothiophene, indole, and benzofuran, respectively. Fusion of two benzene rings gives rise to a third large family of compounds, respectively the acridine, dibenzothiophene, carbazole, and dibenzofuran. The unsaturated rings can be classified according to the participation of the heteroatom in the pi system. **Piperidine (Azinane** after the Hantzsch–Widman nomenclature) is an organic compound with the molecular formula $(\text{CH}_2)_5\text{NH}$. This heterocyclic amine consists of a six-membered ring containing five methylene bridges (-CH₂-) and one amine bridge (-NH-). It is a colorless fuming liquid with an odor described as ammoniacal, pepper-like; the name comes from the genus name *Piper*, which is the Latin word for pepper. Piperidine is a widely used building block and chemical reagent in the synthesis of organic compounds, including pharmaceuticals.

REVIEW OF LITERATURE

Piperidine itself has been obtained from black pepper, from *Psilocaulon absimile* N.E.Br (Aizoaceae) and in *Petrosimonia monandra*. The piperidine structural motif is present in numerous natural alkaloids. These include piperine, which gives black pepper its spicy taste. This gave the compound its name. Other examples are the fire ant toxin solenopsin, the nicotine analog anabasine of the Tree Tobacco (*Nicotiana glauca*), lobeline of the Indian tobacco, and the toxic alkaloid coniine from poison hemlock, which was used to put Socrates to death.

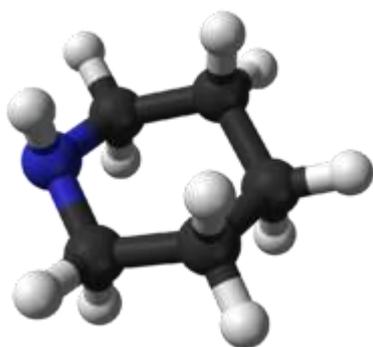
MATERIAL AND METHOD

piperidine is produced by the hydrogenation of pyridine, usually over a molybdenum di Sulphide catalyst:

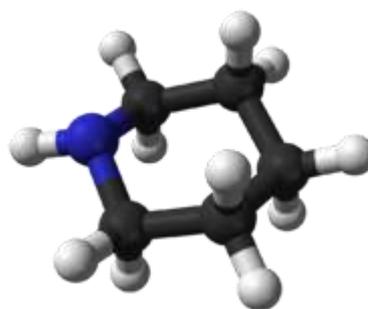


Pyridine can also be reduced to piperidine by sodium in ethanol.

Piperidine prefers a chair conformation, similar to cyclohexane. Unlike cyclohexane, piperidine has two distinguishable chair conformations: one with the N–H bond in an axial position, and the other in an equatorial position. After much controversy during the 1950s–1970s, the equatorial conformation was found to be more stable by 0.72 kcal/mol in the gas phase. In nonpolar solvents, a range between 0.2 and 0.6 kcal/mol has been estimated, but in polar solvents the axial conformer may be more stable. The two conformers interconvert rapidly through nitrogen inversion; the free energy activation barrier for this process, estimated at 6.1 kcal/mol, is substantially lower than the 10.4 kcal/mol for ring inversion. In the case of *N*-methylpiperidine, the equatorial conformation is preferred by 3.16 kcal/mol, which is much larger than the preference in methylcyclohexane, 1.74 kcal/mol.



Axial conformation



Equatorial conformation

CONCLUSION AND RESULT

Piperidine is a widely used secondary amine. It is widely used to convert ketones to enamines. Enamines derived from piperidine can be used in the Stork enamine alkylation reaction. Piperidine can be converted to the chloramine $C_5H_{10}NCl$ with calcium hypochlorite. The resulting chloramine undergoes dehydrohalogenation to afford the cyclic imine.

NMR chemical shifts ^{13}C NMR = (CDCl₃, ppm) 47.5, 27.2, 25.2
 1H NMR = (CDCl₃, ppm) 2.79, 2.19, 1.51

Piperidine is used as a solvent and as a base. The same is true for certain derivatives: *N*-formylpiperidine is a polar aprotic solvent with better hydrocarbon solubility than other amide solvents, and 2,2,6,6-tetramethylpiperidine is a highly sterically hindered base, useful because of its low nucleophilicity and high solubility in organic solvents.

A significant industrial application of piperidine is for the production of dipiperidinyl dithiuram tetrasulphide, which is used as a rubber vulcanization accelerator.

- Piperidine and its derivatives are ubiquitous building blocks in the synthesis of pharmaceuticals and fine chemicals. The piperidine structure is e.g. found in the pharmaceuticals: SSRI (Selective Serotonin Reuptake Inhibitors)
 - paroxetine
- Analeptics/Nootropics (Stimulants)
 - methylphenidate
 - ethylphenidate
 - pipradrol
 - desoxypipradrol
- SERM (Selective Estrogen Receptor Modulators)
 - raloxifene
- Vasodilators
 - minoxidil
- Neuroleptics (Antipsychotics)
 - risperidone
 - thioridazine
 - haloperidol
 - droperidol
 - mesoridazine
- Opioids
 - Pethidine (Meperidine)
 - loperamide
- Other agents
- Psychochemical compounds
 - melperone the psychochemical agents Ditrans-B (JB-329), *N*-methyl-3-piperidyl benzilate (JB-336) and in many others.

Piperidine is also commonly used in chemical degradation reactions, such as the sequencing of DNA in the cleavage of particular modified nucleotides. Piperidine is also commonly used as a base for the deprotection of Fmoc-amino acids used in solid-phase peptide synthesis

REFERENCES

1. Knunyants, I. L., ed. (1988). "Voltage molecules". *Chemical Encyclopedia* **3**. "Soviet encyclopedia". pp. 330–334.
2. ^{a b} Traven VF (2004). VFTraven, ed. *Organic chemistry: textbook for schools* **2**. ECC "Academkniga". pp. 102–106. ISBN 5-94628-172-0.
3. ^a Cunningham G. L., Levan W. I., Gwinn W. D. (1948). "The Rotational Spectrum of Ethylene Oxide". *Phys. Rev.* **74** (10): 1537. doi:10.1103/PhysRev.74.1537.
4. ^a "The dipole moments of certain substances". ChemAnalitica.com. 1 April 2009. Retrieved 2009-09-21.
5. ^a Kondrat'ev, VN, ed. (1974). *Energy of chemical bonds. Ionization potentials and electron affinity*. Nauka. pp. 77–78.
6. ^{a b} "Medical Management Guidelines for Ethylene Oxide". *Medical Management Guidelines (MMGs)*. Agency for Toxic Substances and Disease Registry. Retrieved 2009-09-29.