Welcome students. I'm Dr. Chandan Amonkar from P.E.S.

college. I'll be taking paper: organic chemistry, CHC 107,

semester 5th, section B, Unit 4, Chemistry of Heterocyclic compounds,

module name, structure, reactivity, resonance

and industrial source of pyridine. In this presentation I will

be discussing structure of pyridine, reactivity of pyridine

resonance in pyridine, and industrial source of pyridine.

In this presentation, the students will be able to learn.

Structure of pyridine, reactivity of pyridine, resonance in pyridine

and industrial source of pyridine. Structure of pyridine,

The IUPAC name for pyridine is Azine. The

structure of pyridine is similar to the benzene ring except one

Carbon atom is replaced by nitrogen atom. It is a 6- membered

heterocyclic aromatic organic compound. It is a liquid having

fish-like smell. It is basic in nature, and it is found in many natural products,

Pharmaceutical products and synthetic intermediates. In pyridine.

Nitrogen Atom is numbered as 1. Some methyl derivatives

of pyridine are shown here. 2-picoline, in this case, methyl

group is attached to carbon 2. 3-picoline, in this methyl

group is attached to third position, 4- picoline, in this methyl is

attached to 4th position. 2,4-Lutidine, in this case, two methyl groups are attached to C2

and C4 positions, 2,4,6 -collidine, in this three methyl groups are

attached to 2nd, 4th and 6th positions. carboxylic derivatives.

In this COOH is attached to second position, that compound

is called picolinic acid. When the COOH group is attached to third

position, it is called nicotinic acid. It is also called as naicin or Vitamin B-3,

when the COOH is attached to fourth position it is called isonicotinic acid.

Hybridization of carbon and nitrogen atoms in pyridine. Hybridization means mixing of

atomic orbitals to form new orbitals. In pyridine

all 5 carbon and one nitrogen atoms are sp2 hybridized. In all

five carbon atoms, there are three SP2 orbitals with one electron in each, and

there is one p orbital with one electron.

This figure shows hybridization of carbon atom in pyridine. In this, all the

3 SP2 hybridized orbitals, with one electron each, form three Sigma bonds.

Unhybridized P orbital with a single electron, forms π bond. The

two SP2 hybridized orbitals of carbon atoms form two Sigma

bonds with adjacent atoms by axial overlap of orbitals. The

third SP2 hybridized orbital of carbon atoms form Sigma bonds

with S orbital of each H atom.

Hybridization of nitrogen atom in Pyridine. There are three SP2 hybrid orbitals and one

Unhybridized P orbital on nitrogen. The two SP2 hybrid

orbitals contain one electron each form two Sigma bonds with

two adjacent carbons. The third SP2 hybrid orbital contains a lone pair on nitrogen lies outside the ring and along the plane of the ring and the unhybridized P orbital with one electron, on nitrogen remains perpendicular to the plane of the ring. This figure shows hybridization of nitrogen atom in pyridine. The two SP2 hybridized orbitals with one electron each form two Sigma bonds and the third SP2 hybridized orbital with lone pair lies on nitrogen, outside the ring along the plane of the ring and the unhybridized P orbital with single electron form Pi bond. It lies perpendicular to the plane of the ring. This figure shows P orbitals in pyridine.

All the five carbon atoms and nitrogen atom contain unhybridized P orbitals with one electron each. This structure shows molecular orbital picture of pyridine. All the P orbital lies perpendicular to the plane of the ring and they overlap laterally to form Pi electrons clouds.

Reactivity of pyridine,

Pyridine is less reactive than benzene towards electrophilic aromatic substitution. Pyridine is more reactive than benzene towards nucleophilic aromatic substitution. This is because, nitrogen is more electronegative than carbon and withdraws

electron density towards itself. Resonance in pyridine. Resonance:

a molecule can have more than one Lewis structures. The

molecule is represented by a single resonance hybrid structure. The resonance hybrid

structure has a lower energy than the other contributing

structures. This figure shows resonance contributing

structures in pyridine. Structure 1: shifting of

double bonds give structure 2.

Shifting of electrons from N and C2 bond gives negative charge on

the nitrogen and positive charge on carbon 2. Shifting of double

bond of third and fourth position delocalized positive

charge on 4th carbon, and shifting of C-5 and C-6 double bond

delocalizes positive charge, giving Intermediate 5. So

in pyridine there are five

resonating structures. The Resonance hybrid structure can

be written by drawing a small circle inside the six membered

ring. Evidence for resonance in pyridine. Its resonance energy is

96 kilojoule per mole. Pyridine is planar. All the carbon,

hydrogen, nitrogen atoms lie in the same plane. All C-C bonds are

of equal lengths. That is1.39 Angstrom unit, which is

intermediate between C-C. Singlebond, and C-C double bond. The two

C-N bonds are.

also of equal lengths, that is 1.37 Angstrom unit, which is intermediate between C-N single bond, and C-N double bond. It resists addition reactions shown by double bonds due to absence of true double bonds, it undergoes electrophilic substitution reactions. Industrial source of pyridine. Pyridine can be obtained from coal tar. Pyridine can also be obtained, by heating tetrahydro-furfurylaldehyde and ammonia in presence of alumina catalyst. To summarize, structure of pyridine, resonance in pyridine, reactivity of pyridine and industrial source of pyridine were discussed in detail. ,Students, for your further knowledge you can refer these books. Thank you.