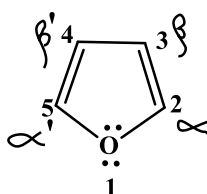


FURAN

Structure:

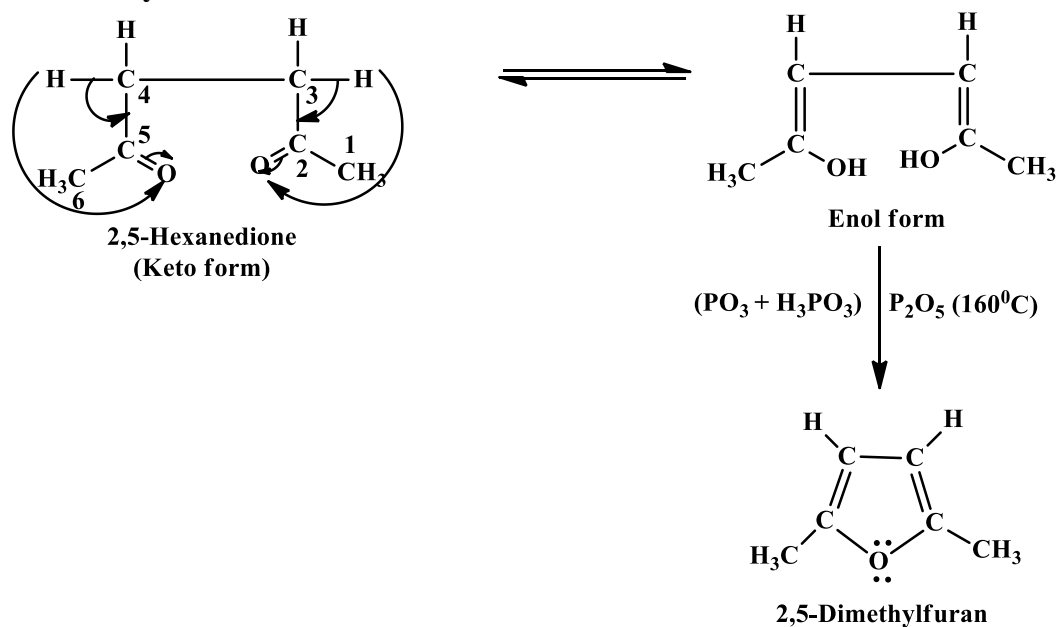


Molecular formula= C₄H₄O

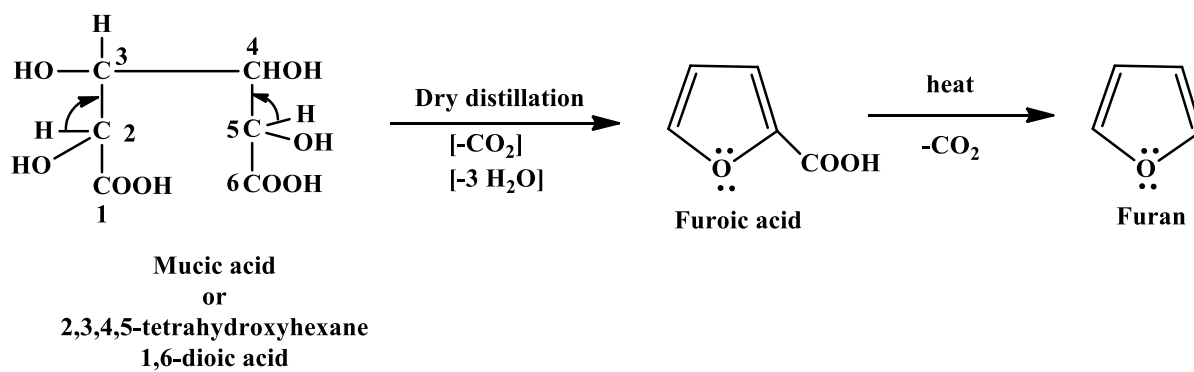
Nomenclature= 1-Oxole or Oxacyclopent-2,4-diene

Preparation:

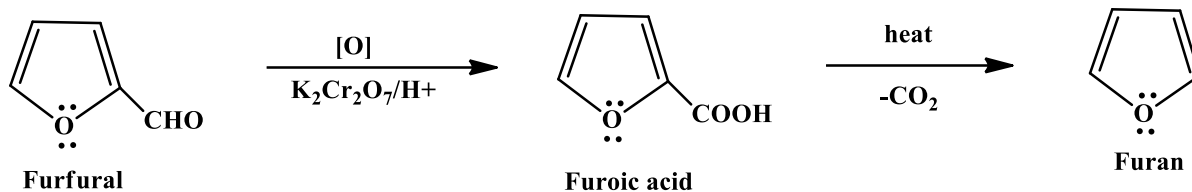
1. Paal-Knorr synthesis:



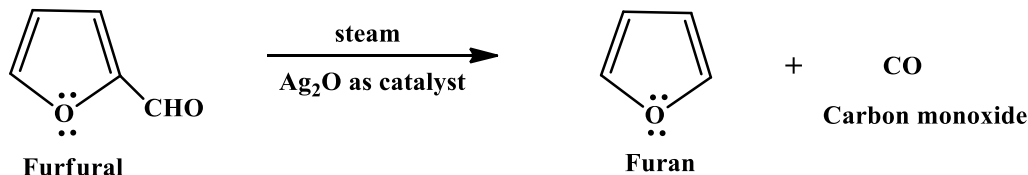
2.



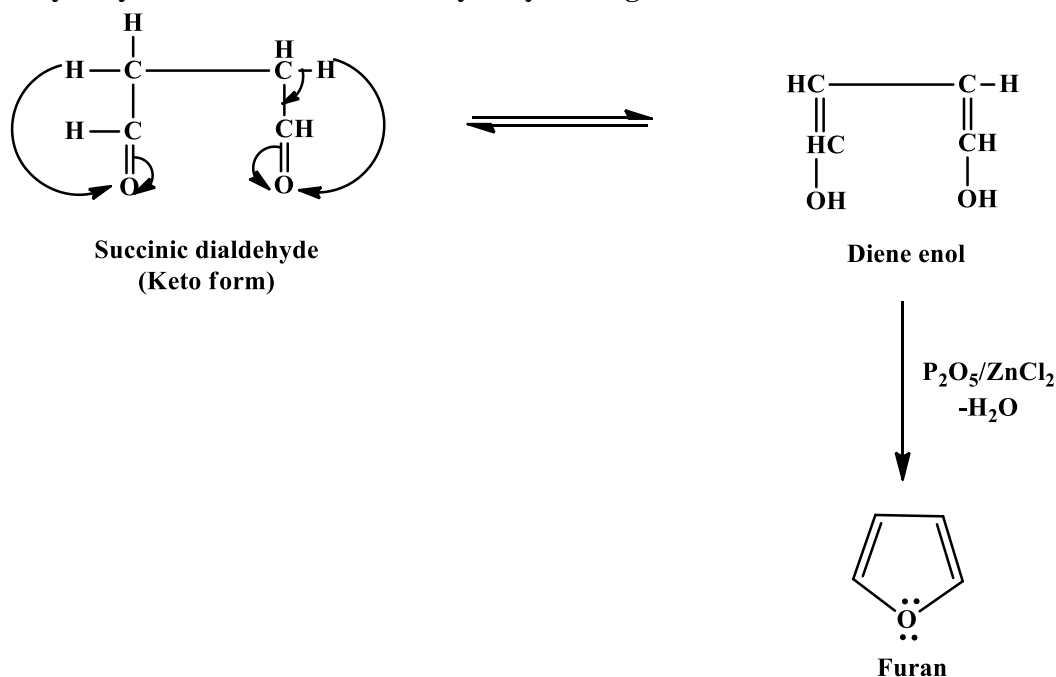
3.



4. Commercial preparation:



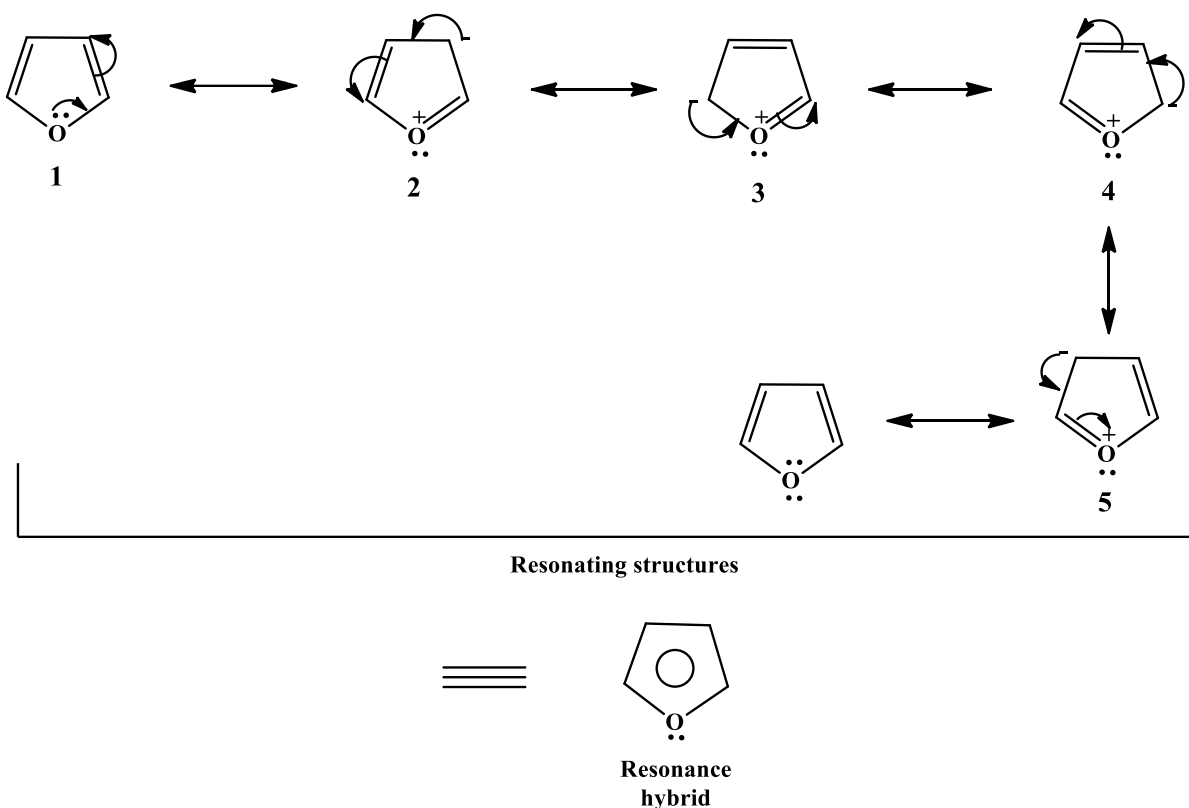
5. By dehydration of succinic dialdehyde by heating with $\text{P}_2\text{O}_5/\text{ZnCl}_2$:



Chemical Properties:

1. Structure:

Furan is aromatic in nature because it follows Huckel's rule i.e. $(4n+2)\pi$ electrons. It has total six electrons (one lone of electron involved in resonance but second lone pair occupies an sp^2 hybrid orbital which is perpendicular to the π system of the ring). It behaves as a resonance hybrid.



2. Electrophilic Substitution Reaction:

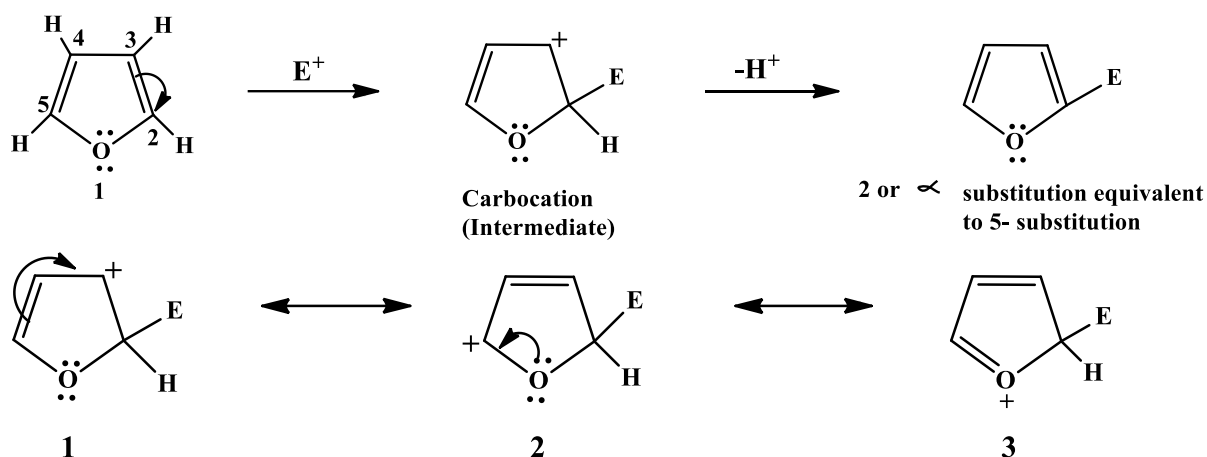
Furan is aromatic in nature and shows the usual reaction of aromatic compounds, the electrophilic substitution reactions.

Furan is more reactive than benzene towards electrophilic substitution reactions as it contains electron withdrawing Oxygen atom.

Orientation of substitution in Furan:

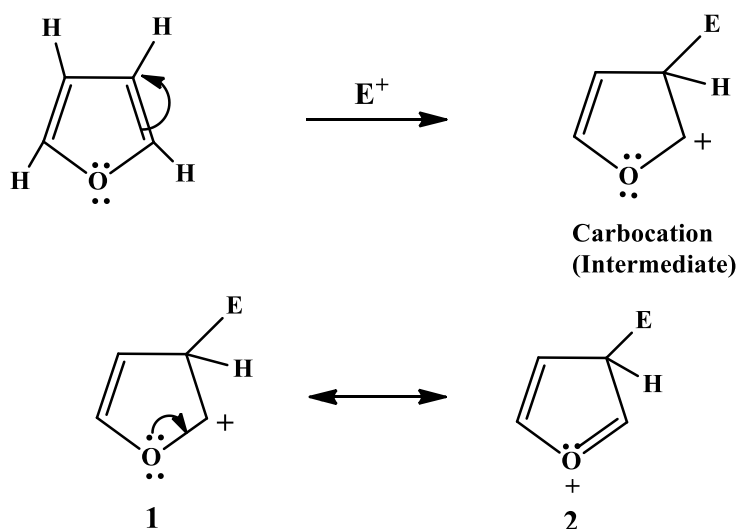
Electrophilic substitution of this ring system occurs at 2 or 5 position. The intermediate carbocation resulting by the attack of an electrophile at 2 and 5 position is resonance stabilised to a greater extent than that in case of 3 or 4 substitution. Substitution at 3 or 4 position, can take place if 2 and 5 position blocked because intermediate carbocation is stabilised by the accommodation of the positive charge on the heteroatom.

2-or 5(α)- substitution:



Resonance stabilization of intermediate Carbocation

3- or 4(β)- substitution:



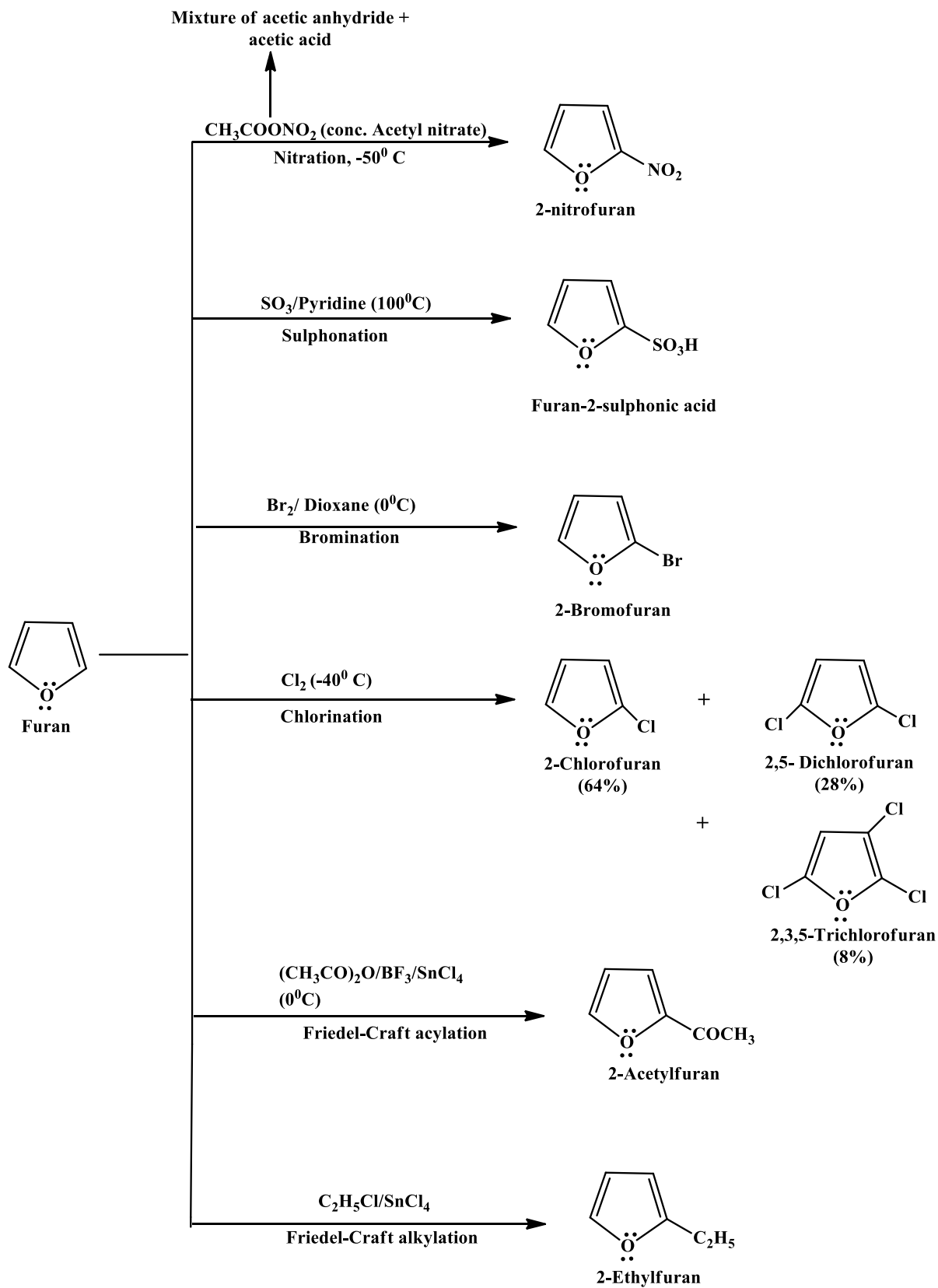
Resonance stabilization of intermediate Carbocation

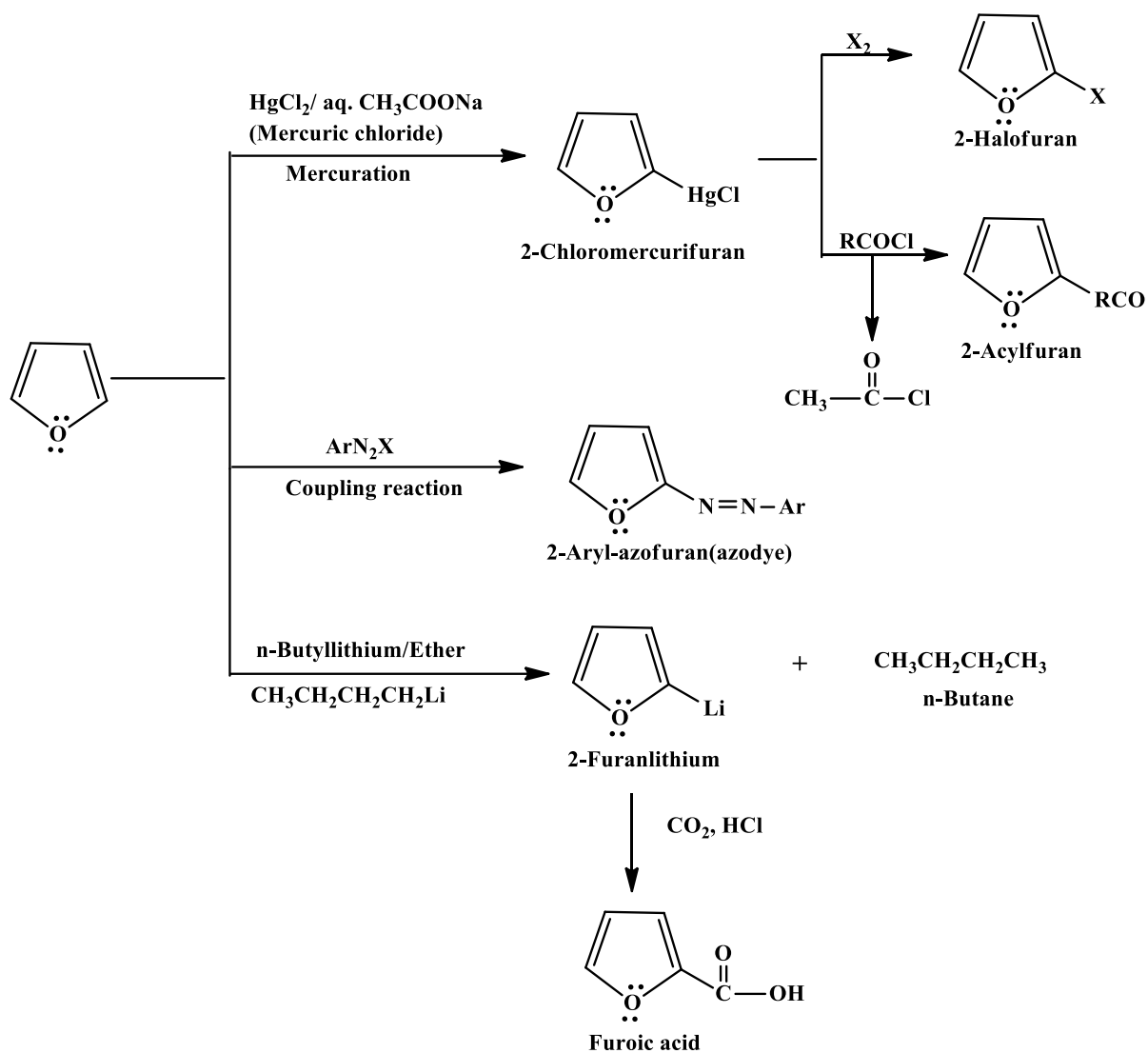
Now comparing the resonating structures for both the attacks, it may be indicated that 3 resonating structures are possible for attack at 2nd position while only two for at 3rd position. Attack at position -2 preferred due to greater number of resonance structures, greater is the stability of the compound. So E^+ substitution in Furan mainly takes place at position -2.

Note:

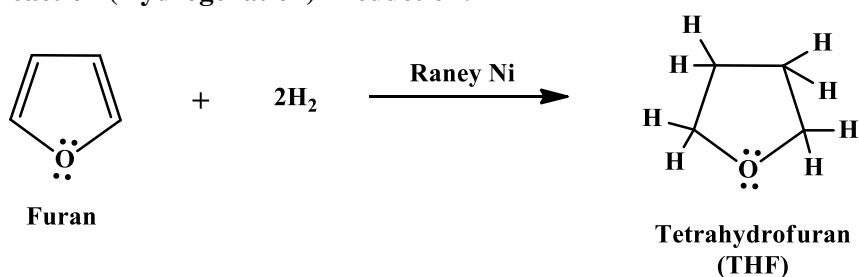
- a. Furan, like Pyrrole undergoes electrophilic substitution reactions mainly at C-2 substitution at C-3 occurs only when both of the 2- positions (i.e. α and α') are already blocked.
- b. Electrophilic substitution reactions of furan are not carried in the presence of strong acids. because under such conditions it undergoes polymerization.

Important Reactions:





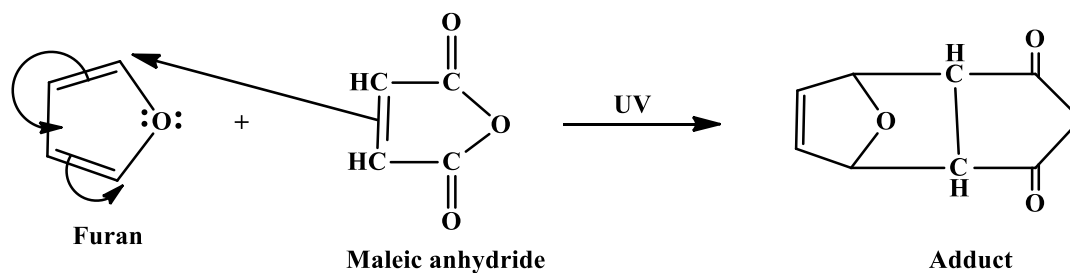
3. Addition reaction (Hydrogenation)- Reduction:



4. Diels-Alder reaction:

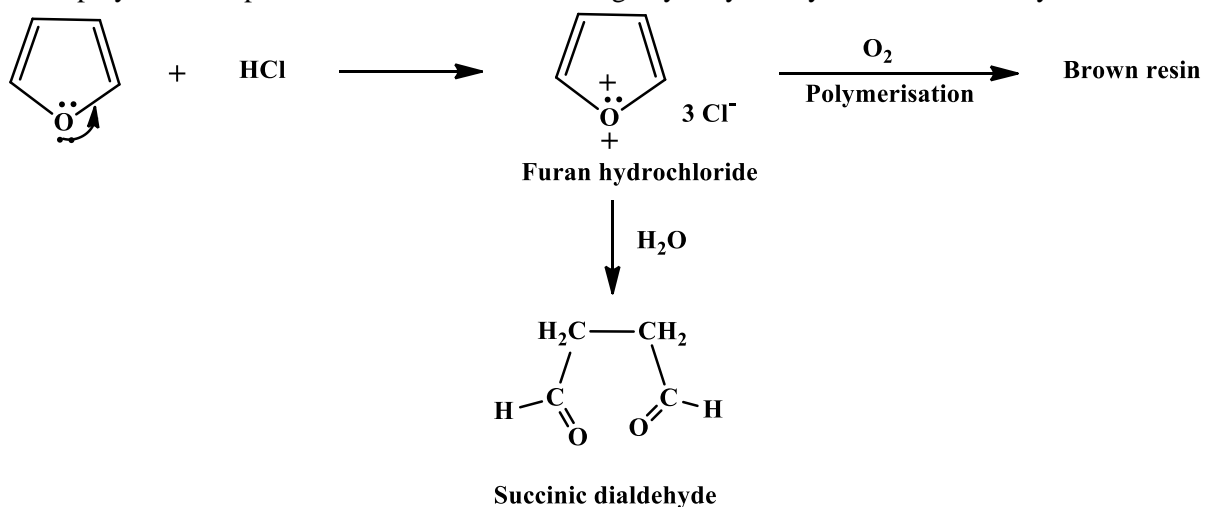
Note:

- Furan has sufficient diene character to undergo Diels-Alder reaction with maleic anhydride to form an addition product (Adduct).
- The addition occurs across C-2 and C-5.
- Pyrrrole and Thiophene do not give this reaction.

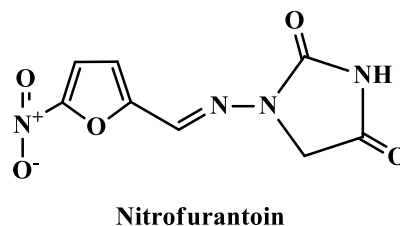
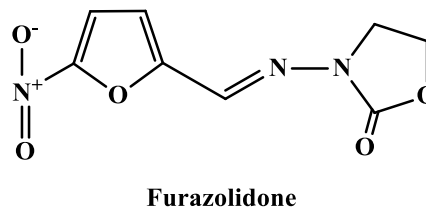
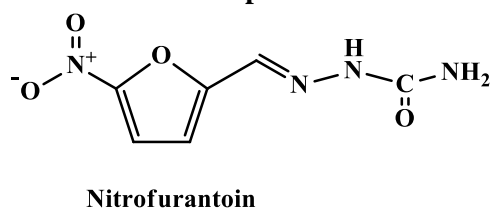


5. Basic Character:

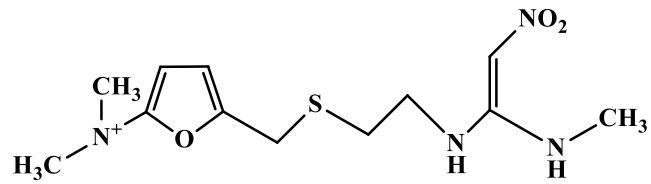
Furan, like Pyrrole, is a weak base. It forms unstable salts with mineral acids. These salts may either polymerise to produce a brown resin or undergo hydrolysis to yield succindialdehyde.



Pharmaceutical Importance / Medicinal uses:



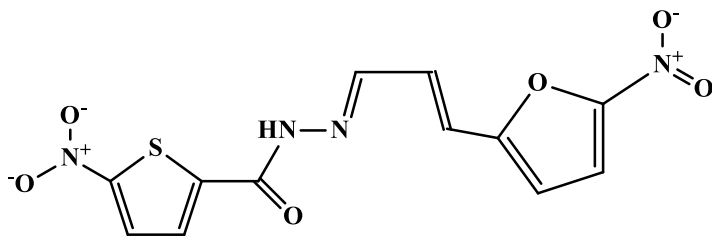
Furan derivatives drugs like furazolidone, nitrofurazone, nitrofurantoin used to treat diarrhoea and enteris caused by bacterial or protozoan infection as antiparasitic drug.



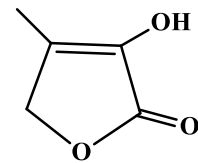
Ranitidine
(H₂ histamine as antagonist)

Furan is used in synthesis of Ranitidine.

Furan is used in synthesis of furaneol, natural perfume distilled from strawberries.



Nifurzide (antiinfective)



Furaneol