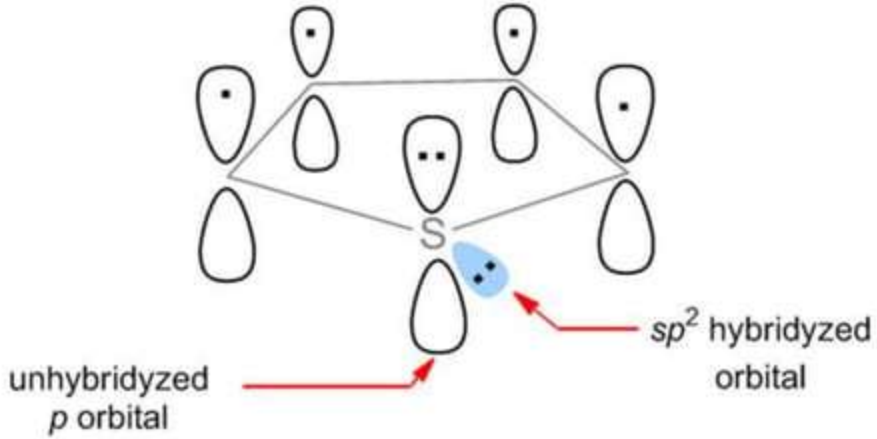
Properties

1. Aromaticity



Properties

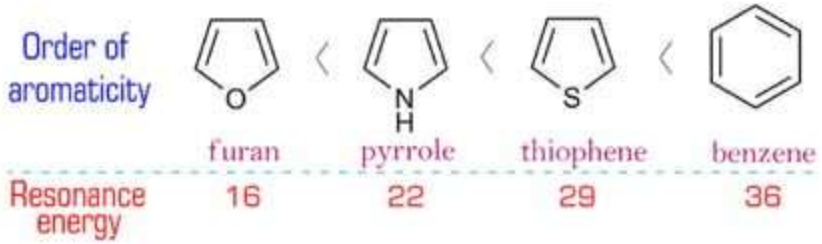
1. Aromaticity

- Thiophene have 4 C and 1 S , all are sp^2 hybridized
- sp^2 hybridization is planar, it makes a planar thiophene ring structure.
- Each ring atom also contains unhybridized p orbital that is perpendicular to the plane of σ bonds (plane of ring).
- Here p orbitals are parallel to each other, so overlapping btwn p orbitals is possible.
- the total nu of non bonding e- are 6 (4 of four C, 2 from one S)
- The resonance of 6 e- follows the Hückel's rule
- So the thiophene is aromatic .

Properties

1. Aromaticity

Furan is less aromatic / thiophene is more aromatic

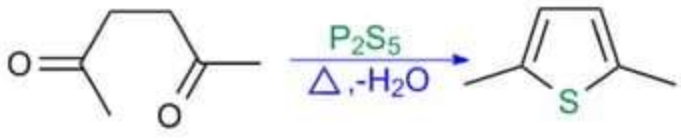


- This order depends on order of electronegativity of heteroatoms
- The more e-ve is the atom → the more tightly holds its lone pair of e- → more reduce the *ease of delocalization (aromaticity).*
- So most e-ve O in furan most decrease aromaticity.
  & Least e-ve S in thiophene least decrease aromaticity.
- Thus ....

Synthesis

1. Paal-Knorr synthesis of thiophene

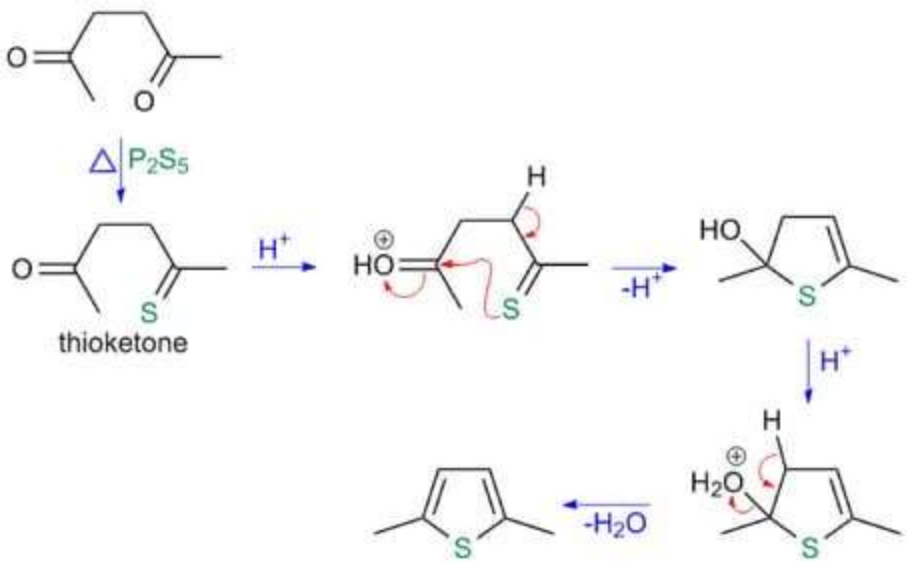
- The condensation of 1,4-dicarbonyl compounds with sulfur sources gives thiophene.



Synthesis

1. Paal-Knorr synthesis of furan

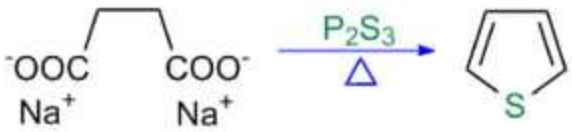
Mechanism



Synthesis

2. From sod. succinate

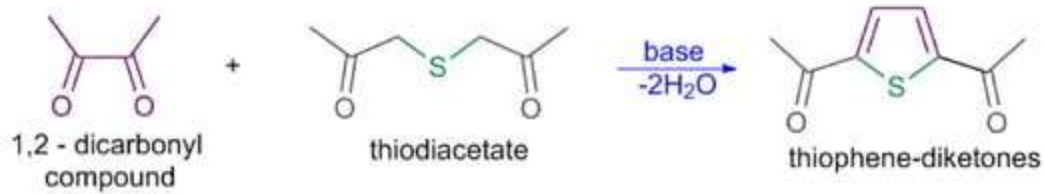
- Laboratory synthesis
- Heating a mix. of sod. succinate and phosphorus trisulfide.

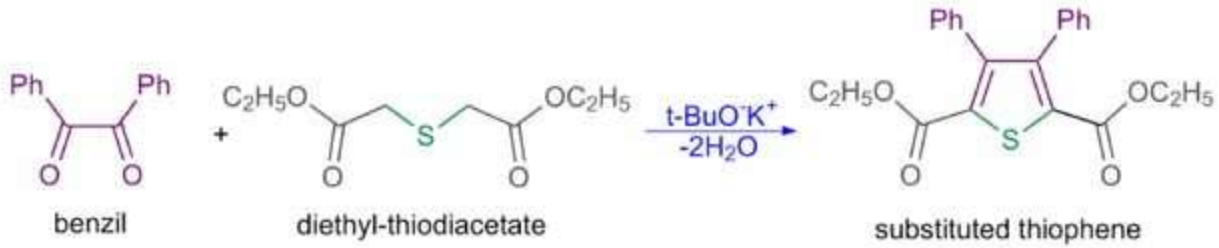


Synthesis

3. Hinsberg Synthesis

- Condensation between a 1,2 - dicarbonyl compound and diethyl thiodiacetate in presence of strong base give thiophene 2,5 - diacids (- diketone)

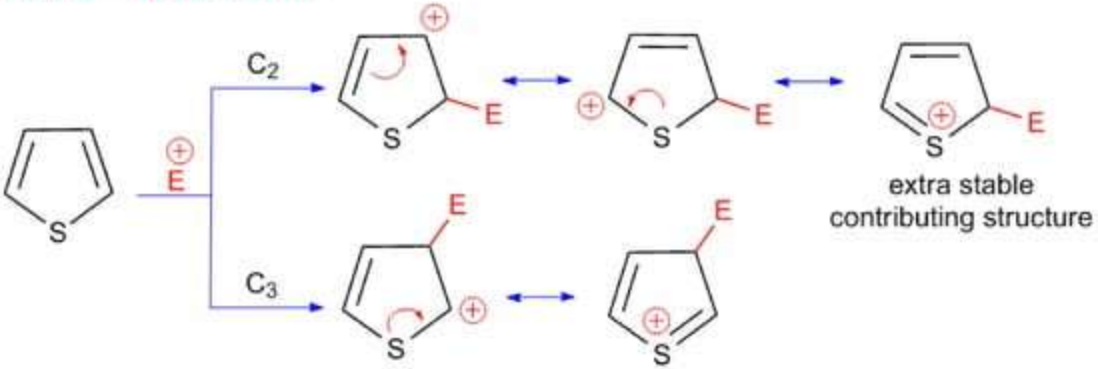




Reactions

1. Electrophilic substitution

thiophene undergoes electrophilic substitution reaction at 2nd position



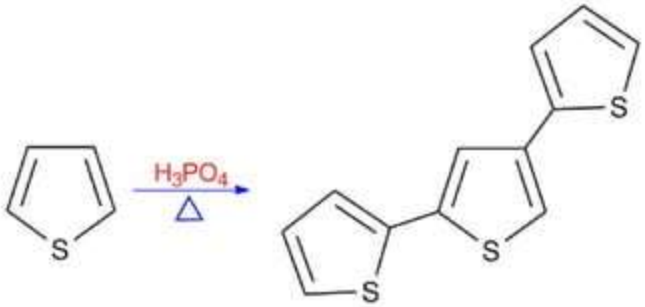
2 reasons…

- C2 attack gives more resonance contributing structures than C3.
- Extra stable contributing structure generates upon C2 attack

Reactions

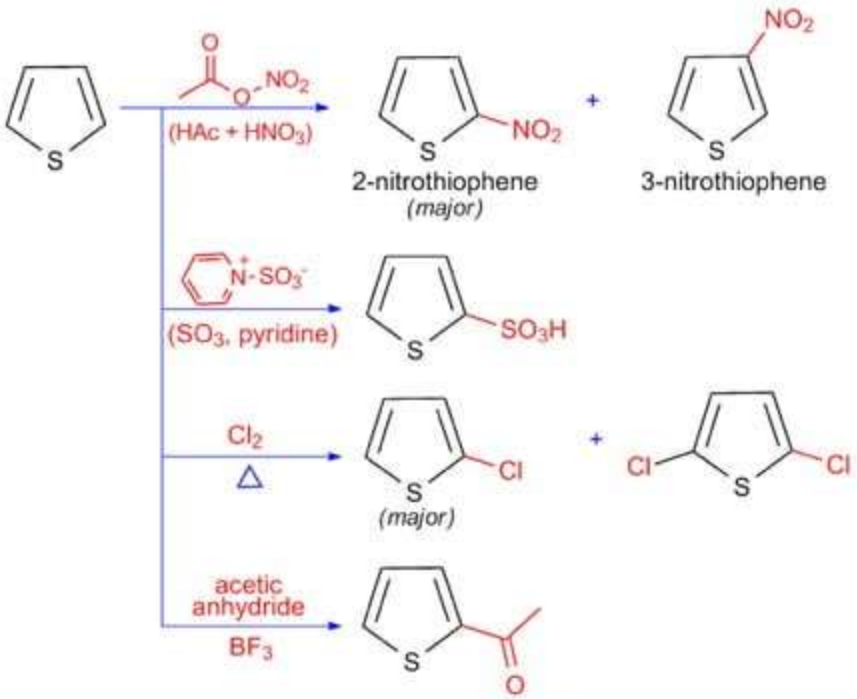
1. Electrophilic substitution

- Very strongly acidic conditions lead to acid – catalysed polymerization.
- The action of hot phosphoric acid on thiophene leads to a trimer.



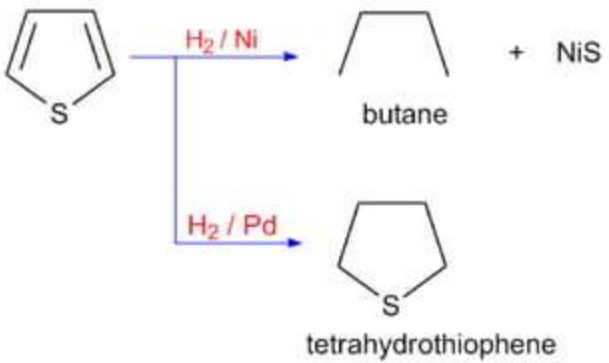
Reactions

1. Electrophilic substitution



Reactions

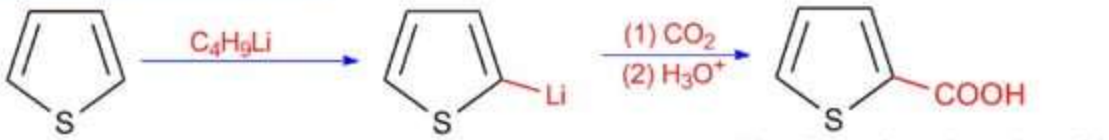
2. Reduction



Reactions

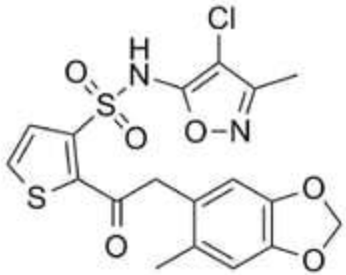
3. reaction

reaction with organolithium

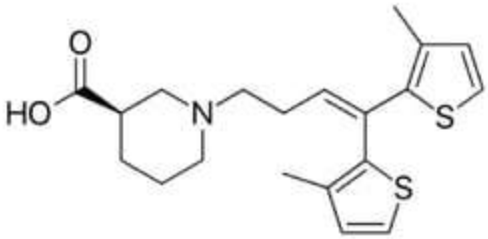


Medicinal uses

(1) *Sitaxsentan:* Cardiovascular Agent , used in pulmonary artery hypertension



(2) *Tiagabine:* Anticonvulsant Agent, used in the treatment of epilepsy



Medicinal uses

(3) *Articaine:* Anesthetic Agent