Chapter 4 Furans, Benzofurans, Thiophenes, and Benzothiophenes

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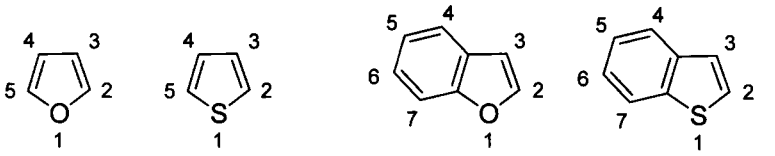
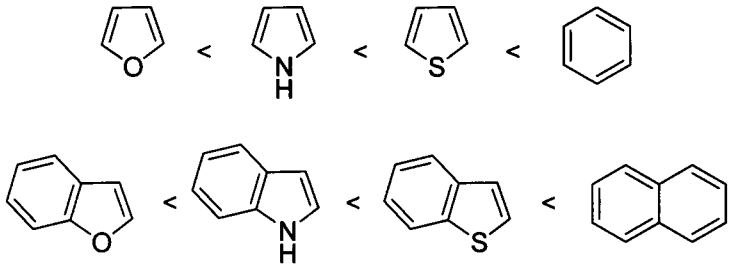
4.1 Introduction



Furan is a colorless, water-insoluble liquid with a boiling point of 31 °C and is described as having a pleasant odor. Polymerization of furan occurs readily at room temperature but can be stabilized by the addition of hydroquinone or phenol. Thiophene, the sulphur congener of furan, is a stable, colorless liquid with a boiling point of 84 °C and an odor similar to benzene.

Benzofuran is a colorless oil with a boiling point of 173 °C. It occurs naturally in coal tar and is believed to form during carbonization by cyclodehydration of 2-ethylphenol. In contrast, benzothiophene is a white solid with a melting point of 32 °C. It is considered an aquatic toxin with acute and long-lasting effects.


Aromaticities

Furan and thiophene rings are electron-rich, five-membered aromatic systems. The donation of a pair of electrons by the heteroatom into the π-system is essential to the aromaticity of these compounds. Due to the highly electronegative oxygen heteroatom, the aromaticity of furan is comparable to pyrrole.[1] The aromaticity of benzofuran is comparable to indole for similar reasons. On the other hand, the aromaticity of thiophene resembles benzene due to the decreased electronegativity of the sulfur heteroatom. For similar reasons, the aromaticity of benzothiophene is comparable to naphthalene.[1]