Electrophilic Aromatic Substitution #6: Friedel Crafts Acylation

Reaction

\[
\text{C}_6\text{H}_5 - 1) \overset{\text{AcCl} / \text{AlCl}_3 (1.2 \text{ eq.})}{\rightarrow} \overset{\text{H}_2\text{O}}{\longrightarrow} \text{C}_6\text{H}_4\text{COH}
\]

Electrophile

Mechanism

For this acylation process the electrophiles are always acylium ions. They are resonance stabilized. The C-O bond is shorter than in a carbonyl. This suggests a greater contribution of the \( \text{C}=\text{O} \) to the resonance hybrid.

The Friedel-Crafts acylation reaction requires at least an equivalent amount of the Lewis acid because it is bound to the product forming an adduct. Experimentally more than an equivalent is added. Then addition of water as a second step is used to break-up the adduct.

In the case of Friedel-Crafts acylation over-acylation rarely occurs. This is due to the fact that the product of the reaction is deactivated toward EAS more so than the starting reagent.

On disadvantage of the acylation process is that in a substituted aromatic starting reagent the substituent has to activate the arene compound. Halogens or less deactivating substituents will not allow arene compounds to react.