

Editorial on Nucleophilic Aromatic Substitution

Sandhya Kille

Department of Microbiology, Acharya Nagarjuna University, Guntur, Andhra Pradesh, India

EDITORIAL

Intermediates have been isolated by adding nucleophiles to various electron-poor aromatic molecules with a leaving group. It is possible to separate and classify Meisenheimer intermediates. When heated, however, the compound transforms into the nucleophilic aromatic substitution element.

We've noticed that most aromatic compound reactions require electrophilic substitutions since the aromatic ring is electron-rich and therefore nucleophilic due to the electrons. Nucleophilic substitution (S_NAr) can occur instead of electrophilic substitution in some aryl halides with heavy electron-withdrawing substituents on the ring.

The EWG stands for electron-withdrawing group, which is used to unlock the ring by making it electron-deficient. X stands for leaving group, and EWG stands for electron-withdrawing group.

While other resonance-withdrawing groups such as carbonyls may also activate the ring against a nucleophilic attack, the nitro group is commonly used as the electron-withdrawing group.

A number of charged and neutral heavy nucleophiles, such as -OH, -OR, -NH₂, -SR, NH₃, and other amines, can be used as the nucleophile.

The ortho or para position of the electron-withdrawing group to the leaving group is one condition for these reactions. The resonance stabilisation of the negative charge in the transition state is only possible in this orientation.

We'll go through the specifics of the mechanism later, but for now, know that the reactivities of aryl halides increase in the following order, depending on the leaving group.

In a nucleophilic aromatic substitution, the more electronegative the halogen, the stronger the leaving group.

And this goes against all we learned in the S_N1 and S_N2 reactions. The strongest bond is carbon-fluorine, and the best leaving group is iodide since it is polarizable.

The Mechanism of Aromatic Nucleophilic Substitution

The leaving group halide is substituted by a nucleophile, as in other substitution reactions. However, the mechanism of nucleophilic aromatic substitution differs from that of the S_N1 and S_N2 reactions. The main difference is that aryl halides cannot undergo an S_N2 reaction due to a nucleophile backside attack, and unlike S_N1, the leaving group cannot be lost because the phenyl cations are very unstable.

Correspondence to: Sandhya Kille, Department of Microbiology, Acharya Nagarjuna University, Guntur, Andhra Pradesh, India, E-mail: sandhyaranikille96@gmail.com

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