

Solvent-effects on photoreactions

Solvents control the pathway of photoreactions by modulating solubility, redox potentials, photon flux, and reorganization energies. Particularly strong solvent effects are observed for electron-donor-acceptor (EDA) complexes due to the formation of a radical ion pair intermediate. EDA complexes are formed in solution by association of an electron-rich and an electron-poor substrate and reactive radical ion pairs can be obtained by visible light irradiation. EDA complexes have been known in biological systems for decades but have recently gained attention as tools for selective radical reactions.¹ Solvents primarily influence the rate of formation of the radical ion pair as well as that of its separation to the free radical ions. In this module we will show how a solvent cocktail can be designed to enable highly selective reactions of electron-donor-acceptor (EDA) complexes.



Figure 1. EDA complex formation.

Specifically, the photoactivity of EDA complexes will be harnessed to achieve cross-coupling reactions without expensive transition metal-based catalysts. The candidates will perform solvent screens on a micro-scale using our indigenously built photoreactors. The reactions will be analyzed by GC-FID, GC-MS, and NMR spectroscopy.

In this practical course, the candidates will learn:

1. Setting up micro-scale reactions in photoreactor.
2. Analyzing the outcome of a crude reaction by using a combination of advanced analytical techniques.
3. The role of solvation in organic reactions.

References

1. Crisenza, G. E. M.; Mazzarella, D.; Melchiorre, P. *J. Am. Chem. Soc.* **2020**, *142*, 5461.