Light-Camera-Action: Shining Visible Light on Hantzsch Ester

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When exposed to light, molecules in an electronically excited state undergo fascinating chemical reactions distinct from their behavior in the ground state.[1] This captivating principle lies at the core of photochemistry, giving rise to unprecedented transformations. In excited state, a molecule can serve as a superior electron donor (reductant) or a more effective electron acceptor (oxidant), capabilities unattainable through conventional ground-state reactivity.[2]

The redox reaction found in almost all living cells involves the conversion between NAD+ and NADH. This process is essentially a hydride (H^-) transfer reaction. In the realm of synthetic organic chemistry, the structurally similar 1,4-dihydropyridine (1,4-DHP) or Hantzsch ester has emerged as a promising hydride source in its ground state, commonly used in catalytic hydrogenation reactions.[3] Recent research has unveiled its potential to act as a strong photoreductant or as a source of hydrogen atoms via a single electron transfer (SET) process when exposed to visible light.[4]

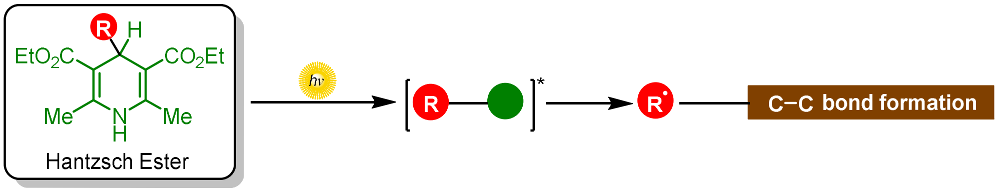

Figure 1. Graphical abstract of the generation of radicals from Hantzsch Ester

Moreover, structurally resemble, 4-alkyl-1,4-DHPs, in its excited state can act as a source of alkyl radicals without the need for any photocatalyst, and the resulting radicals can be further utilized to form C-C bonds. Inspired by the groundbreaking work of Melchiorre, Nishibayashi, and others,[5, 6] our group has also demonstrated C(sp3)-C(sp3) cross-coupling using these 4-alkyl-1,4-DHPs.[7] The focus of this talk will primarily center on the potential of these DHPs to reduce challenging molecules or to leverage the generated alkyl radicals to create diverse molecular complexity.

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