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Visible-Light-Mediated Energy Transfer Enables the Synthesis of β-Lactams via Intramolecular Hydrogen Atom Transfer
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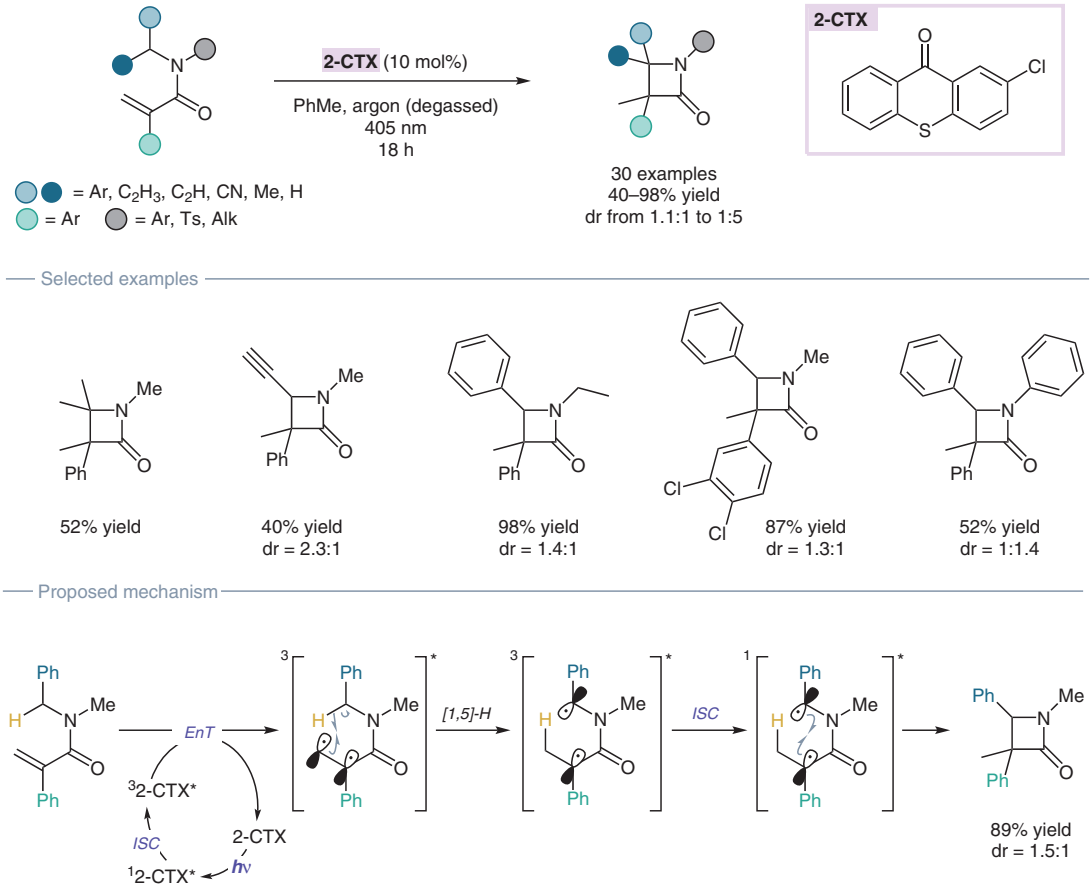
Visible Light-Mediated β-Lactam Synthesis from Acryl Amide Precursors



Significance: Petersen and co-workers report a visible light-mediated β-lactam synthesis from acryl amide precursors catalyzed by 2-chlorothioxanthone (2-CTX). The corresponding 2-azetidinones are obtained in moderate to excellent yields with poor to moderate diastereoselectivities. Mechanistic investigations including DFT calculations, deuterium labeling studies and competition experiments support a variation of the Norrish-Yang type II photocyclization being the dominant mechanistic pathway.

Comment: Supported by DFT calculations, an ionic Staudinger-like pathway is ruled out by the authors. Instead, a reaction mechanism is proposed that is initiated by an energy transfer (EnT) from the excited photosensitizer to the acryl amide, furnishing its triplet excited state. A 1,5-hydrogen atom transfer (HAT) is followed by an intersystem crossing (ISC) to its singlet state. Radical-radical coupling ultimately leads to the β-lactam formation. Notably, the lack of diastereoselectivity that is expected from this radical pathway, is mostly in agreement with the experimental results.

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Organo- and Biocatalysis

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