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Radical Strategies for the Aminofunctionalisation of Alkenes

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Amine-containing molecules are of significant importance to society, ranging from pharmaceuticals and agrochemicals, to the materials required to support the latest technological advances. Despite this, construction of C–N bonds is often still accomplished using well-established alkylation reactions or reductive amination processes, involving toxic and/or potentially unstable precursors. Transition metal mediated hydroamination of alkenes provides an alternative strategy for constructing C–N bonds; however, broadly applicable methods based on this concept remain limited.[1] While C–N bond forming reactions generally involve two-electron processes, recent advances in the field of photoredox catalysis have unlocked a range of hydroamination and aminofunctionalisation reactions involving nitrogen centred radicals.[2] These photo-mediated processes proceed under mild conditions and enable the conversion of alkenes into structurally diverse nitrogen-containing molecules.[3]

Here we describe our work on the synthesis of amine derivatives via the radical aminofunctionalisation of alkenes. In the first approach, we report a radical amination, ring expansion strategy for the functionalisation of both styrene and unactivated alkene substrates to access amine derivatives containing an all-carbon quaternary centre (Fig. 1A).[4] Our recent work on the applications of the radical amination chemistry in the synthesis of heterocyclic frameworks will then be discussed (Fig. 1B).

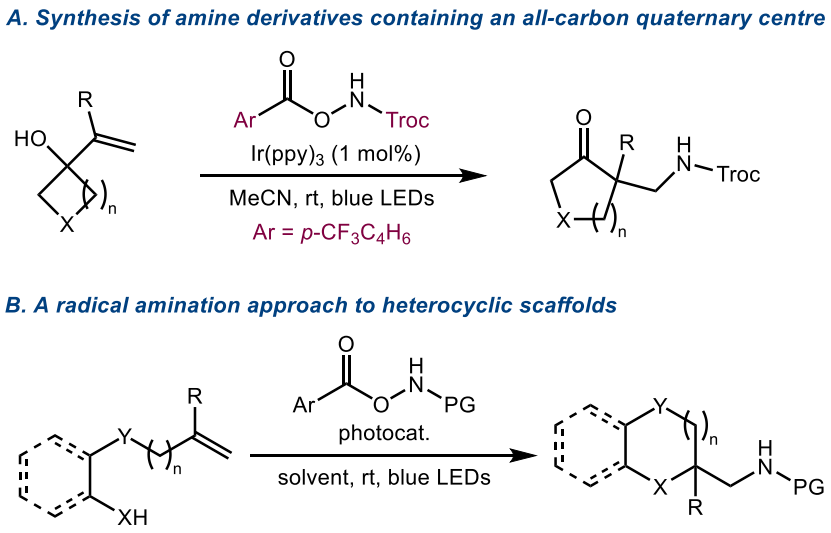

Figure 1. Radical aminofunctionalisation of alkenes.

1. Huang, L.; Arndt, M.; Gooßen, K.; Heydt, H.; J. Gooßen, L. *Chem. Rev.* **2015**, *115*, 2596–2697.

2. (a) Kwon, K. Simons, R.T.; Nadakumar, M.; Roizen, J.L. *Chem. Rev*. **2022**, *122*, 2353–2428; (b) Kärkäs, M.D. *ACS Catal*. **2017**, *7*, 4999–5022.

3. For recent examples see: (a) Liu, S.; Wang, J.; Qing, F.-L.; Xu, X.-H. *J. Am. Chem. Soc.* **2022**, *144*, 1962–1970; (b) Jiang, H.; Yu, X.; Daniliuc, C.G.; Studer, A. *Angew. Chem. Int. Ed.* **2021**, *60*, 14399–14404; (c) Yi, X.; Hu, X. *Chem. Sci*. **2021**, *12*, 1901–1906.

4. For a similar strategy that was recently reported see: Shi, D.-Q. *et al Org. Chem. Front.* **2021**, *8*, 4224–4229.