Surfactant-driven Strategies for Sustainable C–H Activation: Progressing Towards Mild Reaction Conditions

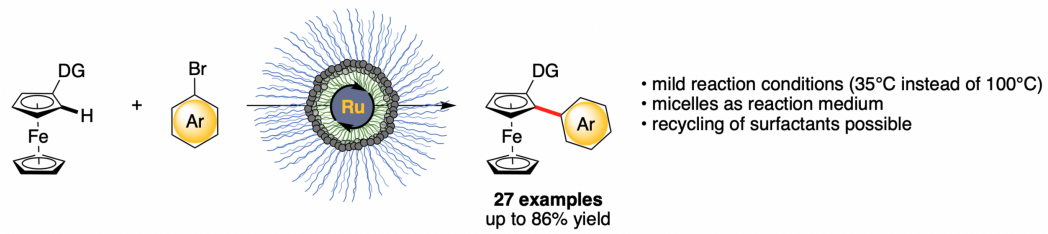
P. Hauk[1], J. Wencel-Delord[1]*, F. Gallou[2]*

[1]Laboratoire D'Innovation Moléculaire et Applications (UMR CNRS 7042), Université de Strasbourg/Université de Haute Alsace, ECPM, 67087, Strasbourg, France, [2]Chemical & Analytical Development, Novartis Pharma AG, 4056, Basel, Switzerland

Sustainability has become a top priority for every chemistry practitioner! Considering the development of a new reaction or that of a chemical process, sustainability, waste and energy minimization have become highly significant. The urgency has been further reenforced with the potential for a ban of several reprotoxic polar aprotic solvents such as DMF and NMP through the REACH regulation.[1] Alternatives for such reaction media are indispensable. In the last decade, micellar conditions in bulk water have emerged as promising alternatives for several transformations such as a variety of cross-couplings or amide bond formation. In clear contrast, only a handful of examples emerged for C–H activations under micellar conditions, and the rare examples often require high temperatures.[2]

Our research focuses on the development of new catalytic systems for mild C–H activations occurring under micellar conditions. Two approaches are envisioned: 1) the careful design of additives to commercially available surfactants[3] or 2) the implementation of novel designer surfactants, able to facilitate challenging C–H activations at ambient temperature.[4]

Remarkably, with newly designed surfactant obtained *via* installation of an additional ligand at the core of a commercially available surfactant in hand, we were able to lower the reaction temperature for the ruthenium C–H arylation of ferrocenes from 100°C to 35°C. Our conditions have shown to tolerate a broad spectrum of functional groups with yields up to 86% and a high chemoselectivity, enabling the late-stage functionalization of active pharmaceutical ingredients and natural products.



[1] L. Bergkamp, N. Herbatschek, Rev Eur Comp Int Environ Law, **2014**, 23, 221–245.

[2] P. Hauk, J. Wencel-Delord, L. Ackermann, P. Walde, F. Gallou, *Curr. Opin. Colloid Interface Sci.* **2021**, 56, 101506.

[3] P. Hauk, V. Mazan, F. Gallou, J. Wencel-Delord, *Manuscript under revision.*

[4] P. Hauk, S. Trienes, T. Oyama, P. Vana, M. Andersson, J. Wencel-Delord, F. Gallou, L. Ackermann, *Manuscript under revision.*