Caffeine and theophylline as NHC ligand precursors for second-generation ruthenium-alkylidene olefin metathesis catalysts

François Mazars and Lionel Delaude*

Laboratory of Catalysis, University of Liege, Allée du six août 13, 4000 Liege, Belgium

F.Mazars@uliege.be, http://www.cata.ulg.ac.be

Caffeine and theophylline are cheap, natural alkaloids that feature a bicyclic ring system derived from xanthine (Fig. 1). Upon alkylation, their imidazole moiety may be converted into imidazolium salts, which afford imidazolylidene N-heterocyclic carbenes (NHCs) upon deprotonation. Alternatively, the formation of a hypoxanthinium salt from the 6-membered ring of caffeine provides a distinct entry point to access the chemistry of amido-amino NHCs [1].

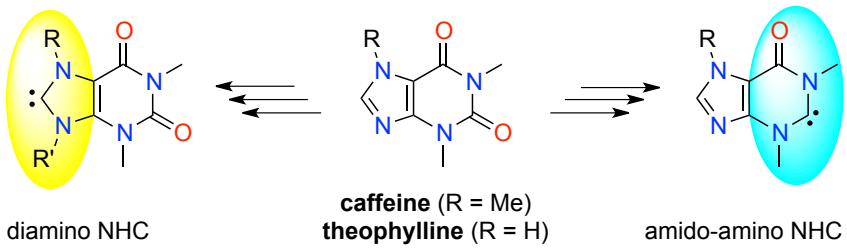

Fig. 1 NHCs derived from caffeine and theophylline.

The replacement of phosphine ligands by NHCs onto a ruthenium-alkylidene scaffold has led to a second-generation of highly efficient catalyst precursors for olefin metathesis [2, 3]. In particular, compounds featuring a benzimidazolylidene carbene, such as the BTol ligand, were highly active at promoting the ring-closure of tetrasubstituted cycloalkenes [4] (Fig. 2). In this communication, we shall disclose our recent endeavours to synthesize NHCs derived from caffeine and theophylline, and their use as ancillary ligands in ruthenium-catalyzed RCM reactions.

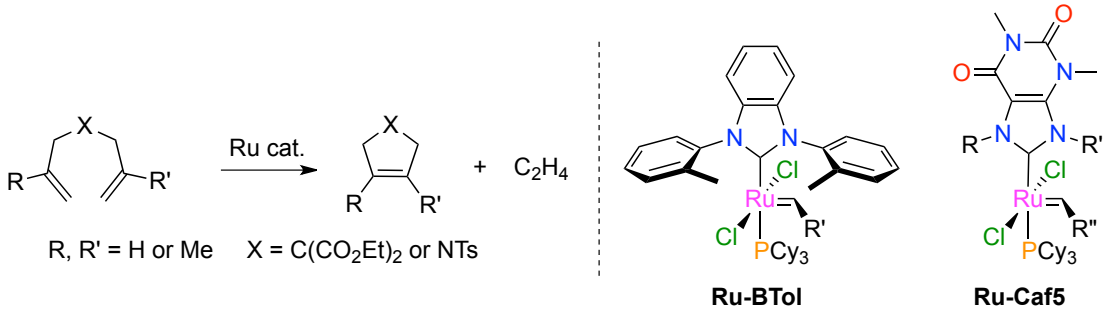

Fig. 2 RCM reactions catalyzed by second-generation ruthenium-alkylidene catalysts.

[1] A. Makhloufi, W. Frank, C. Ganter, *Organometallics*, **2012**, *31*, 7272-7277.
[2] C. Samojłowicz, M. Bieniek, K. Grela, *Chem. Rev.*, **2009**, *109*, 3708–3742.
[3] G. C. Vougioukalakis, R. H. Grubbs, *Chem. Rev.*, **2010**, *110*, 1746–1787.
[4] Y. Borguet, G. Zaragoza, A. Demonceau, L. Delaude, *Dalton Trans.*, **2015**, *44*, 9744-9755.