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New method for direct C-C bond formation from alcohols catalyzed by N-halo organic compound under solvent-free reaction conditions

Njomza Ajvazi[1] and **Stojan Stavber**[1, 2]
[1]Jožef Stefan International Postgraduate School, Slovenia
[2]Jožef Stefan Institute, Slovenia

The development of protocols for the construction of C-C bond following the principles of green chemistry is one of the most challenging tasks in organic synthesis. Since more and more organic solvents are blacklisted due to their damaging effect on human health and environment, organic reactions under solvent-free reaction conditions (SFRC), mainly fulfill these principles. C-C bond forming reactions display one of the most important implements for the synthesis of complex organic products, many of them developed bioactivity as drugs or agrochemicals. C-C bond formation by direct coupling of alcohols with other partners could be a very attractive strategy from practical, atom-efficient and environmental point of view, producing water as only a by-product of the reaction. Because of their lower leaving group ability, hydroxyl moieties are rarely substituted under mild conditions and must often be activated before treatment with nucleophiles. Numerous related methodologies have been elaborated using a substoichiometric amount of Brønsted acids, metals ions, Lewis/Brønsted acid combination or other promoters which have been touched on by several excellent reviews and recent advanced related reports. Silver hexafluoroantimonate (V) (AgSbF6) has been used as a catalyst for direct α-alkylation of unactivated ketones using benzylic alcohols. While a new method for direct benzylation/allylation of malonates with alcohols via a palladium catalyzed Tsuji-Trost type reaction was developed. Accordingly, the development of an efficient and environmentally benign catalytic methodology for C-C bond formation remains an attractive research subject. We report new, efficient and selective methodology for the direct C-C bond formation through the direct coupling of various benzyl alcohols with a different type of electron rich compounds including 1,3-dicarbonyl compounds, heteroatom benzo-cyclenes, phenyl substituted alkenes, or tertiary benzyl alcohols, bearing a vicinal hydrogen atom as alkene precursors, catalyzed by N-halo organic compound as a metal- and acid-free catalyst under SFRC, enhancing the green chemical profiles of these transformations.

Figure 1: General concept and work plan of the research

Recent publications

1. Kumar R and Van der Eycken E V (2013) Recent approaches for C-C bond formation via direct dehydrative coupling strategies. Chemical Society Reviews 42:1121-1146.
2. Trost B M (2002) On inventing reactions for atom economy. Accounts of Chemical Research 35:695-705.
3. Emer E, Sinisi R, Capdevila M G, Petruzziello D, De Vincentiis F and Cozzi P G (2011) Direct nucleophilic SN1-type reactions of alcohols. European Journal of Organic Chemistry 2011:647-666.
4. Dryzhakov M, Richmond E, Moran J (2016) Recent Advances in Direct Catalytic Dehydrative Substitution of Alcohols. Synthesis 48:935-959.
5. Naveen N, Koppolu SR, Balamurugan R (2015) Silver Hexafluoroantimonate-Catalyzed Direct α-Alkylation of Unactivated Ketones. Advanced Synthesis & Catalysis 357:1463-1473.

Biography

Njomza Ajvazi received her BSc degree and MSc degrees in the field of Organic Chemistry with Biochemistry at the University of Prishtina "Hasan Prishtina", Kosova in 2009. Her Doctor of Science degree was conferred by Jožef Stefan International Postgraduate School, Ljubljana, Slovenia, in 2016, under the supervision of Professor Dr. Stavber. Currently, she is working as an Assistant Professor in the College of Medical Sciences Rezonanca - Prishtina, Kosova. She is a member of American Chemical Society. Her research interest lies in the development of new methodologies for comprehensive direct transformation of alcohols forming new C-C or C-heteroatom bonds under green reaction conditions.

njomzaajvazi@hotmail.com