PhD POSITION (3 years)
Laboratoire Hétérochimie Fondamentale et Appliquée, UMR CNRS 5069
Université de Toulouse 3 – Paul Sabatier (France)

Smart (nano)catalysts for streamlined synthesis and bioinspired transformations

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Nowadays sustainable approaches are necessarily required for both fundamental and applied research, including tunability, flexibility and adaptability as well as environmental friendliness in the conception of any chemical process, in particular those leading to the synthesis of complex molecules finding applications in drugs and natural products sectors.

To illustrate how disruptive methodologies can be implemented in synthesis, this PhD project aims to explore both novel catalyst design and the use of neoteric solvents in the synthesis of targeted molecules based on biomass precursors, such as carbohydrates, to be incorporated into biomolecules, offering privileged synthetic alternatives to mimic enzymatic methods. In particular, leveraging the efficiency, regioselectivity and stereocontrol of glycosylation reactions via sustainable approaches remains an unmet challenge for synthetic chemists, as equimolar amounts of reagents are usually employed. Thus, the search of versatile ways to effect glycosidic bond formation not only challenges current methodologies for the introduction of new functionalities (C–C or C–heteroatom bond formation), but also it requires robust and highly reusable catalytic systems capable of outsmarting the shortage of transition metal resources.

This thesis proposal aims at developing a general catalytic blueprint for bioorthogonal glycosylation reactions combining transition metal-based nanocatalysis and main group chemistry in neoteric solvents (glycerol, ionic liquids, deep eutectic solvents). We propose the use of activable glycosyl donor building blocks as new versatile platforms for N- and O-glycosylation. Cutting-edge innovations in nanocatalysis, ranging from molecular to surface heterogeneous-like reactivity, will be actively sought as greener tools, while reducing wastes associated to current methods. Furthermore, novel C–H bond functionalization strategies will be implemented for the development of new chemical approaches towards C-linked glycosides.

Given the sound biochemical implications of glycosylation, the discovery of innovating technologies encompasses untapped potential in the access of highly valuable carbohydrate motifs. The potential of this transformation will be assessed towards recycling of the catalytic systems, including flow chemistry approaches to harness novel glycosylation strategies for the sustainable future.
Application

This PhD program is addressed to highly qualified and talented graduate students with an enthusiastic interest in synthesis and catalysis. Motivated students have the opportunity to join the research group “Metallic Systems Applied in Catalysis” (SYMAC) at the LHFA, a joint research unit from the French National Centre for Scientific Research (CNRS) and the University of Toulouse 3 – Paul Sabatier located in Toulouse with state-of-the-art facilities. The host team belongs to the French-Mexican International Associated Laboratory (LIA) “Laboratory for Molecular Chemistry with applications towards Materials and Catalysis (LCMMC)”, coordinated by Profs. Pascal Lacroix (France) and Norberto Farfan (Mexico).

Applications shall include a motivation letter, a detailed Curriculum Vitae and the contact of at least one referee.

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References