

## PhD proposal

### “Toward the direct synthesis of novel sorbitan-based amines *via* the Borrowing Hydrogen methodology”

**Laboratory:** Organic and Bio-organic Chemistry (COB), Institute for Molecular and Supramolecular Chemistry (ICBMS)

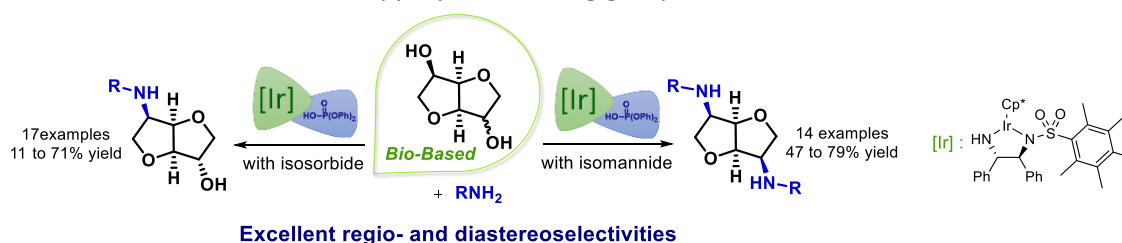
**Supervisor:** Pr. Florence Popowycz, Co-supervisor: Dr. Maïwenn Jacolot, ICBMS-INSA Lyon

**Context of the proposal:** The PhD position described below will be funded by the Chinese Scholarship Council and expected to start in October 2022 for 42 months. The candidate will be hosted in the COB laboratory (ICBMS-UDL-INSA-Lyon).

#### Scientific content:

In the context of transition from petroleum to biorenewable resources, valorization of biomass such as starch and cellulose represents an interesting opportunity for the production of new highly functionalized “low-volume, high-value chemicals” (pharmaceuticals, agrochemicals, polymers, etc.).<sup>1</sup> Among all bio-based chemicals, sorbitol, industrially produced from depolymerization of starch or cellulose, is a promising platform molecule. Sorbitol can indeed be converted to Sorbitan<sup>2</sup> and Isosorbide<sup>3</sup> [The French company leader in starch industry, Roquette is producing isosorbide Polysorb® at a rate of 20 000 tons per year] respectively by single and double dehydration.

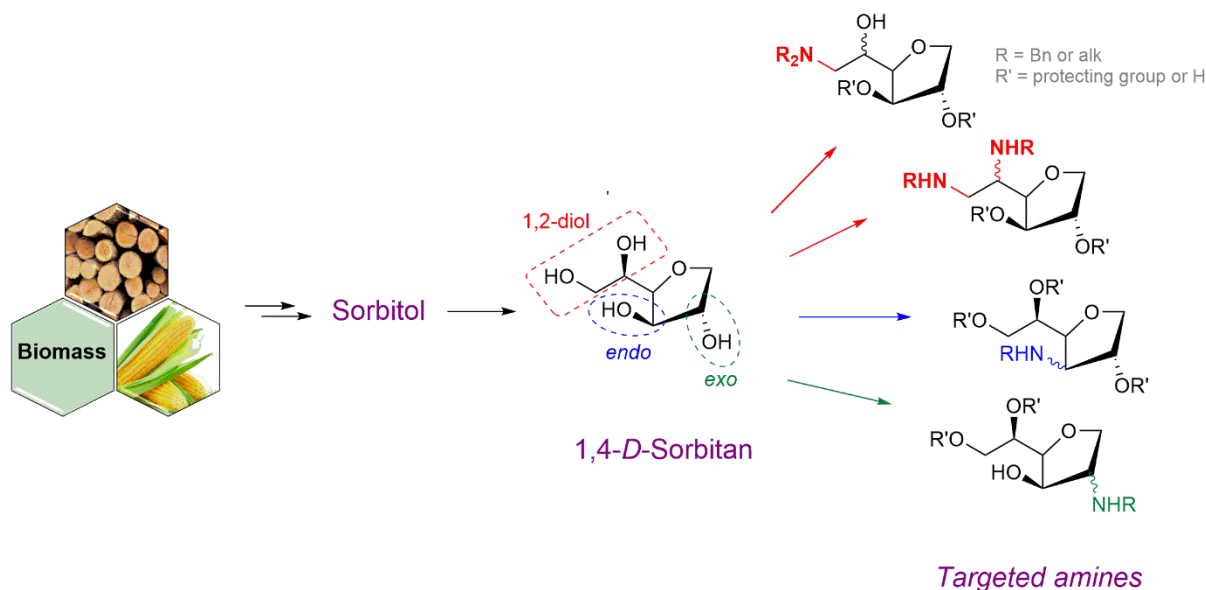
Functionalization of isosorbide and stereoisomers into corresponding amines has attracted considerable interest for polymer applications and for asymmetric induction in organic synthesis.<sup>4</sup> Very recently, our research group reported a direct and diastereoselective amination of these biosourced isohexides through a borrowing hydrogen (BH) methodology using a cooperative catalysis combining iridium metal and phosphoric acid (Figure 1).<sup>5</sup> This methodology is a sustainable alternative of the classic strategy of nucleophilic substitution after introduction of an appropriate leaving group.



**Figure 1. Direct regio and diastereoselective amination of isohexide derivatives**

On contrary, 1,4-*D*-sorbitan is yet underexploited in fine chemistry [only few publications described the use of sorbitan in total synthesis of natural products<sup>6</sup> or for the preparation of biologically active molecules<sup>7</sup>] and its functionalization deals mainly with the synthesis of sorbitan esters or ethers.<sup>8</sup> To our knowledge, the amination of sorbitan has not been reported, and could be an efficient route to accede novel bio-based amines (biosurfactants, biologically active molecules, etc.).

Thus, the main objective of this project is to develop the synthesis of novel sorbitan-based amines using the borrowing hydrogen methodology (Figure 2). A particular attention will be devoted to the comprehension of regio- and diastereoselectivities.



**Figure 2. PhD project: Toward the synthesis of novel chiral biobased amines**

Nowadays, more sustainable alternatives has gained increasing attention such as the use of abundant first-row transition metals. In this regards, homogeneous catalysis using iron complexes should be further investigated due to its economic (0.109 €/kg) and ecological benefits (4<sup>th</sup> most common element in the earth's crust). A second aspect of the thesis will thus consist to develop the direct amination of sorbitan derivatives using iron metal species.

**Required Background:** We are looking for a highly motivated person with a strong background in organic chemistry (Master degree). Appropriate education profile should include experience in multi-step organic synthesis and associated analytical skills (NMR, MS, IR). Experience in organometallic chemistry and/or in asymmetric synthesis will be appreciated but are not mandatory. A good motivation to learn, communication skills, curiosity, and agreeable team spirit are also among important qualities. Proficient knowledge of English is also important.

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