Diversity Oriented Preparation of Pillar[5]arene-Containing [2]Rotaxanes by a Stopper Exchange Strategy

Dedicated to Prof. Jean-Marie Lehn on the occasion of his 80th birthday

Invited for this month’s cover are Iwona and Jean-François Nierengarten from the University of Strasbourg. The cover picture shows the structure of a [2]rotaxane building block bearing 3,5-bis(trifluoromethyl) benzenesulfonate (BTBS) stoppers. The BTBS moieties of this compound are good leaving groups allowing to perform stopper exchange by treatment with different nucleophiles to afford the corresponding rotaxanes with ester, ether or thioether stoppers. Read the full text of their Full Paper at 10.1002/open.202000035.

What prompted you to investigate this topic/problem?

We have recently shown that a stopper exchange approach is particularly well suited for the synthesis of pillar[5]arene-containing [2]rotaxanes. Our first methodology was based on the reaction of a [2]rotaxane with two 2,4-dinitrophenyl ester stoppers with amines to afford the corresponding [2]rotaxanes with amide stoppers. This first building block was great but was limited to the formation of amides. In order to generate a larger structural diversity, we became interested in new building blocks for the preparation of pillar[5]arene-containing [2]rotaxanes using nucleophilic substitution reactions. We have thus selected 3,5-bis(trifluoromethyl) benzenesulfonate (BTBS) leaving groups as stoppers. The major difficulty was to find the appropriate arylsulfonate group, namely BTBS, allowing at the same time to prepare rotaxanes in good yields and to afford stable building blocks that could be stored under standard laboratory conditions in order to be used whenever they are needed.

What aspects of this project do you find most exciting?

The stopper exchange reactions occur through a concerted mechanism that prevents the unthreading of the axle. As a result, the structure of the [2]rotaxanes is preserved during the nucleophilic substitutions of its BTBS stoppers. On the other hand, this new synthetic strategy allowed us to prepare pillar[5]arene-containing [2]rotaxanes that would be impossible to obtain by the direct introduction of two stoppers in a single synthetic step from a pillar[5]arene-based inclusion complex. Our strategy will be therefore useful for the synthesis of a wide range of unprecedented pillar[5]arene-containing [2]rotaxanes for applications in various fields at the interface of chemistry with materials science or biology. We also believe that our strategy can be easily used to prepare other rotaxanes incorporating different macrocyclic subunits.

Anything else you would like readers of ChemistryOpen to know?

This particular ChemistryOpen paper is dedicated to Prof. Jean-Marie Lehn on the occasion of his 80th birthday. He is not only one of the founding Fathers of supramolecular chemistry but also a pioneer in the field of self-assembled systems as well as in dynamic combinatorial chemistry. His impact on the chemical sciences is simply amazing and Jean-Marie Lehn has been a source of inspiration for all of us. It is also a privilege to have such an eminent colleague in our University. We are therefore particularly happy to dedicate him this paper.

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