Pillar[6]arene: An investigation into Synthesis Methods and Novel Host-Guest Complexes

PhD Seminar

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Friday, April 19, 2024
2:00 – 3:00 p.m.
Beaupre Room 105

Pillar[n]arenes (PAs) are macrocycles made up dialkoxybenzene units linked together by methylene bridges, where [n] designates the number of linked units. Beginning with Ogoshi's discovery of pillar[5]arene (P5A) in 2008 interest has grown in PAs and their potential contributions in the field of supramolecular chemistry where they have been used in molecular separation, binding and isolation of biologically important guests, and drug delivery. This is in part due to their unique shape, versatile functionality, solubility in non-polar solvents, and reactivity. The rigid structure of their electron rich hydrophobic core allows them the ability to act as host to electron deficient guest molecules, such as drugs, drug-like molecules, toxicants and pollutants.

P5A has been the subject of numerous studies, in part due to its straight-forward and high-yielding synthesis. Recently more attention has come to pillar[6]arene (P6A) which appears very promising for a number of applications such as binding biologically relevant guests. Though P5A and P6A have the same repeating units and are both cyclic, P5A has a pentagon-like cyclic structure and P6A has a hexagon-like cyclic structure. By treating P5A and P6A as a "regular pentagonal pillar" and a "regular hexagonal pillar", respectively, the diameters of the internal cavities were found to be ~5.6 Å for P5A and ~7.7 Å for P6A by Geacintov et al.

Unlike P5A, the synthesis of P6A has proven to be non-trivial. Synthesis goes smoothly and with high yields when large alkoxy substituents are incorporated but there is a need for access to P6A with smaller derivatives which can be easily functionalized. Beginning with a bromine monomer, this study aims to develop a clear-cut, reproducible pathway to the synthesis of an easily functionalized P6A. We will also present results of our attempts to initiate host-guest interactions with P6A as the host to larger, non-linear guests, such as polycyclic aromatic hydrocarbons.