FULLERENE-C60: FROM THE INOCCENT GUEST MOLECULE TO A PHOTOCATALYST

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The tubular nanoscale self-assembled systems are highly desired due to their possible application in the drug delivery, molecular encapsulation or flow-through catalysis. Such tubular assemblies can be obtained either by utilization of various growth templates, ring stacking or by bio-inspired supramolecular chemistry employing weak intermolecular forces. On the contrary, the synthesis of such systems comprising large cavities still remains challenging[1]. Herein we present the strategy of using chiral C_2-symmetric bicyclo[3.3.1.]nonane framework encompassing self-complementary ureidopyrimidinone (Upy) moiety as our synthon for supramolecular cyclic tetrameric structures[2]. We noticed that introduction of fullerene guest molecule into the cavity of our supramolecular aggregate enhances fullerene's ability to generate singlet oxygen without external stimuli which oxidizes sulfide groups in the side chains of the cyclic tetramer.

Based on our observations we developed a green and mild method which facilitates chemoselective oxidation of sulfides using oxygen as the terminal oxidant under heterogeneous catalysis. Thus, we propose light-driven sulfide oxidation catalyzed by non-soluble fullerene (C60) in ethanol without further overoxidation to sulfones. We took this even further by employing much cheaper fullerene soot as a heterogenous catalyst which would allow us to recover the catalyst by simple filtration and reuse it many times without losing its intrinsic properties. The fullerene soot could possess the huge advantage amongst other reusable catalyst because it does not require the catalyst immobilization to any heterogenous supports such as resins or insoluble polymers, it is available from multiple suppliers and is very cheap.

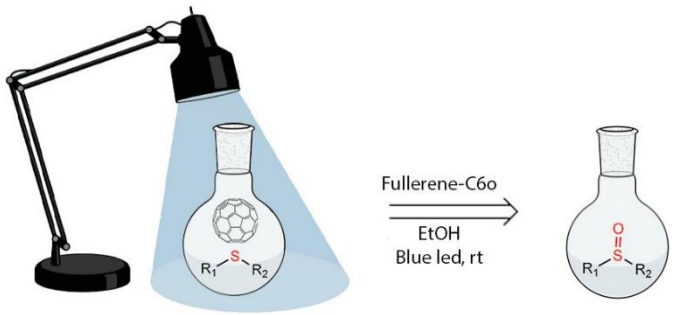

Fig. 1. Photoxidation of sulfides to sulfoxides using a heterogeneous catalyst

[1] M. A. B. Block, C. Kaiser, A. Khan, S. Hecht, Top. Curr. Chem., **245**, 89-150 (2005).
[2] D. Rackauskaite, R. Gegevicius, Y. Matsuo, K. Wärnmark, E. Orentas, Angew. Chem. Int. Ed., **55**, 208-212 (2016).