Review

Environment-friendly Fullerene Separation Methods

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Environment-friendly Fullerene Separation Methods

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Abstract: The unique physicochemical properties of fullerenes are to a great extent determined by their purity. Pure fullerenes separated from fullerene soot are currently promising nanomaterials for versatile potential applications. But there are few efficient methods to obtain fullerenes in pure form, most of fullerene properties remain unclear. To gain their optimal properties in potential applications, more efficient methods to separate pure fullerenes are supposed to develop. One of the most active researches in fullerene separation is to find suitable receptors to bind fullerenes and then release them through host-guest interactions based on supramolecular chemistry to obtain pure products. So this review highlights the recent advances in the design of molecular receptors that feature corresponding size, shape or electronic complementary to fullerenes as the primary recognizing factor. The method using designed molecular receptors for fullerene separation here is called as selective complexation technology. And some designed polymers that can be used as supports to achieve fullerene selective separation via reversible Diels-Alder addition are also described. Besides, other two common practical separation methods, improved chromatography and fractional crystallization, are presented. All separation methods mentioned in this review can achieve selective fullerene separation with recycling process and no special equipment, which conform to the requirement of environment friendly development in 21st century. Each method has its own characteristic depending on the applied fields. Our purpose is to show the readers efficient designed methods exploitable for scalable preparation of high-quality pure fullerenes and stimulate their boarder potential applications.

Keywords: Fullerenes; Host-guest interactions; Covalent chemistry; Coordination bonds; Recycle

Contents

Abbreviations

AC, activated carbon; CVD, chemical vapor deposition; DA, Diels-Alder; DCE, 1,2-dichloroethane; exTTF, 2-[9-(1,3-dithiol-2-ylidene)anthracen-10(9H)-ylidene]-1,3-dithiole; MIL, Matérial Institut Lavoisier; MOFs, metal-organic frameworks; MTN, Mobil Thirty-Nine; ST, super tetrahedron; TFA, trifluoroacetic acid; TMB, 1,2,4-trimethylbenzene; TTF, tetrathiafulvalene.