

Separation of Fullerenes by
Liquid Chromatography

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*Separation of Fullerenes by Liquid
Chromatography*

Edited by Kiyokatsu Jinno

Toyohashi University of Technology, Japan

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SEPARATION OF FULLERENES
BY LIQUID CHROMATOGRAPHY

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Preface

The history of fullerenes is highlighted by the following three important scientific findings: (1) in 1970 the presence of a round, hollow, geodesic sphere-shaped molecule consisting of 60 carbon atoms was predicted by Osawa (*Kagaku*, 1970, **25**, 854); (2) in 1985 this stable carbon molecule was actually observed in the mass spectrum of laser ablated graphite by Kroto *et al.* (*Nature*, 1985, **318**, 162); (3) Kratschmer *et al.* (*Chem. Phys. Lett.*, 1990, **170**, 167) finally found the method to prepare the microscopic quantities of this substance by resistive heating of graphite under an inert atmosphere, although before that time there was no evidence to prove the existence of this compound on the Earth. This compound, consisting of carbon atoms arranged to form 12 isolated pentagon and 20 hexagon rings, was named 'Buckminsterfullerene', 'Fullerene' or simply 'Bucky Ball', honouring Buckminster Fuller who was the artist in designing geodesic dome structures in Germany. Almost at the same time Kratschmer *et al.* (*Chem. Phys. Lett.*, 1990, **170**, 167) found the existence of C₇₀, consisting of 70 carbon atoms, as the second most abundant molecule formed by resistive heating of graphite. Since this discovery, fullerenes, because of their unique structures, have attracted the attention of many chemists, physicists and materials scientists in a wide variety of scientific fields. There have been many publications about their characteristics, which have been investigated using instrumental analytical techniques such as mass spectrometry (MS), nuclear magnetic resonance spectrometry (NMR), infrared spectrometry (IR), ultraviolet spectrometry (UV) and other spectrometric measurements. In order to obtain accurate spectrometric information, the isolation and purification of the compounds from the carbon soot mixtures is the key process in this scientific research field. Therefore various separation methods for the separation and purification of fullerenes and their derivatives have been proposed. It is clear that high-performance liquid chromatography (LC) is the most promising of these proposed methods but it requires good stationary phases for better separation performance.

Thus one can conclude that the construction of new separation systems which offer enhanced selectivity and performance for the separation of fullerenes is one of the most important tasks for separation scientists. There are huge demands for such systems to solve fullerene separation problems.

In this book, in order to emphasize the importance of LC techniques for the separation of fullerenes including C_{60} , C_{70} and higher than C_{70} , metallofullerenes and their derivatives, the recent approaches and efforts to fullerene separation by several research groups are described. As editor I would like to express my sincere thanks to those contributors who gave me their excellent chapters. I also appreciate very much the help of Dr. Hatsuichi Ohta in my research group who spent much time in reorganizing and retyping the chapters to ensure consistency. Finally I should thank the staff of the Royal Society of Chemistry who gave me this opportunity to make this kind of contribution to separation science and to fullerene-related science.

Kiyokatsu Jinno
Toyohashi, Japan

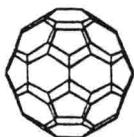
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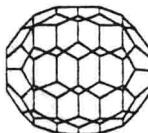
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Fullerene Gallery

C60

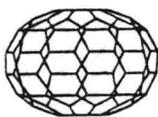


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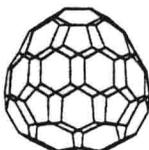
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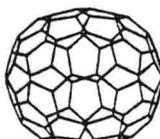
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C74



D3h

C76

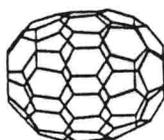


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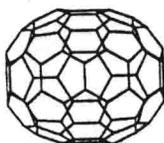


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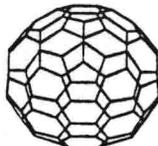
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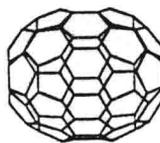
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C2v'

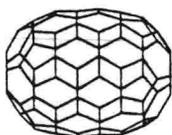


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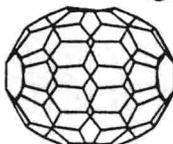


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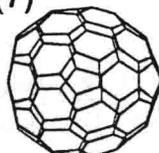
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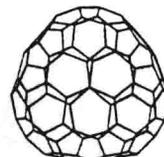
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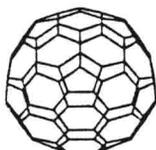
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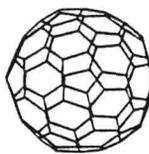
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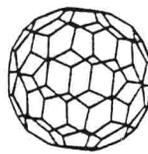
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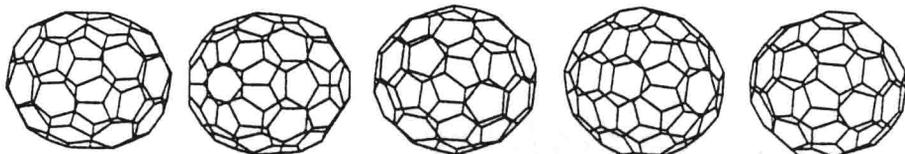
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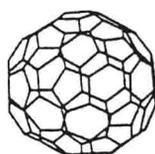
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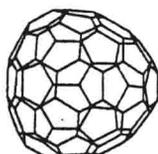
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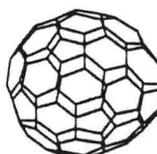
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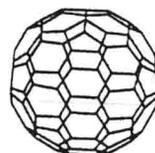
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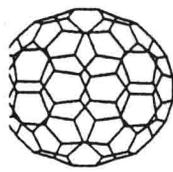
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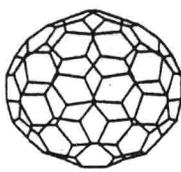
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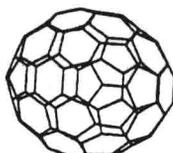
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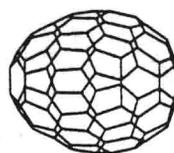
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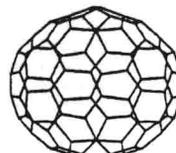
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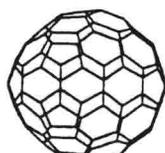
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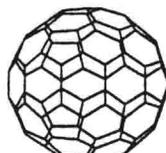
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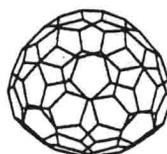
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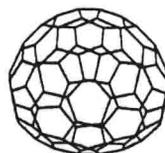
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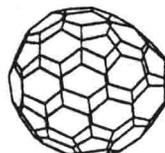
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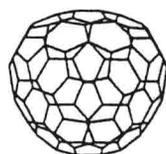
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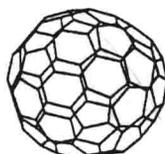
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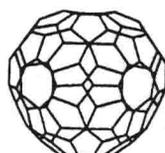
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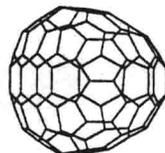
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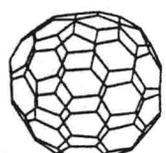
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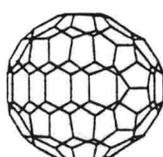


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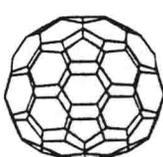


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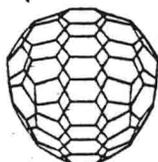
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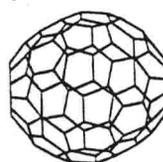
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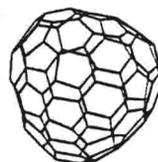
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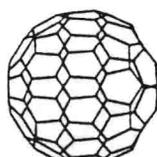
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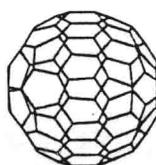
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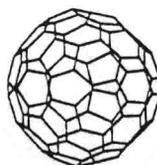
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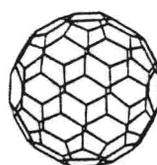
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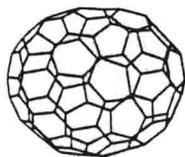


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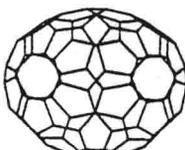


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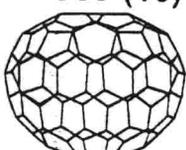
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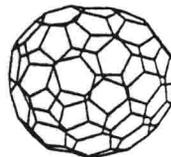
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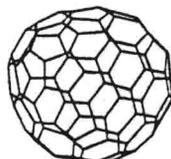
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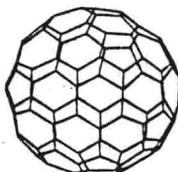
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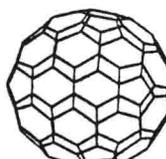
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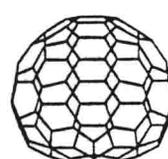
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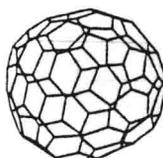
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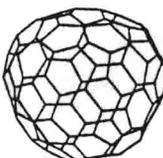
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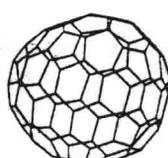
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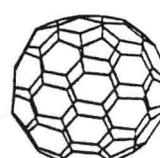
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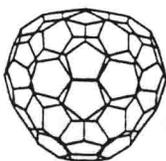


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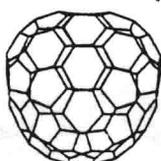


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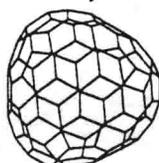
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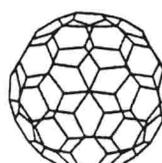
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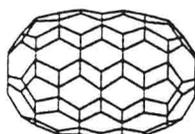


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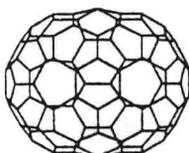


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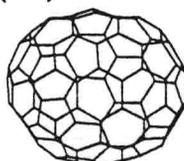
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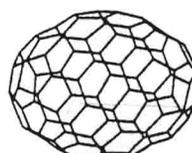
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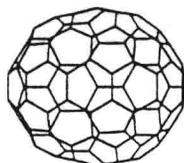
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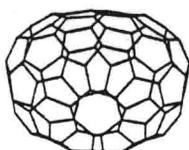
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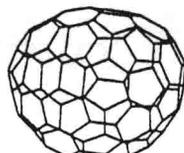
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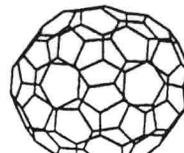
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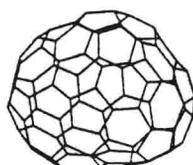
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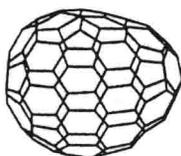
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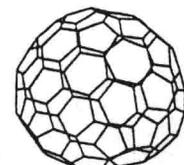
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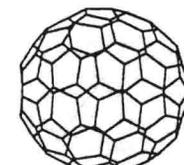
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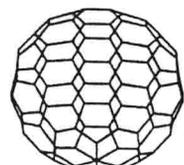
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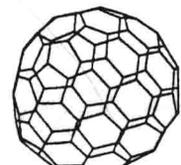
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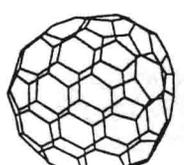
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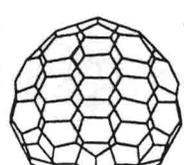
C2v



C1

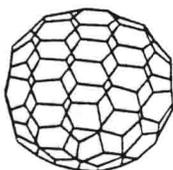


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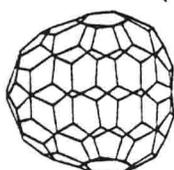


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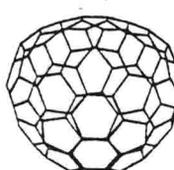
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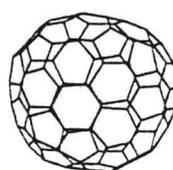
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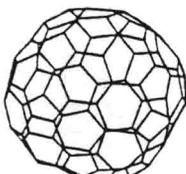
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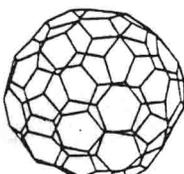
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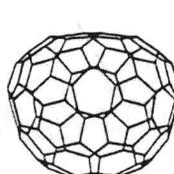
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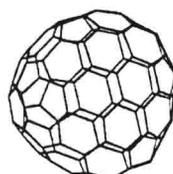
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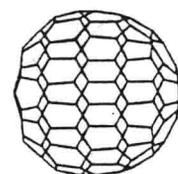
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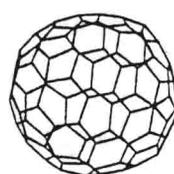
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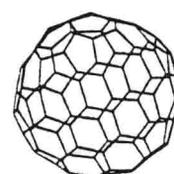
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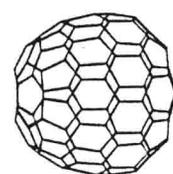
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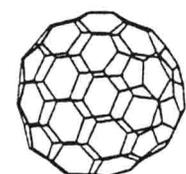
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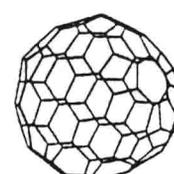
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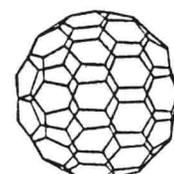
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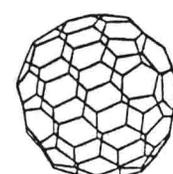
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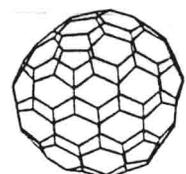
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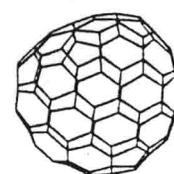
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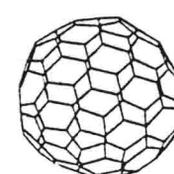
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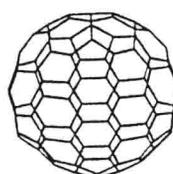
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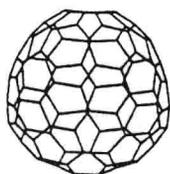
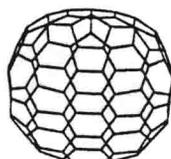
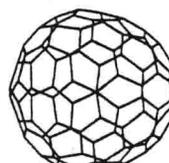
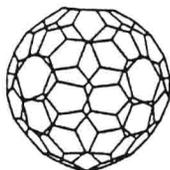
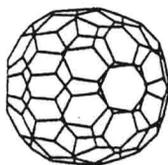
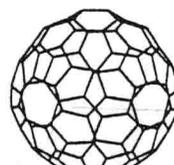
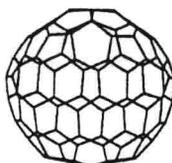
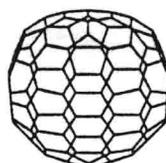
Cs



Cs



C2v

C90(continued)**C2****C1****C2v****C2****C2****C2****C2****C2****C2****C2v**

The fullerenes structures were obtained from the following URL:
<http://shachi.cochem2.tutkie.tut.ac.jp/Fuller/Fuller.html>

Contents

Contributors	vii
Fullerene Gallery	xiii
Chapter 1 Technical Advances in the Liquid Chromatographic Separation of Fullerenes	1
<i>Kiyokatsu Jinno and Jing Wu</i>	
1 Separation of C ₆₀ and C ₇₀ Fullerenes	1
2 Separation of Higher Fullerenes than C ₇₀	8
3 Separation of Metallofullerenes	10
4 Conclusions	15
5 References	15
Appendix	19
Chapter 2 The Preparative Separation of Fullerenes	25
<i>John C. Fetzer</i>	
1 Introduction	25
The Carbon Number Distribution in Fullerenes	26
The UV Absorbance Spectra of the Fullerenes	26
2 Isolation of C ₆₀	27
3 Isolation of C ₇₀ (Separation of C ₇₀ from C ₆₀)	29
4 Separation of the Higher Fullerenes	32
Isolation of Higher Fullerenes by Carbon Number	32
Isolation of Individual Isomers of the Higher Fullerenes	37
5 Separations of Endohedral Metallofullerenes	44
6 Conclusions	46
7 References	46
Chapter 3 Separation of Fullerenes by LC with Octadecyl Silica (ODS) Stationary Phases	49
<i>Kiyokatsu Jinno, Hatsuichi Ohta and Yoichiro Sato</i>	
1 Introduction	49
2 Separation and Identification of Higher M _r Fullerenes by LC with Monomeric and Polymeric ODS Bonded Phases	50

	Mobile Phase Selection	51
	Comparison of Monomeric and Polymeric ODS phases for the Separation of Higher Fullerenes	52
3	Retention of Fullerenes by ODS – Correlation with NMR Spectra at Low Temperatures	61
	NMR Studies	63
4	Separation and Identification of Higher Fullerenes	71
	Separation of Fullerenes Based on Their Molecular Weights	72
	Separation of Higher Fullerenes	73
	Separation of C ₈₂ and C ₈₄	78
	Investigation on Other Higher Fullerenes and Their Isomers	79
	UV–Vis Spectra of Higher Fullerenes	90
	Effect of Column Temperature on the Separation of Higher Fullerenes	90
	Separation of C ₈₂ and C ₈₄ Isomers	93
5	Conclusions	100
6	References	105

Chapter 4	Development of a High-capacity Stationary Phase Containing Heavy Heteroatoms for the Separation of Fullerenes	107
	<i>Nobuo Tanaka, Kazuhiro Kimata and Ken Hosoya</i>	
1	Introduction	107
2	Separation of Fullerenes on Alkyl-type Bonded Phases	108
3	Design of a Stationary Phase for Large-scale Separation of Fullerenes	109
4	Development of Stationary Phases for Separation of Fullerenes Based on a Reciprocal Approach	111
	PAH-bonded Silica as a Highly Retentive Stationary Phase for Solvent Screening	111
	Differentiation of Dipolar Fullerene Oxides from Fullerenes by Using Stationary Phases Bonded with Dipolar or Nonpolar Aromatic Groups	114
	Correlation Between the Refractive Index of a Solvent and the Solvent Strength in Chromatography	117
	Correlation between the Refractive Index of a Solvent and the Solubility of C ₆₀ in the Solvent	120
	Dominant Contribution of Dispersion Interactions with Fullerenes	121
5	High-capacity Stationary Phases Containing Heavy Heteroatoms	121
	Correlation Between the Refractive Index of a Bonded Moiety on a Silica Surface and the Retentivity for Fullerenes	121
	Pentabromobenzoyloxypropylsilyl (PBB) Silica Gel as a Highly Retentive and Efficient Packing Material for the Separation of Fullerenes	122