Review of *Organoselenium Chemistry – between synthesis and biochemistry*

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The book "Organoselenium chemistry – between synthesis and biochemistry" edited by Prof Claudio Santi is a useful tool for chemists and biochemists who are interested in delving in the "*green side of the moon*", as Prof Santi has been calling the new, green aspects of organoselenium chemistry in his lectures around the world.

In his book, Prof. Santi had the prowess to join a select team of renowned experts in organoselenium chemistry and biochemistry, which were meticulous in describing specific aspects of this class of compounds. Through the more than 420 pages of the book, it's possible to find the more recent advances in the synthesis and application of selenium compounds in chemistry, biochemistry and food chemistry, as well as modern NMR techniques to characterization of organoselenium compounds.

Through the 13 chapters, including a short introduction by the editor, the book brings to the reader the very latest in key topics on the chemistry and biochemistry of organic compounds containing selenium, including the synthesis and characterization of chiral molecules and their use as a catalyst in green organic reactions.

The book starts by presenting some of more efficient ways to introduce an organoselenium group to an organic substrate, including electrophilic and nucleophilic selenium reagents.

The use of electrophilic selenium on the preparation of organoselenium derivatives by its addition to double bonds or in selenocyclizations is depicted by Ścianowski and Rafiński in Chapter 2. Authors present the synthesis of electrophilic organoselenium compounds (including chiral ones) and their use in reactions for formation of new carbon-heteroatom (C-O, C-N) and carbon-carbon bonds.

In Chapter 3, Movassagh and Navidi present the preparation and the usefulness of nucleophilic selenium reagents in a sort of reactions, including in nucleophilic substitutions, attack at an acyl carbon (acid chlorides, anhydrides , esters and lactones), ring opening and new applications to solid-phase synthesis.

Chapter 4, authored by Lewkowski, brings an overview of literature from early 1990s until 2012 on the role of selenium compounds in radical reactions from the point of view of the source of selenium radicals: alkyl phenyl selenides, acyl phenyl selenides, imidoyl phenyl selenide, benzeneselenol and others.

Hypervalent selenium derivatives – selenuranes, are the subject approached by Drabowicz and co-workers in Chapter 5. This interesting class of compounds has a central selenium atom with an expanded valence shell to 10 or 12 electrons. Methods to prepare selenuranes and their involvement as intermediate in organic synthesis are discussed in terms of mechanistic and stereochemical aspects.

The synthesis and reactivity of selenoamides are scrutinized in Chapter 6 by Murai. The chemistry of selenoamides has attracted the attention of synthetic organic chemists due the peculiar characters of Se and N atoms combined in such molecules. Classical, well stablished and new methods to prepare thisd class of compounds, as well as their use in intermolecular cyclizations and other reactions are presented in this chapter.

The asymmetric synthesis of organoselenium compounds using chiral organometallic catalysts, organocatalysts and biocatalysis is addressed in Chapter 7 by Marini and co-workers. Besides new improvements in the preparation of chiral selenides, authors present several applications of them, includind the synthesis of chiral amines, esters, nitriles, cyclopropanes, spirolactones, amino alcohols among others.

Selenium compounds made green: this is the subject of Chapter 8. Prof. Braga and colleagues describe in this comprehensive review the synthesis and applications of organoselenium compounds in a green fashion. The use of environmentally benign, alternative solvents, solvent-free conditions, solid-supported catalysts and microwave irradiation to prepare organoselenium compounds are highlighted in this chapter. The use of organoselenium molecules as organocatalysts in selective organic reactions is also covered in this nicely updated overview (Chapter 11 is fully dedicated to the use of organoselenium as a catalyst).

Chapter 9 open the 'biochemical part' of the book. In a very comprehensive text, Francesco and co-workers bring a very attractive text about the role of selenium as an essential micronutrient and how the environmental availability of selenium affects its containing in food. On the words of authors, "*the chapter provides a systematic analysis of the literature available on these aspects, particularly focusing on nutritional and biochemistry features of Se*". The chapter cover from the food chain of Se, its metabolism and bioavailability, daily requirements and intake to the selenium toxicity and dietary sources, passing by the health promoting and adverse effects of selenium and the biochemistry and molecular biology of selenoproteins.

An up to date overview on the antimicrobial activity of selenium-containing compounds is shown by Galli and colleagues in Chapter 10. In an enjoyable reading, you can access information about antibacterial and antifungal activities of several classes of selenium compounds, including ebselen, selenoquinolines diselenides, selenoamines, Se-containing heterocycles among others. The application of organoselenium compounds as food preservative, pesticide and wound dressing is also discussed.

Prof. Santi himself authored, along with Tidei, a chapter in the book. Chapter 11 is a mandatory reading for those looking for something new and exciting in the development of new

methodologies for green organic chemistry. By exploring biomimetic reactions, it is possible to promote useful transformations in organic synthesis making use of organoselenium compounds in the so-called 'bio-logic' catalysis.

Chapter 12 is devoted to the antioxidant activity of organoselenium compounds. By discussing topics such the regulation of oxidative stress using organoselenium antioxidants, their interaction with the reactive oxygen species (ROS) and their action as prooxidants, Prof. Iwaoka brings to the reader the recent studies on the main aspects involved in the antioxidant activity of organoselenium compounds as radical scavengers against ROS in vitro and in vivo.

In Chapter 13, Nakanishi and Hayashi presents the ^{77}Se NMR spectroscopy, a powerful tool in the study of the selenium chemistry, providing important information about structural elucidation using this technique. The authors start by presenting a general theoretical background of NMR spectroscopy, which is subsequently deepened to the ^{77}Se nucleus. Throughout the chapter, the authors introduce the reader to the basis for the structural elucidation of organoselenium compounds using ^{77}Se NMR. The historical development and application of calculated chemical shifts σ(Se), the information derived from it, the origin of δ(Se) and the charge effect on σ(Se) are also detailed. According the authors, "*the assignment of spectra easier when supported by of the calculated values*". and in this line, they discuss the determination of structures and detection of intermediates in solutions.

I found in this book an indispensable resource to those who are considering to include organoselenium compounds in their synthesis plan or even to explore them in the prospection of new bioactive molecules or new materials. Allied to a rigorous scientific standard, this book stands out for its environmentally friendly approach involving the chemistry of organoselenium compounds, ranking it alongside other excellent reference books on the subject. Be sure to have it in your library; or better, in your PC.