Editorial

Special Issue on the Applications of Molecularly Imprinted Films

Andrei Sarbu

Team 1, Polymer Department, National Institute for Research & Development for Chemistry and Petrochemistry—ICECHIM, Spl. Independentei 202, Sector 6, 060021 Bucharest, Romania; andr.sarbu@gmail.com

1. Introduction

Modern separation science and technology require the development of new materials with enhanced properties that are able to separate a substance from complex matrices. To this end, a great deal of research has attempted to develop and characterize highly selective new materials. One innovative way of improving the selectivity and retention capacity is to develop molecularly imprinted polymers (MIPs).

The most common definition of this new class is that they are polymers possessing voids with a shape, size, and group functionality complementary to the molecule used for the imprinting, known as the template. In order to understand the principle underlying MIP preparation, we can imagine a coin being pushed into plasticine. When the coin is taken off the plasticine, a trace remains, having the shape and size of the face of the coin that was pushed into it. If one does the same thing with a template molecule in a polymer matrix, firstly, a composite is obtained at a molecular scale. After the template extraction, a MIP is prepared with voids corresponding to the shape, size, and group functionality of the template. It is very important to keep these voids unchanged after the template extraction. To achieve this, structure stabilization is required, with properties such as a high degree of crosslinking. The MIP preparation methods presented in the state-of-the-art studies can be divided into two categories: chemical methods, based on polymerization (bulk [1], suspension [2], emulsion [3], precipitation [4], etc.) or on sol–gel reactions, [5] and physical methods, referring especially to phase inversion [6], which are implemented far more rarely. MIPs can be produced in various shapes, such as beads [7,8], pearls [9], irregulate particles [10], hydrogels [11], membranes [12], and films [13]. Due to the requirement that MIPs have a high specific surface, a very fast-growing area of development concerns the use of membranes and films. The application of these new materials refers mostly to the purification of a liquid, the separation of a substance from a complex mixture, analysis, and sensing, but other applications have been studied as well, such as catalysis or the slow release of bioactive substances, explaining the need for this Special Issue of Applied Sciences. However, the sensing surfaces and the solid phase extraction are at present the main application methods of MIPs membranes and films.

2. Molecularly Imprinted Films

This Special Issue contains five articles, four research articles, and one review.

The first paper, “Role of Functional Monomers upon the Properties of Bisphenol A Molecularly Imprinted Silica Films” [14], is dedicated to the production of molecularly imprinted films using a chemical method, namely the sol-gel process for preparing sensitive layers of biomimetic sensors. Two types of MIPs were prepared based on two different organosilane functional monomers, N-(2-aminoethyl)-3-aminopropyl trimethoxysilane (DAMO-T) or (3-mercaptopropyl) trimethoxysilane (MPTES).

The second paper, “A Molecularly Imprinted Polymer Based SPR Sensor for 2-Furaldehyde Determination in Oil Matrices” [15], is also dedicated to optical biomimetic sensors and based on surface plasmonic resonance (SPR). For this purpose, a polymer optical fibre (POF) was used.
Another article published in this Special Issue and dedicated to sensors is “Potentiometric Biosensor Based on Artificial Antibodies for an Alzheimer Biomarker Detection” [16]. In this case, an electrochemical biomimetic sensor was targeted. This paper presented a potentiometric biosensor for the detection of amyloid-42 (A-42) in a point-of-care analysis.

The fourth article, namely, “Modern and Dedicated Methods for Producing Moleculely Imprinted Polymer Layers in Sensing Applications” [17], is a review, presenting the main approaches to sensing surface preparation.

The last article in this Special Issue, “Adsorptive Recovery of Cu²⁺ from Aqueous Solution by Polyethylene Terephthalate Nanofibers Modified with 2-(aminomethyl) Pyridine” [18], deals with the second main field of the application of MIF surfaces, namely, the solid phase extraction. In this study, a solution of modified PET or waste PET from plastic bottles was prepared, to which a silica-supported 2-(aminomethyl)pyridine powder was added, and the mixed solution was electrospun into composite nano-fibres.

3. Future of Moleculely Imprinted Films

Although this Special Issue has been concluded, more in-depth research on MIF films and membranes is expected. It can be predicted that more films and membranes with improved characteristics, such as selectivity and permeability, will be produced, and that the application fields will be expanded to include, for instance, enantiomer detection and separation.

Funding: This work was funded by the Romanian Funding Agency UEFISCDI, through the supporting Project no. 157ERA-NET/2020 COFUND-BLUEBIO-BIOSHELL and by the Ministry of Research, Innovation and Digitalization through project NUCLEU PN.19.23.02.01 (Sub-theme MAT-INNOVA).

Acknowledgments: Thanks are due to all the authors and peer reviewers for their valuable contributions to this Special Issue. I am also indebted to the editorial team of Applied Sciences for their constant support, particularly Delia Pan.

Conflicts of Interest: The authors declare no conflict of interest.

References


