Tentative Outline

Special Thematic Issue for Current Organic Chemistry

Title of thematic issue

The preparation and investigation of biodegradable and biocompatible polymers.

Guest Editor's Name: Dr. Jinbao Xu

Aims & Scope:

Biodegradable and biocompatible polymers offer unique material characteristics which may be employed for a variety of applications, such as packages, textiles, biomedicine and electronics. Natural polymers have been widely investigated due to their inherent biocompatibility and bioactivity, but issues with construct stability and material batch variation remain a limitation. Thus, the preparation of functional biodegradable and biocompatible polymers with enhanced opportunities for materials tunability is of great importance. Furthermore, the physical and chemical properties of the synthetic polymers are heavily related to the molecular structures and compositions. Recent advances in the preparation and investigation of biodegradable and biocompatible polymers should be well organized and reviewed, e.g., polyesters, polycarbonates and polyoxazolines.

Keywords:

Biodegradable and biocompatible polymers, polyesters, polycarbonates, polyoxazolines, functionality

Subtopics along with Contributing authors and abstract

The subtopics to be covered within this issue are listed below:

Title: Recent advances in the Ring-Opening Polymerization of *ε*-Caprolactones

- **Authors names, affiliation and email addresses:** Jinbao Xu, Guangdong University of Technology, Email: xujinbao@gdut.edu.cn
- **Abstract:** The exponential increase in the use of plastic demands that biosourced and biodegradable polymers such as poly(*ε*-caprolactone)s (PCL)s be considered to replace some petroleum based polymers in a range of applications. In order to produce PCL in the greenest manner, i.e. by ring-opening polymerization (ROP) of CL using an organocatalyst has proven to be a significant challenge. Indeed, metal-based catalysts were most researched today. However, metal-based catalysts lead to polymer materials with metal residues, which limits its properties and applications. As a result, organocatalysts have received great attention. In this review, the progress of organocatalytic ROP of CL in the past 20 years was systematically summarized. The potential challenges and development directions in this field are also discussed.
- **Keywords:** ring-opening polymerization, *ε*-caprolactone, organo-catalysts

Title: Recent Advances in Functional Biopolymers for Flexible Electronics and Sensors

- **Authors names, affiliation and email addresses:** Liguo Xu, School of Applied Chemical Technology, Shunde Polytechnic, Foshan 528333, China. Email: 21099@sdpt.edu.cn
- **Abstract:** To reduce the disposal of e-waste, the demand for the application of degradable biopolymers in flexible electronics is growing rapidly. Natural biopolymers have many remarkable characteristics, including light weight, excellent mechanical properties, biocompatibility, non-toxicity, low cost, etc. Thanks to these superior merits, functional biopolymers can be designed and optimized for the development of high-performance flexible electronic devices. This review is focused on polymer materials, both natural and synthetic, that are utilized in biodegradable and/or biocompatible electronic devices as substrates, dielectrics, conductors, or semiconductors. Specific application examples are highlighted, such as biodegradable electronic devices, implantable medical devices, and edible sensors.

- **Keywords:** Biopolymers, Flexible Electronics and Sensors

Title: Recent progress of biodegradable stimulus response polymer micelles for drug delivery

- **Authors names, affiliation and email addresses**: Zhonglin Cao, Guizhou Minzu University, Email: zhonglincao@126.com
- **Abstract:** The biodegradable stimulus response polymer micelles have a pivotal role in drug delivery for the effective solubility of hydrophobic cancer drugs and the precisely targeting to tumor. This review covers the recent progress of the design and applications of the biodegradable stimulus response polymer micelle in the past 20years. We first present the responsive mechanisms of biodegradable stimulus response polymer micelles and the preparation of corresponding micelles. Next, we summarize the functionalization of stimulus response polymer micelle for more precisely targeting to tumor. Research advances in the application of biodegradable stimulus response polymer micelles in tumor diagnosis and therapy are also thoroughly described. Finally, the overall current status, potential challenges, and future directions in this field are also discussed.
- **Keywords:** biodegradable, stimulus response polymer micelles, drug delivery, tumor diagnosis and therapy

Title: Organocatalytic/Metal-Free Ring-Opening Alternating Copolymerization of Epoxides and Cyclic Anhydrides

- **Authors names, affiliation and email addresses**: Junpeng Zhao (South China University of Technology, Email: msjpzhao@scut.edu.cn) and Heng Li (Xiangtan University, Email: iheng@xtu.edu.cn)
- **Abstract:** Polyesters have been extensively spread in the industry, daily life, and high-end fields for their unique and indispensable physical/chemical properties. The ring-opening alternating copolymerization (ROAP) of epoxides and cyclic anhydrides is one of the important methods to delivering polyesters because the diversity and economy of monomers greatly enrich the structure and properties of polyesters. With the increasing attention to environmental issues and the growing demand for metal-free polymers, organo/metal-free catalysis has developed rapidly in the last 20 years and has become an important research field. This review provides an account of the ROAP of epoxides and cyclic anhydrides using organo/metal-free catalysts that have developed so far and brief investigations on the relationships between the structures and properties of resulting polyesters.
- **Keywords:** ring-opening alternating polymerization, metal-free catalysis, epoxide, cyclic anhydride
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Title: Recent Advances in the Ring-Opening Polymerization of Lactide

- **Authors names, affiliation and email addresses:** Hongwei Duan, Nanyang Technological University, Singapore. Email: hduan@ntu.edu.sg
- **Abstract:** Polylactide (PLA) is one of the most important biodegradable polymers. PLA has attracted considerable attention as a candidate for non-petroleum-based biodegradable polymeric materials, because PLA is a biocompatible polymer with thermal plasticity, a semicrystalline nature with good processing properties and mechanical properties similar to those of polystyrene PLA is one of the most promising candidates capable of replacing petro-chemical polymers and PLA can be used in industrial, biomedical, pharmaceutical, and environmental applications and also in other fields, such as agriculture, food applications, packaging, and furnishings. In this review, the progress of organocatalytic ROP of CL in the past 20 years was systematically summarized. The potential challenges and development directions in this field are also discussed.
- **Keywords:** ring-opening polymerization, PLA, biodegradable

Title: Recent Advances in the Chitosan-Based Antibacterial Material

- **Authors names, affiliation and email addresses:** Mary B. Chan-Park, Nanyang Technological University, mbechan@ntu.edu.sg
- **Abstract:** Derived from chitin, chitosan is a unique biopolymer that exhibits outstanding properties, beside biocompatibility and biodegradability. Most of these peculiar properties arise

from the presence of primary amines along the chitosan backbone. As a consequence, this polysaccharide is a relevant candidate in the field of biomaterials, especially for antibacterial materials to medical applications. The current article highlights the preparation and properties of innovative chitosan-based biomaterials, with respect to their applications as antibacterial materials.

- **Keywords:** chitosan, antibacterial, biomaterials

Title: Radical Ring-Opening Polymerization to (Bio)Degradable Materials

- **Authors names, affiliation and email addresses:** Stergios Pispas, Theoretical and Physical Chemistry Institute, National Hellenic Research Foundation of Greece, Email: pispas@eie.gr)
- **Abstract:** Cyclic monomers bearing either vinyl or exomethylene groups have the ability to be polymerized through a radical pathway via a ring-opening mechanism (addition−fragmentation process), leading to the introduction of functionalities in the polymer backbone. Radical ring-opening polymerization (rROP) combines the advantages of both ring-opening polymerization and radical polymerization, that is the preparation of polymers bearing heteroatoms in the backbone but with the ease and robustness of a radical process. This current review presents a comprehensive description of rROP by detailing: (i) the various monomers that polymerize through rROP; (ii) the main parameters that govern the rROP mechanism; (iii) the copolymerization by conventional or controlled/living radical polymerization between rROP monomers and traditional vinyl monomers to obtain copolymers with advanced properties; (iv) the applications preparation of (bio)degradable materials of rROP monomer.
- **Keywords:** radical ring-opening polymerization, vinyl monomers, biodegradable

Title: Ring opening polymerization of NCA: advances in synthesis and applications of polypeptides

- **Authors names, affiliation and email addresses:** Nikos Hadjichristidis (King Abdullah University of Science and Technology, Email: nikolaos.hadjichristidis@kaust.edu.sa.) and Wei Zhao (Shaanxi University of Science and Technology, Email: zhwgah1028@126.com)
- **Abstract:** Polypeptides have attracted considerable attention in recent decades due to their inherent biodegradability and tunable cytocompatibility. Macromolecular design in conjunction with rational monomer composition can direct architecture, self-assembly and chemical behavior, ultimately guiding the choice of appropriate application within the biomedical field. This review focuses on the applications of polypeptides alongside the synthetic advances in the ring opening polymerization of NCA achieved in the past five years. Key architectures obtained through NCA ROP or in combination with other polymerization methods are reviewed, as these play an important role in the wide range of applications towards which polypeptides have been applied.
- **Keywords:** NCA, polypeptide, ring-opening polymerization

Title: Synthesis and Application of Biodegradable Hydrogels

- **Authors names, affiliation and email addresses:** Thomas Groth (Martin Luther University Halle-Wittenberg06099 Halle (Saale), Germany. Email: thomas.groth@pharmazie.uni-halle.de) and Guoying Zhou (Zhejiang Chinese Medical University, China. Email: guoyingzhou@163.com)
- **Abstract:** Biomaterial-based hydrogels, both natural and synthetic, have been attractive candidates for biomaterials. Advantages of hydrogels include their fine control over viscosity, crosslinking, and surface tension of bioink, as well as their provision of a microenvironment for cell growth and tissue formation. This review focuses on the applications of biodegradable hydrogels alongside the synthetic advances of it.
- **Keywords:** hydrogels, biodegradable

Schedule:

- ✧ Manuscript submission deadline: 15/05/2023
- ✧ Peer Review Due: 30/05/2023
- ✧ Revision Due: 15/06/2023
- ✧ Announcement of acceptance by the Guest Editors: 30/06/2023
- ✧ Final manuscripts due: 30/06/2023

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