



Polymer in Energy Storage: Enabling the Transition to a Sustainable Energy Future

Document Type : Review

Authors

[mahir.jalal](#)¹ [Shaymaa Abd Al Kareem](#)² [Alyaa abdulkarem](#)¹ [zainab A zainab](#)³ [alia ali](#)⁴

¹ 1Department of chemistry and polymer research, polymer research center, University of Basrah, Basrah, Iraq

² Material Science Department, Polymer Research Center, University of Basrah, Basrah, Iraq.

³ Basrah university

⁴ Food science department, Agriculture college , Basra University

 <https://doi.org/10.36582/ksj.2026.171326.1049>

Abstract

Polymer chemistry is an important sciences for energy storage technologies and has a vital role in energy transition to sustainable systems worldwide. This review identify the major roles for polymers related to capacity enhancement, elemental safety, and ecological enhancement of batteries, supercapacitors, and other energy storage devices. Given their structural diversity, function variability, and cost effectiveness, polymers Have many applications such as polymer electrolytes, polymer electrolytes/additives, electrode binders, and conducting (e.g., functionalized) composites, while still addressing major concerns in lithium ion batteries (LIBs), sodium ion batteries (SIBs), or supercapacitors (e.g., energy density, cycle life, elemental safety, environmental impact). Also this review aims to highlight various applications, such as solid polymer electrolytes to enhance safety and prevent thermal run-away in LIBs; bio-derived binders for green development of electrodes in LIBs and SIBs; and conducting (e.g., functionalized) polymer composites, which enhance the specific capacitance of supercapacitors. On the other hand this study also described challenges in energy storage utilizing polymers, including scaling up, cost, and problems associated with the raw materials in polymer synthesis and the final product itself, and suggested solutions (i.e., PFAS-free and recyclable) to prevent contamination of groundwater and waterways. Ethical issues, i.e., equitable access to advanced technologies (Li, Co, etc.), were also discussed over future directions, such as AI-assisted material discovery, and biodegradable polymers for energy storage. Finally this study included the highlights prospects of exploiting polymer chemistry and sustainable practices to realize effective, green energy storage systems and the future of decarbonized energy.

Keywords

[polymer chemistry](#) [energy storage](#) [sustainable energy](#) [batteries](#) [supercapacitors](#)



Subjects

[Chemistry](#)



Republic of Iraq
Ministry of Higher Education and Scientific
Research
Al-Kunooze University



[Volume 12, Issue 3](#)
Summer 2026





Al-Kunooze Scientific Journal

مجلة الكنوز العلمية

PRINT ISSN: 2706-6223 ONLINE ISSN:2706-6231

SUBMITTED IN THE IRAQI NATIONAL LIBRARY UNDER NO 2414 YEAR



VOL **NO** **202**

WWW.KUNSCJ.KUNOOZE.EDU.IQ



Files

[XML](#)

History

Share

How to cite

Statistics

[Article View](#)

57

Search

[Advanced Search](#)

[Home](#)

[Browse](#)

[Journal Info](#)

[Guide for Authors](#)

[Submit Manuscript](#)

[Reviewers](#)

[Contact Us](#)

[Home](#)

[About Journal](#)

[Editorial Board](#)

[Submit Manuscript](#)

[Contact Us](#)

[Sitemap](#)

News

Newsletter Subscription

Subscribe to the journal newsletter and receive the latest news and updates

Subscribe