frontiers | Frontiers in Materials

TYPE Editorial
PUBLISHED 03 November 2022
DOI 10.3389/fmats.2022.1059009

OPEN ACCESS

EDITED AND REVIEWED BY
Robert Li,
City University of Hong Kong, Hong Kong SAR, China

*CORRESPONDENCE
Nafisa Gull,
nafisagull@gmail.com,
nafisagull.ipte@pu.edu.pk

SPECIALTY SECTION
This article was submitted to Polymeric and Composite Materials, a section of the journal Frontiers in Materials

RECEIVED 30 September 2022
ACCEPTED 06 October 2022
PUBLISHED 03 November 2022

CITATION
Gull N, Khan SM, Ullah A and Khan RU (2022), Editorial: Polymer blends for drug release systems.
Front. Mater. 9:1059009.
doi: 10.3389/fmats.2022.1059009

Editorial: Polymer blends for drug release systems

Nafisa Gull[1]*, Shahzad Maqsood Khan[1], Aman Ullah[2] and Rafi Ullah Khan[1]

[1]Institute of Polymer and Textile Engineering, University of the Punjab, Lahore, Pakistan, [2]Department of Agricultural, Food and Nutritional Science, Faculty of Agricultural, Life & Environmental Sciences, University of Alberta, Edmonton, AB, Canada

KEYWORDS

polymers, blend, drug release, crosslinking, hydrogel

Editorial on the Research Topic
Polymer blends for drug release systems

Controlled drug release is considered a new approach in pharmaceutical fields to reduce recurrent, severe drug reactions and to optimize efficiencies by reducing fluctuations in both the concentration and dosage of drugs. In this regard, polymer blending, where the properties of the blends are different from the individual polymers, is considered to be an attractive approach. This Research Topic presents six research articles, two mini-reviews, and one review, providing insight into this field and offering a basis for further studies.

Shirazi et al. extracted keratin from protein-based chicken feathers using reduction hydrolysis (sodium sulfide). Nanogel composites comprising different ratios of keratin and Tragacanth gum were produced using a chemical crosslinking method. Cinnamon (5 and 10%), as an antibacterial herbal extract, was subsequently added to the nanogels which were then coated on cotton fabric. Finally, different properties of the prepared nanogels were evaluated to assess their suitability for drug delivery in wound dressings and medical textiles. Ghasemiyeh et al. provided an overview on polymer blends that can be used as release-modulating tools in drug delivery. Firstly, different types of polymers and their various applications in biomedical sciences were discussed, and smart or stimuli-responsive polymers were introduced and categorized based on their nature. Secondly, the rationale for polymer blending in drug delivery systems was discussed. Different types of polymer blends, including physical mixtures, core-shell polymeric carriers, and block copolymers were summarized, with a focus on the effect of polymer blending on encapsulated drug release profiles. Finally, the impact of each blending approach on the drug release profiles and the kinetics of drug release were discussed in tabular format.

Raza et al. proposed a state-of-the-art irradiation technology for the fabrication of hydrogels and studied their applications in drug release systems. Irradiation crosslinking of polymers is considered to be a safe method for the fabrication of hydrogels because crosslinking occurs without the addition of unnecessary toxic reagents such as initiators

or crosslinkers. This technology is a useful way to sterilize and crosslink in a single step. Several different combinations of natural and synthetic polymers can be crosslinked using high-energy ionizing radiation such as electron-beam and gamma-ray irradiation. Polymeric hydrogels prepared using these techniques exhibit excellent gel fractions, swelling ratios, mechanical properties, drug loading and release characteristics, antimicrobial characteristics, and *in-vivo*/*in-vitro* cytocompatibilities. This mini-review on irradiation-crosslinked hydrogels provides excellent guidelines for new researchers to proceed further in this field.

Redondo et al. discussed the use of a composite poly (dimethylsiloxane-*block*-ε-caprolactone) copolymer coating and tricalcium phosphate as precursors for the electrophoretic deposition of compact and homogenous coatings, yielding useful substrates for hydroxyapatite growth. The authors argued that the obtained coatings exhibited an enhanced capacity to induce the precipitation of tricalcium phosphate and suggested that the chemical transformation of tricalcium phosphate into hydroxyapatite occurred *via* a dissolution–precipitation mechanism.

Buntum et al. explored the potential of a drug delivery system based on longan seed extract (LSE) incorporated in alginate/chitosan (Alg/CS) beads. The beads were prepared using an ionic gelation method *via* the interaction between protonated amino groups in CS and negatively charged carboxylic groups in Alg. The properties of the LSE-loaded Alg/CS beads, including the morphology of the beads, particle sizes, encapsulation efficiency (%EE), controlled release profile, cytotoxicity, and biocompatibility, were investigated. Based on the results, the beads can be used as drug carriers for biomedical applications. Rehmat et al. developed novel pH-sensitive, biodegradable, and antimicrobial hydrogels from the bio-macromolecule pectin, polyvinyl pyrrolidone (PVP), 3-aminopropyl (diethoxy) methylsilane (3-APDEMS), and sepiolite clay using a blending and solution-casting technique. The purified sepiolite (40 μm) was functionalized with the crosslinker 3-APDEMS (*ex-situ* modification) followed by hydrogel fabrication.

Naz et al. prepared nanofiber mats consisting of a chitosan (CTS)/polyvinyl alcohol (PVA)/halloysite nanoclay. Drug-loaded CTS/PVA/halloysite nanoclay//3-glycidyoxypropyl trimethoxysilane nanofibers were fabricated using an electrospinning method. The electrospun nanofiber samples were characterized using Fourier transform infrared spectroscopy (FTIR), scanning electron microscopy (SEM), and thermogravimetric analysis (TGA). These drug-loaded nanofibers are proposed to be used in different clinical applications.

Manna et al. synthesized matrix-type transdermal glibenclamide patches using a combination of hydrophilic and hydrophobic polymers and utilized them to investigate the efficacy of transdermal carriers. The matrix-type transdermal patches were developed using a solvent-casting technique by dissolving a hydrophilic and a hydrophobic polymer. HPMC E50 was selected as the hydrophilic matrix-forming polymer and was combined with the hydrophobic Eudragit RS 100. The authors concluded that the developed formulations may be superior alternatives to the conventional oral delivery of glibenclamide. Aktas et al. explored the specific pathways associated with the fabrication of polymeric organic hydrogels in order to develop novel biomaterials for pharmaceutical, medical, and drug-delivery platforms. This short review focused on a number of pioneering, prospective organo-hydrogels, particularly those useful in clinical therapy. The review also discussed their biodegradable, target-responsive properties for use as sensing components in novel microscale apertures. The authors expect that these organogels will be increasingly utilized in the coming years because of their unique characteristics such as biocompatibility, facile tunability, and tailorability using chemical modifications. These properties enable organogels to be potentially applied in a vast array of applications such as drug delivery, anti-icing, anti-fouling, food processing, and so on.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

Conflict of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note