Review Article

Recent developments in sustained-release and targeted drug delivery applications of solid lipid nanoparticles

Hanaa Ali Hussein, Fatin L. Khaphi, Ramachandran Sivaramakrishnan, Sivamani Poornima & **Mohd Azmuddin Abdullah**

Received 24 Sep 2024, Accepted 14 Apr 2025, Published online: 29 Apr 2025

Cite this article https://doi.org/10.1080/02652048.2025.2495290

Abstract

Solid Lipid Nanoparticles (SLNs) are versatile nano-carriers for wide range of applications. The advantages of SLNs include ease of preparation, low toxicity, high active compound bioavailability, flexibility of incorporating hydrophilic and lipophilic drugs, and feasibility of large-scale production. This review provides an overview on the preparation methods of the SLNs, the micro and nanostructure characteristics of the SLNs, and the different factors influencing sustained release and targeted drug delivery. The applications in agriculture and environment, cosmetics, wound healing, malarial treatment, gene therapy and nano-vaccines, and cancer therapy, are elaborated. The mechanisms such as passive, active, and co-delivery are discussed. The issues, challenges and the way forward with ionisable SLNs for delivery of gene and vaccines, RAS-targeted therapy, and bioactive compounds, are highlighted. In combination with multiple compounds and the potential for

integration with nature/bio-based solutions, SLNs are proven to be effective, and practical for diverse applications.

Keywords:

Solid lipid nanoparticles sustained release targeted delivery

biomedical application mechanism ionisable lipids

Acknowledgements

The authors thank the respective institutions for research opportunities and facilities.

Disclosure statement

The authors declare no competing interests.

Data availability

Data based on published data from literature are duly cited, and personal data will be made available upon request.

Ethics approval and consent to participate

Not applicable.

Patient consent for publication

Not applicable.

Log in to Taylor & Francis Online

Log in

Restore content access

Restore content access for purchases made as guest

PDF download + Online access

- 48 hours access to article PDF & online version
- Article PDF can be downloaded
- Article PDF can be printed

USD 68.00 Add to cart

Issue Purchase

- 30 days online access to complete issue
- Article PDFs can be downloaded
- Article PDFs can be printed

USD 894.00 Add to cart

* Local tax will be added as applicable