

REVIEW



Cite this: *J. Mater. Chem. B*,
2024, 12, 11887

Nanobiopolymers in cancer therapeutics: advancing targeted drug delivery through sustainable and controlled release mechanisms

Shikha Gulati,^a Nabeela Ansari,^d Yamini Moriya,^c Kumud Joshi,^c
Disha Prasad,^a Gargi Sajwan,^b Shefali Shukla,^a Sanjay Kumar^{*a} and
Rajender S. Varma^{*e}

Nanobiopolymers have emerged as a transformative frontier in cancer treatment, leveraging nanotechnology to transform drug delivery. This review provides a comprehensive exploration of the multifaceted landscape of nano-based biopolymers, emphasizing their diverse sources, synthesis methods, and classifications. Natural, synthetic, and microbial nanobiopolymers are scrutinized, along with elucidation of their underlying mechanisms and impact on cancer drug delivery; the latest findings on their deployment as targeted drug delivery agents for cancer treatment are discussed. A detailed analysis of nanobiopolymer sources, including polysaccharides, peptides, and nucleic acids, highlights critical attributes like biodegradability, renewability, and sustainability essential for therapeutic applications. The classification of nanobiopolymers based on their origin and differentiation among natural, synthetic, and microbial sources are thoroughly examined for inherent advantages, challenges, and suitability for cancer therapeutics. The importance of targeted drug release at tumour sites, crucial for minimizing adverse effects on normal tissues, is discussed, encompassing various mechanisms. The role of polymer membrane coatings as a pivotal barrier for facilitating controlled drug release through diffusion is elucidated, providing further insight into efficient methods for cancer treatment and thus consolidating the current knowledge base for researchers and practitioners in the field of nanobiopolymers and cancer therapeutics.

Received 22nd March 2024,
Accepted 20th October 2024

DOI: 10.1039/d4tb00599f

rsc.li/materials-b