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Control of Polymeric Nanoparticle Size to Improve Therapeutic Delivery

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Abstract

As nanoparticle (NP)-mediated drug delivery research continues to expand, understanding parameters that govern NP interactions with the biological environment becomes paramount. The principles identified from the study of these parameters can be used to engineer new NPs, impart unique functionalities, identify novel utilities, and improve the clinical translation of NP formulations. One key design parameter is NP size. New methods have been developed to produce NPs with increased control of NP size between 10 to 200 nm, a size range most relevant to physical and biochemical targeting through both intravascular and site-specific deliveries. Three notable techniques best suited for generating polymeric NPs with narrow size distributions are highlighted in this review: self-assembly, microfluidics-based preparation, and flash nanoprecipitation. Furthermore, the effect of NP size on the biological fate and transport properties at the molecular scale (protein-NP interactions) and the tissue and systemic scale (convective and diffusive transport of NPs) are analyzed here. These analyses underscore the importance of NP size control in considering clinical translation and assessment of therapeutic outcomes of NP delivery vehicles.

Key Words: size control, polymeric nanoparticles, nanomedicine, drug delivery