Rational Design in Fashioning Iron Oxide Nanoparticles with Polymer Capping Layer for Drug Delivery Applications

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Abstract

The application of iron oxide nanoparticles (IONPs) in the biomedical sector has been explored comprehensively, especially in drug delivery systems. However, the limitations of IONPs related to agglomeration tendency and instability due to oxidation are still the main problems in applying IONPs practically. Surface modification of IONPs using a polymer as a capping layer is an excellent solution that has recently been developed to overcome these problems. In this review, we try to compile the information and extract plausible strategies to obtain a highly efficient polymer capping layer for IONPs, especially in supporting their applications in drug delivery systems. The discussion starts with the basic introduction of IONPs and the polymer capping layer, as well as the synthesis mechanism of polymer-stabilized IONPs. The polymer characteristics that highly contributed to the physical and chemical characteristics of polymer-stabilized IONPs are described. The future steps to enhance specificity targeting and efficacy in a drug delivery were also explained together with the exploration of targeting molecules or ligand-assisted IONPs attachment to the specific receptor, continued by drug release to the cells is also discussed comprehensively. We expect that our review can pave the way for the implementation of polymer-stabilized IONPs in targeted drug delivery systems for various drugs in the field of cancer treatment and infection. This study also provided information about the key role of the polymer capping

layer for IONPs, thus we hope that this review article is not only important for laboratory-scale research but also for industrial research-based developments.