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# Gadolinium-Based Polymer Nanostructures as Magnetic Resonance Imaging Contrast Agents

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**Abstract :** Recent advances in diagnostic imaging technology have significantly contributed to a better understanding of specific changes associated with diseases progression. Among different imaging modalities, Magnetic Resonance Imaging (MRI) represents a noninvasive medical diagnostic technique, which shows low sensitivity and long acquisition time and it can discriminate between healthy and diseased tissues by providing 3D data. In order to improve the enhancement of MRI signals, some imaging exams require intravenous administration of contrast agents (CAs). Recently, emerging research reports a progressive deposition of these drugs, in particular, gadolinium-based contrast agents (GBCAs), in the body many years after multiple MRI scans. These discoveries confirm the need to have a biocompatible system able to boost a clinical relevant Gd-chelate. To this aim, several approaches based on engineered nanostructures have been proposed to overcome the common limitations of conventional CAs, such as the insufficient signal-to-noise ratios due to relaxivity and poor safety profile. In particular, nanocarriers, labeling or loading with CAs, capable of carrying high payloads of CAs have been developed. Currently, there's no a comprehensive understanding of the thermodynamic contributions enable of boosting the efficacy of conventional CAs by using biopolymers matrix. Thus, considering the importance of MRI in diagnosing diseases, here it is reported a successful example of the next generation of these drugs where the commercial gadolinium chelate is incorporate into a biopolymer nanostructure, formed by cross-linked hyaluronic acid (HA), with improved relaxation properties. In addition, they are highlighted the basic principles ruling biopolymer-CA interactions in the perspective of their influence on the relaxometric properties of the CA by adopting a multidisciplinary experimental approach. On the basis of these discoveries, it is clear that the main point consists in increasing the rigidification of readily-available Gd-CAs within the biopolymer matrix by controlling the water dynamics, the physicochemical interactions, and the polymer conformations. In the end, the acquired knowledge about polymer-CA systems has been applied to develop of Gd-based HA nanoparticles with enhanced relaxometric properties.

**Keywords :** biopolymers, MRI, nanoparticles, contrast agent
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