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Preparation of Polymer-Stabilized Magnetic Iron Oxide as Selective Drug Nanocarriers to Human Acute Myeloid Leukemia

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Abstract : Drug delivery to target human acute myeloid leukemia (AML) using a nanoparticulate chemotherapeutic formulation that can deliver drugs selectively to AML cancer is hugely needed. In this work, we report the development of a nanoformulation made of polymeric-stabilized multifunctional magnetic iron oxide nanoparticles (PMNP) loaded with the anticancer drug Doxorubicin (Dox) as a promising drug carrier to treat AML. Dox@PMNP conjugates simultaneously exhibited high drug content, maximized fluorescence, and excellent release properties. Nanoparticulate uptake and cell death following addition of Dox@PMNPs were then evaluated in different types of human AML target cells, as well as on normal human cells. While the unloaded MNPs were not toxic to any of the cells, Dox@PMNPs were found to be highly toxic to the different AML cell lines, albeit at different inhibitory concentrations (IC₅₀ values), but showed very little toxicity towards the normal cells. In comparison, free Dox showed significant potency concurrently to all the cell lines, suggesting huge potentials for the use of Dox@PMNPs as selective AML anticancer cargos. Live confocal imaging, fluorescence and electron microscopy confirmed that Dox is indeed delivered to the nucleus in relatively short periods of time, causing apoptotic cell death. Importantly, this targeted payload may potentially enhance the effectiveness of the drug in AML patients and may further allow physicians to image leukemic cells exposed to Dox@PMNPs using MRI.

Keywords : magnetic nanoparticles, drug delivery, acute myeloid leukemia, iron oxide, cancer nanotherapy
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