580c Equilibrium of Gadolinium Binding to Biocompatible Nanoparticles as Mri Contrast Agents

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Gd3+ has been used as MRI contrast agent. However, few side effects such as mild headache, nausea and local pain of Gd3+ have been reported. The biocompatible nanoparticle of Gd3+ has thus been formulated to reduce the side effect during biodistribution.

Objectives: To determine the equilibrium of binding of the Gd3+ to the biocompatible nanoparticles.

Methods: The nanoparticle containing 0.5 mM of phospholipid chelate dimyristoyl phosphoethanolamine diethylene triamine penta acetic acid (PE DTPA-NPs) was designed as O/W microemulsion composed of 2 mg of Ewax and 4 mg of Brij78. PE DTPA then chelated with 0.5 mM GdCl3 which resulted in a delivery tool for Gd3+. Purification of Gd3+ bound form with PE-DTPA-NPs (PE-DTPA-NPs-Gd3+) was performed by using gel permeable chromatography (GPC). The Sepharose™ CL4B was used as a stationary phase. PE-DTPA-NPs-Gd3+ was selectively eluted by 0.1 M NaCl, pH 7.4. The conditional equilibrium binding of the PE-DTPA-NPs-Gd3+ was then determined by using a competitive binding experiment between PE-DTPA-NPs-Gd3+ and the color dye arsenazo (III) at pH 4. The binding constant was determined spectrophometrically using uv-vis with a wavelength of 660 nm.

Result: The size of PE-DTPA-NPs-Gd3+ was 95.5 ± 37.6 nm. The conditional binding constant , Log K cond, was found to be 9.29±0.052 . The calculated thermodynamic binding constant, Log K thermo, was found to be approximately 18.

Conclusion: This nanotemplate engineering approach allows the possibility of incorporating targeting agents on the surface of the NPs. The high thermodynamic binding constant calculated indicates that the binding is sufficiently strong to prevent the release of toxic Gd3+ ions.