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Novel Polymer-Coated Magnetic Nanobeads with Bioactive Molecules Immobilized Strongly onto the Surfaces

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Under neutral conditions (pH=7-9) and temperature as low as 4°C we successfully synthesized ferrite nanoparticles (Fe_3O_4-γ-Fe_2O_3 intermediate) from an aqueous solution. These experimental conditions enabled us to immobilize even very unstable bioactive molecules onto the surfaces of the ferrite nanoparticles during their synthesis. The bioactive molecules were strongly fixed onto the ferrite surface intermediated by specific amino-acids or related-structure molecules each having pairs of carboxyl (COOH) groups. Utilizing the strong bonds between such molecules and ferrites, we successfully prepared bioactive ferrite nanobeads where the ferrite nanoparticles were encapsulated in a polymer exhibiting negligible non-specific absorption of proteins. We also successfully fixed bioactive molecules onto the surfaces of the polymer coating of the ferrite nanobeads. Furthermore, we succeeded in replacing the ferrite nanoparticles with Fe nanoparticles, thus enhancing magnetization. We will describe promising applications of our novel bioactive ferrite nanobeads such as high performance magnetic carriers for bio-screening, hypothermia, MRI contrast enhancement, and magnetic drug delivery.