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Isolation of DNA using superparamagnetic iron oxide nanoparticles

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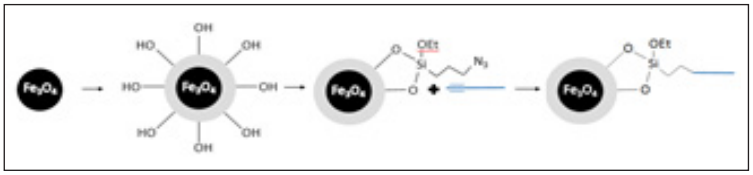

Detection of low abundant target DNA in the cases of viral infections, tumor characterization, disease prognoses, transplantations and many more are extremely difficult because these low abundant target sequences are buried in huge human genomic background. Therefore, DNA separation is mostly coupled with either primer-based amplification or probe-based capture methods. Probe based capture method, such as using streptavidin coupled magnetic beads, however, does not increase the DNA capturing efficiency because of high level non-specific interaction. To overcome this limitation, we redesign the surface chemistry of capture beads by applying click chemistry. Other than the most commonly used streptavidin-biotin interaction, click chemistry employs Cu[I]-catalyzed Azides-Alkynes Huisgen cycloadditions (CuAAC) lead to stable and rigid triazole linkages. Along with inert silica surface coverage, triazole linkers could effectively reduce any possible non-specific interaction. Moreover, CuAAC reaction is fast, high-yielding and highly tolerant of a variety of functional groups. It performs efficiently in aqueous media and generates stable products in the face of heat and denaturation agents. We firstly prepared magnetic nanoparticles (nanoclusters) with silica core-shell and designated super-paramagnetic behavior. In a second step, we introduced azide groups onto the surface of magnetic nanoparticles as the functionalization layer for click chemistry. Finally, we applied CuAAC click reaction for a facial and highly efficient cross-linking of oligonucleotides to the silica surface. The physicochemical properties of the particles such as size, morphology, magnetic properties, crystallinity, DNA loading fully characterized by using SEM, TEM, VMS, XRD, XPS and FT-IR techniques. The characteristic tests and DNA isolation experiments show that a biocompatible nanocluster with a dense monolayer of oligonucleotide were generated with increased the DNA capturing efficiency and decreased the non-specific interaction.

Biography

Fereshte Damavandi is currently a PhD student in Chemical and Material Engineering Department, University of Alberta. She has obtained her MSc and BSc degrees both in the field of Chemical Engineering from Amirkabir University of Technology, Tehran, Iran.

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