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High-Stabilization of Biomolecules DNA-C, L on Magneto NPs

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Abstract

Objectives: The project is based on extensive studies on applied nanoparticles in biology and medicine. **Methodology**: Fe_3O_4 Magnetic Nanoparticles (MNPs) with core/shell structure was synthesized by a chemical-co-precipitation method. This work is done at 0.5 h to 48h with multi-times i.e., 20ng numbers of nanoparticles is provided regular with good morphology which was synthesized in <20 nm in size. Basic aim was used of nanoparticles in the absorption of biomolecules, DNA-L, C (linear, convoluted), which that detected by an Ultraviolet Spectrophotometer (UV-Vis).

Results:The results showed that absorption and diffusion of DNA-C or L at the surface of nanoparticles were 95% to 99% and 85% to 89% respectively (i.e. absorbance of DNA-C>DNA-L is) with rate of removing of on MNPs was >99%.

Conclusion: By examining the current experiment, 99% of DNAs can be stabilized on the surface of magnetic nanoparticles without any material loss. Finally, the pure DNA sample adsorbed on the surface of the magnetic nanoparticles can be isolated by an external magnetic field and a suitable method for transfer to the target cell that has a genetic defect can be modified and repaired.

Keywords: Magnetic nanoparticles • Spectrophotometry analysis

Introduction

In recent years, much research on the application of nanoparticles in the biomedical industry has received more and more attention from researchers. These days, studies on the size of nanoparticles (<20 nm) have expanded, and among these, the use of magnetic nanoparticles is a priority because it has the ability to be easily separated by an external magnetic field without harmful effects on the transfer to the target cell. As in previous research [1-3], on the use of magnetic nanoparticles in the stabilization of protein and ampicillin, led to their use in the stabilization and release of DNA. In this project we intend to competitively to do investigate an absorption and removing of DNA (linear and cyclic) from silica-coated magnetic nanoparticles to an important goal being the selection of a nanocomposite designed for targeted stabilization andrelease of biomolecules that we can achieve in vitro (Figure 1a).

Methods and Materials

The solvents purchased were completely pure. DNA marker is the standard of Chinese biotechnology. Fe^{2+}, Fe^{3+} and NaOH from German Merck.Tris / HCl solution was purchased from Sino-pharm Chemical China as a buffer, argon gas, HCl, methanol, NaCl, glutaraldehyde. DNA (e.g., models) was prepared in dionized dual water (Maragheh Laboratory, Iran).

Synthesis of silica-coated with Fe_3O_4 magnetic nanoparticles

There are many methods for the synthesis of nanoparticles [1-3] that we used the chemical co-precipitation method in the synthesis of MNPsS. First, Fe (II) and Fe (III) were mixed with argon gas at a ratio of 1: 2 in 1 ml of deionized water at 25°C for 3 h.Finally, the nanocomposite was washed several times with ethanol solvent and placed in an oven at 60 ° C for half a day to dry completely.

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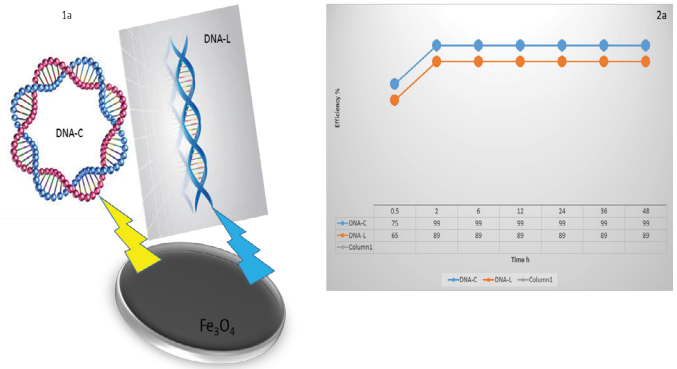

Table 1

Pattern (µl/ml)	Time (min)	Adsorption (µg/ml) %	Releasing (µg/ml) %	Extraction buffer (50µl (buffer+MNPs (DNA-L, C/wavelength (nm)
DNA-L	0.5-12	85	90	Tris.HCl/280
DNA-C	0.5-12	95	95	Tris.HCl/280

Figure 1a: Nanocomposite designed for targeted stabilization andrelease of biomolecules in vitro.

Figure 2a: DNA fixation on the surface of the magnetic nanoparticles.

Table 1. Amounts of absorption and releasing data, DNA-C>L.

Pattern (µl/ml)	Time (min)	Adsorption (µg/ml) %	Releasing (µg/ml) %	Extraction buffer (50µl (buffer+MNPs-(DNA-L, C/ wavelength (nm)
DNA-L	0.5-12	85	90	Tris.HCl/280
DNA-C	0.5-12	95	95	Tris.HCl/280

Results and Discussions

Results of DNAs loaded onto magnetic nanoparticles Fe_3O_4/SiO_2 by spectrophotometry

In this section, using the Tris-hydrochloric acid buffer formula, DNA samples stabilized on the surface of nanoparticles were analyzed for 48 h. This analysis was performed by spectrophotometry, which was sampled several times and passing times between half an hour to 48 h (samples were removed from the solution during the reaction and collected by magnetism and washed with ethanol (several times)was analyzed at 280 nm (Table 1). According to the obtained results, it was shown that DNA was absorbed above 99% during the first half day and during the hours of 12 h to 48 h, no noticeable change was observed in the adsorption process. The release of DNA was close to 100% and there seemed to be no DNA in the residual solution from the former, with a difference of about 10% between linear and ring DNA, with the ring type having a high percentage of fixation on the surface of the magnetic nanoparticles (Figure 2a).

Conclusion

By examining the current experiment, 99% of DNAs can be stabilized on the surface of magnetic nanoparticles without any material loss. Finally, the pure DNA sample adsorbed on the surface of the magnetic nanoparticles can be isolated by an external magnetic field and a suitable method for transfer to the target cell that has a genetic defect can be modified and repaired.

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Conflicts of Interests

The authors declare that they have no conflict of interests.

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