Biopolymer Coated Magnetic Nanoparticles as a Carrier for Controlled Drug Delivery Systems

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Abstract

Drug delivery systems have superior features that can release drugs in the target area of the body at a sufficient dose and at the appropriate time. In controlled drug release systems, the target drug is continuously released at the optimum value over a long period [1]. Among the polymers, materials are mostly preferred as drug carriers which should be non-toxic, allow easy removal from the living system (≤ 45 kDa), and have a long residence time in the body [2]. In recent years, biomaterials sensitive to stimuli such as pH, temperature, magnetic field, and photons, known as intelligent polymers, have started to attract much attention in drug release systems [3].
The magnetic polymers are called smart polymers provide the mobility of the polymers to the desired region thanks to the externally applied magnetic field [4]. Fe_3O_4 nanoparticles are often used in the core in magnetic polymers or materials [5]. The most crucial advantage of magnetic materials is that they can be easily removed from the environment or moved toward the target area with the effect of the magnetic field. A magnetic drug delivery system is directed to the damaged area with the effect of the magnetic field and releases it only in this region. Thus, it is aimed to minimize the side effects of chemotherapeutic drugs in healthy cells.
For this respect, in this study it is aimed to prepare a magnetic drug carrier that can provide effective drug release in the target region in a short time. Magnetic alginate nanoparticles, which are both magnetic and pH-sensitive composite, was easily synthesized at mild conditions. The physicochemical properties of the obtained nanoparticles were investigated using FTIR, SEM/EDS and VSM techniques. However, the usability of the magnetic biopolymer as a carrier for chemotherapy drugs was investigated using 5-Fluorouracil as a model drug. The drug was immobilized around the magnetic alginate, surrounded by polyethyleneimine, and the drug release was controlled. In addition, biocompatibility of drug-immobilized magnetic drug carrier were determined, and the effect of magnetic field on drug release behaviour was also investigated.

References

[1] P. Öncel, J Biomater Sci Polym Ed (2013) 8(6):519-531.
[2] S. Erdoğan, Kocaeli University, (2017).
[3] T.Y. Liu, S.H. Hu, K.H. Liu, D.M. Liu, S.Y. Chen, J. Magn. Magn. Mater. 304 (2006) 397--399.
[4] O. Philippova, A. Barabanova, V. Molchanov, A. Khokhlov, Eur. Polym. J. 47 (2011) 542--559.
[5] M.M. Can, M. Coşkun, T. Firat, J. Alloys Compd. 542 (2012) 241--247.