Adsorption and Desorption Studies of Lysozyme by Thermosensitive Fe_3O_4-PNIPAM Nanocomposite via Fluorescence Spectroscopy

Esra Alveroglu[1], Naz İlker[1], Argun Gökçeören[2,3], Kenan Koç[4]*

[1]Istanbul Technical University, Department of Physics Engineering, 34469 Maslak, Istanbul, Turkey
[2]Istanbul Technical University, Department of Chemistry, 34469 Maslak, Istanbul, Turkey
[3]Ghent University, Department of Textiles, Technologiepark-Zwijnaarde 907, 9052, Belgium
[4]Yildiz Technical University, Department of Physics, 34210 Esenler, Istanbul, Turkey
*kockenan@gmail.com

In this study, Fe_3O_4 nanoparticles containing Poly(N-isopropylacrylamide) (PNIPAM) thermo-sensitive hydrogel in different cross-linker agent were synthesized and characterized. Additionally, adsorption and desorption of lysozyme from these composite materials also studied at above and below lower critical solution temperature (LCST) in deionized water. PNIPAM hydrogel has a lower critical solution temperature (LCST) in water of around 32°C, which is close to human body temperature, and they are sensitive functions of temperature over the range 15-50°C [1].

Fluorescence measurements showed that, the Fe_3O_4-PNIPAM composite materials adsorbed lysozyme molecules in short time. But, there has been no remarkable change seen on the adsorption kinetics at a temperature below and above LCST. Conversely, slow release was observed for 45°C, that is, more lysozyme molecule was desorbed at room temperature (below the LCST) than at 45°C. Accordingly results, the Fe_3O_4-PNIPAM composite materials can be used for drug delivery, protein separation and controlled release of proteins. In addition to these results, fluorescence measurements were found a useful way for following of adsorption and desorption of fluorescent active protein onto Fe_3O_4-polymer composite material [2].

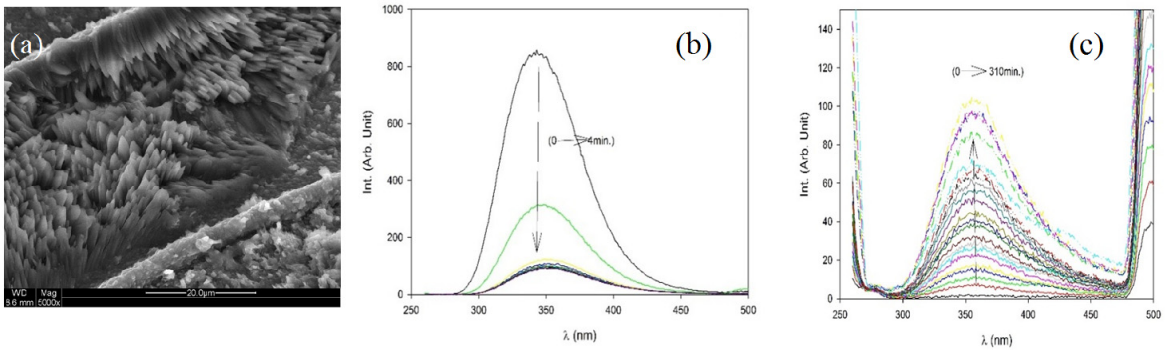

Figure 1: (a) SEM image of Fe_3O_4-PNIPAM composite material. (b) Changing of fluorescence spectra of the lysozyme during adsorption. (c) Changing of fluorescence spectra of the lysozyme into pure water during desorption process from Fe_3O_4-PNIPAM composite.

References

[1] H.G. Schild: *Poly (N-Isopropylacrylamide)-experiment, theory and application*. Progress in Polymer Science **17**, 163-249 (1992).

[2] K. Koc, E. Alveroglu: *Adsorption and desorption studies of lysozyme by Fe3O4–polymer nanocomposite via fluorescence spectroscopy*. Journal of Molecular Structure **1089,** 66–72 (2015).