

Nanochemical and Nanobiotechnology

The impact of magnetic nanoparticles and microwaves on red blood cells

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Magnetic nanoparticles (MNPs) have applications in molecular biology, magnetically assisted drug targeting, medical diagnostic, cancer therapy, etc. [1, 2]. Here we focused on red blood cells response to MNPs and microwave (MW) impact which can occur during specific medical procedure of tumor hyperthermia with MNPs. Shimadzu spectral device was used to assess hemolysis extent in total blood – from healthy adult volunteers - as side effect balancing MNPs/MW benefits. MNPs were prepared by chemical route, while MW of low power density were provided by laboratory assembled system. Hemolytic effect was evidenced mainly in samples treated with magnetic nanoparticles exposed for 12 h at physiological temperature in INCUCCELL device. One can assume that local weak magnetic field generated by MNPs attached to red blood cell membrane could perturb membrane integrity – acting on some ion channels or larger pores involved in cell communication pathway; paramagnetic iron ions from hemoglobin could favor MNP action. MW energy could also trigger some synergic processes that could further result in hemoglobin release. Possible side effects of MNPs utilization in medicine appears as a research issue of high priority for our further project stage.

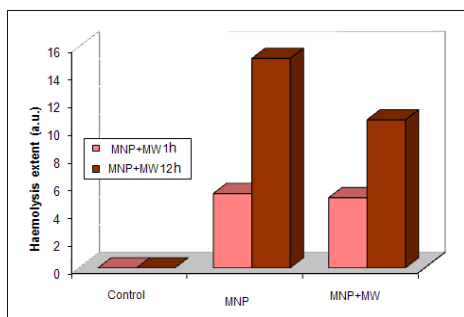


Fig.1. Hemolytic effect of magnetic nanoparticles and microwaves

1. Yamaguchi T, Mukai-sho Y, et al., Disruption of erythrocytes distinguishes fixed cells/tissues from viable cells/tissues following microwave coagulation therapy// Dig Dis Sci -2005.-50. N 7.- P. 1347-1355.

2. Tan J, Thomas A, Liu Y, Influence of red blood cells on nanoparticle targeted delivery in

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