FRIDAY - 596 / FRIDAY - 596 - Iron Oxide Nanoparticles As Antimicrobial Agents

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L. Gabrielyan: None. **A. Trchounian:** None.

Abstract

Background: Growing resistance to antibiotics among pathogenic microorganisms requires the development of alternative approaches. Ability of various nanoparticles to change bacterial metabolic activity represents a key advantage for suppressing bacteria in treatment of different diseases. Small sizes of nanoparticles can contribute to bactericidal effects via their penetration through bacterial membranes. The aim was to study of iron oxide (Fe_3O_4) nanoparticles effects on Gram-negative *Escherichia coli* BW25113 and Gram-positive *Enterococcus hirae* ATCC9790 growth properties and membrane activity. **Methods:** *E. coli* and *E. hirae* were cultivated in anaerobic conditions in peptone and tryptone media, respectively. Fe_3O_4 nanoparticles coated with oleic acid were synthesized by co-precipitation method. These nanoparticles in the concentration of 50 to 500 μg/mL were added into the growth medium. **Results:** Fe_3O_4 nanoparticles of 100-500 μg/mL have shown better bactericidal effect on *E. coli* than on *E. hirae*. Probably they can interact with membranes, and the inactivation of bacteria could be due to penetration into the cell. The reactive oxygen species together with superoxide and hydroxide radicals and singlet oxygen formed by metal oxides could be the inhibition cause. Fe_3O_4 nanoparticles decreased H^+-fluxes through membranes more in *E. coli* than in *E. hirae* (even in the presence of *N,N'*-dicyclohexylcarbodiimide (DCCD). However, DCCD-sensitive H^+-translocating ATPase activity of membrane vesicles was increased more in *E. hirae* than in *E. coli*. The results suggested that the F_OF_1-ATPase can be a target for Fe_3O_4 nanoparticles. **Conclusions:** The alterations in growth properties, transport and enzymatic properties can be considered as cellular mechanisms for the Fe_3O_4 nanoparticles effects on bacteria. These are of significance, since *E. hirae* and *E. coli* can be considered as model organisms for Gram-positive and Gram-negative bacteria, respectively. They have also pathogenic forms, responsible for various diseases. Therefore, Fe_3O_4 nanoparticles can be used to regulate the bacterial growth and membranes activity, facilitating their application in biomedicine and pharmaceutics, as antibacterial agents.