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Paper Poster Session
Discovery of more new antibacterial drugs

Magnetite nanoparticles functionalized with plant derived compounds reduce the resistance and persistence of opportunistic pathogens

Alina Maria Holban*[1], E Andronescu[2], Alexandru Mihai Grumezescu[3], Lm Ditu[4], C Iordache[5], V Lazar[5], V Grumezescu[6], Mariana Carmen Chifiriuc[7]

[1]*University of Bucharest, Bucharest, Romania*

[2]*University Politehnica of Bucharest, Bucharest, Romania, Bucharest, Romania*

[3]*University Politehnica of Bucharest, Bucharest, Romania, Department of Science and Engineering of Oxide Materials and Nanomaterials, Bucharest, Romania*

[4]*University of Bucharest, Bucharest, Romania, Research Institute of the University of Bucharest, Bucharest, Bucharest, Romania*

[5]*Research Institute of the University of Bucharest, Bucharest, Bucharest, Romania*

[6]*Inflpr, Magurele, Romania, Bucharest, Romania*

[7]*University of Bucharest, Research Institute of Bucharest University, Microbiology Immunology, Bucharest, Romania, Bucharest, Romania*

Background: Nanosized shuttles developed for the transport, delivery and stabilization of antimicrobial agents represent efficient alternatives to balance the current antibiotics inefficiency. The aim of this study was to obtain antimicrobial magnetite nanoparticles functionalized with five plants derived natural compounds, efficient against biofilm embedded and planktonic Pseudomonas aeruginosa and Staphylococcus aureus cells.

Material/methods: Ten clinical (five P. aeruginosa and five S. aureus) resistant strains and two laboratory isolates were utilized in this study. Magnetite nanoparticles (Fe3O4@) have been synthesized by co-precipitation, characterized by infrared (IR), scanning electron microscopy (SEM) and high resolution transmission electron microscopy (HR TEM) and functionalized with the plant derived compounds: eugenol (E), eucalyptol (e), carvone (C), limonene (L) and beta-pinene (BP). Minimum inhibitory concentrations were established by broth microdilution, while biofilm formation and production of persisters both in planktonic and sessile cultures were assessed by viable counts, in the presence/absence of the antibiotics Gentamicin (G) and Norfloxacin (N) for different periods of time.

Results: Our results demonstrated that all obtained nanoformulations inhibited bacterial multiplication, attachment and biofilm formation in the following decreasing order of their efficiency: Fe3O4@E>Fe3O4@L>Fe3O4@C>Fe3O4@BP>Fe3O4@e. These effects were dose and time dependent, the results becoming significant after at least 4h of incubation for resistant clinical isolates. Furthermore, subinhibitory concentrations of the obtained nanobioactive materials modulated the resistance of reference and clinical strains to Gentamicin and Norfloxacin. Fe3O4@E significantly

reduced the formation of persister cells in planktonic cultures of P. aeruginosa when grown in the presence of 10microgram/mL G ($p<0.05$) or 3microgram/mL N ($p<0.01$), and of S. aureus in the presence of 7microgram/mL G or 0.3microgram/mL N ($p<0.05$). Fe3O4@E and Fe3O4@Calso reduced the selection of resistant cells in P. aeruginosa and S. aureus monospecific static biofilms grown in the presence of G and N after at least 6h of incubation for resistant strains.

Conclusions: The obtained data demonstrate that magnetite nanoparticles functionalized with plant-derived compounds represent successful combinations for the development of efficient antimicrobial strategies based on natural products to fight severe infections produced by resistant and biofilm forming pathogens.