# Impact of Biohybrid Magnetite Nanoparticles and Moroccan Propolis on Adherence of Methicillin Resistant Strains of *Staphylococcus aureus* : Application fields

Pr Badiaa Lyoussi
Laboratory of Natural Substances, Pharmacology, Environment, Modeling, Health and Quality of Life (SNAMOPEQ), Sidi Mohamed Ben Abdellah University, Fez, Morocco
E-mail: lyoussi@gmail.com

The biologically synthesized nanomaterials are an important aspect in biotechnology as well as in the field of nanomedicine. The capacity of nano-antimicrobial agents to penetrate bacteria and biofilm can make them as potential agents for controlling infectious diseases Magnetite nanoparticles (MNPs) have been evaluated for inhibiting microbial growth and biofilm formation. In this study the effect of the nanocomposite Moroccan propolis extract / MNPs acting against methicillin resistant strains of *Staphylococcus aureus* (MRSA) was evaluated. MNPs were obtained through the co-precipitation method. The fabricated nanostructure was characterized by X-ray Diffraction (DRX), Transmission Electron Microscopy (TEM), and Fourier Transform-Infrared Spectroscopy (FTIR). TEM of MNPs provided a particle average size of 15 nm, FTIR spectral analysis enabled a fast way of identification of MNPs, attesting the occurrence of the different combinations. The use of MNPs loaded with propolis and the antibiotic chloramphenicol at Minimum Inhibitory Concentration (MIC) value inhibited the bacterial growth of MSSA (methicillin susceptible strain of *S. aureus* ) and MRSA strains. After the treatment with MNPs-OA-P-CLo nanocomposite (MNPs with oleic acid, propolis and chloramphenicol), the disruption of the bacterial cell was observed by TEM. The combination of propolis and chloramphenicol in free form at MIC value largely impaired both MSSA and MRSA strains as, after 2 h of treatment, no viable cells of MRSA 2 and MRSA 16 were recovered. Hence, the results elucidated a new antibacterial nanocomposite synthesis, for possible applications as prospective nano-antibacterial agents or drug carriers.

The importance of nanoparticles as drug delivery systems with optimized physicochemical and biological properties consists in the fact that they are taken up by the cells more easily than larger molecules, so they can be successfully used as delivery tools for currently available bioactive compounds. Overall, in this study, we report the synthesis of a 15 nm nanostructure, which when combined with propolis extract and the antibiotic CLo, exhibited antibacterial activity against different S. aureus strains, including MRSA. The action of the propolis nanocomposite targeted the bacterial cell wall evidencing their disruption and protrusions formation. The obtained results demonstrated that the proposed strategy prove to have an important benefit due to its antibacterial properties on demand for numerous medical applications.