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MAGNETIC IRON OXIDE NANOPARTICLES TREATMENT FOR BIOFILM UNDER DIFFERENT CONDITIONS

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Bacterial colonization in the form of biofilms on surfaces causes persistent infections and is an issue of considerable concern to healthcare providers. The most important factor in the pathogenesis of medical device-associated staphylococcal infections is the formation of adherent, multilayered bacterial biofilms. Biofilms play a pivotal role in healthcare-associated infections, especially those related to the implant of medical devices, such as intravascular catheters, urinary catheters and gastrointestinal (GI) endoscopy. So there is an urgent need for novel antimicrobial or biomedical devices that provide protection against biofilm formation and planktonic pathogens, including antibiotic resistant strains. Due to the protection of extracellular polymeric substances (EPS) on biofilms, conventional antibiotics used clinically including methicillin are hard to penetrate inside and effective against the biofilm. As an alternative, magnetic iron-oxide nanoparticles (MNPs) were synthesized into three different sizes (8nm, 11nm and 70nm) and coated with silica act as the "wall breaker" to perpetrate and eradicate the infectious bacteria under AC magnetic field and rotation condition. Methicillin resistant *Staphylococcus aureus* (MRSA) was used to demonstrate the efficacy of the three different sizes MNPs under different conditions. All the three nanoparticles effect has great improvement under rotation and the bacterial reduction ranging between 4.44 to 9.38 logs in varying sizes after contact for 15min. While combine with AC magnetic field which could cause the hyperthermia effect and show bacterial reduction between 2.24 to 8.56 logs for different sizes nanoparticles. The 11nm MNPs presented the greatest effect under each condition and achieved eradicate biofilms under rotation while the 70nm particles demonstrated the worse efficacy. Besides, the MNPs were shown to cause disruption and mechanical damage on the films after combines with the external conditions. These conditions also enable the detachment of the *S. aureus* biofilms by bringing damage to the polymeric EPS.

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