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Carbon nanotubes combat methicillin-resistant *Staphylococcus aureus in vitro*

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The large-scale and unreasonable usage of antibiotics in animal husbandry for a long time has caused the outbreak of drug resistance crisis, seriously threatened the health of livestock and poultry. As a new material, carbon nanotubes have the characteristics of stable performance, easy to be modified and can enter bacterial membrane, and it is not picnic to induce bacterial resistance. Single-walled carbon nanotubes (SWCNTs) and multi-walled carbon nanotubes (MWCNTs) were treated at the gradient concentrations of 1, 0.5, 0.25 and 0.125 mg/ml to determine the minimum bactericidal concentration (MBC) of *Staphylococcus aureus* ATCC29213, Methicillin-resistant *Staphylococcus aureus*-AR1 (MRSA-AR1), Methicillin-resistant *Staphylococcus aureus*-ST9 (MRSA-ST9) that derived from pig. Results revealed that the two kinds of carbon nanotube showed good bacteriostatic effect on three strains of *Staphylococcus aureus*, ATCC29213, MRSA-AR1 and MRSA-ST9 at the concentrations of 0.125 mg/ml. The colony with inhibitory effect was observed under the microscope, and it was found that the carbon nanotube particles diffused into the colony. Carbon nanotubes have larger specific surface area and smaller tube diameter. Therefore, they can be in full contact with bacteria. The antibacterial activity may be produced by affecting the aggregation between bacterial cells. The results showed that the application of carbon nanotubes could be an effective antibacterial materials used in veterinary clinics. Our work will shed light on the alternative strategies to treat the clinical infection of resistant bacteria and development of novel antibacterial agents.

Keywords: Carbon nanotubes, Antibacterial activity, *Staphylococcus aureus*