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Carbon dots: A new class of light-activated antimicrobial agents

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Infectious diseases caused by bacterial pathogens have been a serious threat to public health for decades and remain one of the major concerns of our society. Control and prevention of pathogen contamination are effective ways to reduce the risk of such disease. Photo-activated antimicrobial technology is a rapidly developing field in response to the demand in development of effective treatments, control and prevention of bacterial infectious diseases. While colloidal TiO2 has been the traditional photo-activated antimicrobial agent for years, novel materials are discovered and added to this field rapidly. Recently, carbon dots have been demonstrated for their great potential in serving as effective light-activated antimicrobial agents. Carbon dots (CDots) are generally small carbon nanoparticles with various surface passivation schemes, with their unique optical properties and photocatalytic functions. This study reported CDot's photoinduced bactericidal functions, with the results suggesting that the dots were highly effective in bacteria-killing with visible light illumination. Several important factors that are associated with the light-activated bactericidal efficiency, including surface modification, fluorescence quantum yield and others have been investigated. Mechanistic implications of the results will be discussed. Challenges and opportunities in further development of CDots into a new class of effective, low cost, low to non-toxicity visible/natural light-responsive bactericidal agents for bacteria control and other potential antimicrobial applications will be discussed.

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