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Asymmetric mesoporous silica nanoparticles loaded with curcumin and gentamicin sulfate for antibacterial activity

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Flavor compounds have attracted more attention due to their excellent antibacterial activities and safety. Curcumin as a flavor showed a broad-spectrum antimicrobial property. However, it is difficult to dissolve in water and unstable. The development of encapsulation provide an effective utilization for curcumin. In this work, asymmetric mesoporous silica nanoparticles of Fe_3O_4@SiO_2&EPMO (EPMO = ethane bridged periodic mesoporous organosilica) containing core@shell structured Fe_3O_4@SiO_2 nanospheres and EPMO nanorods have been successfully synthesized via a novel degradation-restructuring induced anisotropic epitaxial growth strategy. Owing to presence of the ethyl group in the EPMO frameworks, the asymmetric silica nanoparticles have hydrophobicity/ hydrophilicity independent mesopores to load multiple guests. So, hydrophilic gentamicin sulfate(GS) and hydrophobic curcumin were chosen to load in Fe_3O_4@SiO_2 nanospheres and EPMO nanorods for multifunctional synergetic bacteriostasis. The loading capacity of curcumin and gentamicin sulfate were 25.75mg g^{-1} and 24.94g g^{-1}, dividedly. Compared with pure Fe_3O_4@SiO_2&EPMO, the asymmetric diblock mesoporous silica nanoparticles simultaneously loading curcumin and GS have outstanding bactericidal efficiency (~87.76%). This asymmetric nanoparticles provide the novel simultaneous loading capacity of hydrophobicity/ hydrophilicity flavor.

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