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# Antibacterial Activity of Ciprofloxacin-Encapsulated Cockle Shells Calcium Carbonate (Aragonite) Nanoparticles and Its Biocompatability in Macrophage J774A.1

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## Abstract

The use of nanoparticle delivery systems to enhance intracellular penetration of antibiotics and their retention time is becoming popular. The challenge, however, is that the interaction of nanoparticles with biological systems at the cellular level must be established prior to biomedical applications. Ciprofloxacin–cockle shells-derived calcium carbonate (aragonite) nanoparticles (C-CSCCAN) were developed and characterized. Antibacterial activity was determined using a modified disc diffusion protocol on *Salmonella* Typhimurium (*S.* Typhimurium). Biocompatibilittes with macrophage were evaluated using the 3-(4,5-Dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide (MTT) and 5-Bromo-2′-deoxyuridine (BrdU) assays. Transcriptional regulation of interleukin 1 beta (IL-1β) was determined using reverse transcriptase-polymerase chain reaction (RT-PCR). C-CSCCAN were spherical in shape, with particle sizes ranging from 11.93 to 22.12 nm. Encapsulation efficiency (EE) and loading content (LC) were 99.5% and 5.9%, respectively, with negative ζ potential. X-ray diffraction patterns revealed strong crystallizations and purity in the formulations. The mean diameter of inhibition zone was 18.6 ± 0.5 mm, which was better than ciprofloxacin alone (11.7 ± 0.9 mm). Study of biocompatability established the cytocompatability of the delivery system without

upregulation of IL-1β. The results indicated that ciprofloxacin–nanoparticles enhanced the antibacterial efficacy of the antibiotic, and could act as a suitable delivery system against intracellular infections.

*Keywords:* **antimicrobial resistance**; **calcium carbonate (aragonite) nanoparticles**; **ciprofloxacin**; **intracellular infection**; **proinflammatory cytokine**