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Natural nanocarriers for nucleic acids transfection and biotechnological applications



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Sepiolite is a natural clay silicate with a wide range of applications, including promising avenues in biotechnology and biomedicine. Importantly, sepiolite nanofibes spontaneously internalize into mammalian cells, and have also been shown to bind effectively to proteins, monoclonal antibodies, RNA and various types of DNA molecules through electrostatic interactions, hydrogen bonding, cationic bridging and van der Waals forces. Because sepiolite spontaneously forms aggregates, its disaggregation can represent an important challenge for improving their disaggregation in liquid dispersion and the assembly with biological species. However, this can also affect the possible toxicity of sepiolite in interaction with mammalian cells. Here, a very pure commercial sepiolite (Pangel S9), which is present as a partially defibrillated clay mineral, was used to study the consequences of additional deagglomeration/ dispersion through sonication. We have also addressed the response of human cells to interactions with those sepiolite fibers, testing three classical cell responses to stress. This study shows that mammalian cells respond to sepiolite exposure and respond, inducing the production of reactive oxygen species and the expression of inflammatory cytokines. Remarkably, sepiolite exposure did not alter the cell cycle distribution and triggers neither the DNA damage response program nor apoptosis, suggesting that it does not significantly assault the genetic material in mammalian cells. These studies demonstrated the use of sepiolite nanofibers as a promising potential nanocarriers for the nonviral transfer of biological macromolecules for functional or therapeutic purposes, among other clinical applications.

Biography:

Fidel Antonio Castro-Smirnov is a Tenured Academician of the Academy of Sciences of Cuba, a Full Professor and Senior Researcher of the University of Havana. His interdisciplinary research includes more than 30 publications and 2 patents in nanobiotechnology, nanomedicine, radionanomedicine, molecular biophysics and nuclear physics. Honored with prestigious national and international awards, including the Medal "Carlos J. Finlay" from the President of the Republic of Cuba, two Annual National Awards of the Cuban Academy of Sciences, a Cuban National Prize of Health and Prize RECELL MX2023 from the Mexican College of Regenerative Medicine.