Functional silica nanoparticles conjugated with beta-glucan to deliver anti-tuberculosis drug molecules

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Tuberculosis is one of the most serious diseases caused by Mycobacterium tuberculosis and results in a great number of deaths, especially in developing countries. Despite the development of antibiotics against the disease, the rates of infected individuals and bacterial resistance against antibiotics have not decreased. In this study, we developed and analyzed ultra-small silica nanoparticles (SiNPs) of less than 5 nm in size that are capable of encapsulating small organic molecules and drugs, such as fluorescein isothiocyanate, doxorubicin, and/or isoniazid (INH). In addition, we developed a new drug delivery system in which the anti-tuberculosis drug INH is encapsulated in beta (β) -glucan-conjugated SiNPs. We focused on synthesizing SiNPs that have amine functional groups as well as the ability to conjugate with β-glucan molecules, making the nanocomplex both a drug carrier and a stimulus for host immune systems.