Engineering internally bridged urchin-like structured nanosilica for controlled delivery of an anticancer drug

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Pharmaceuticals entering the wastewater system is one of the challenges that environmental chemists face. Most current anticancer drugs have a relatively low uptake or efficacy, resulting in harmful pharmaceuticals being excreted from the body and entering the wastewater system. The synthesis of a new and improved drug carrier system with higher efficacy reduces the release of these pharmaceuticals into the wastewater system. Herein, the engineering of a new monodisperse colloid with a sea urchin-like structure with a large complex internal structure is reported, in which silica surfaces are bridged by an aromatic organic crosslinker to serve as a nanocarrier host for drugs such as doxorubicin (DOX) against breast cancer cells. The pH responsiveness of these novel nanoparticulate systems was studied in a phosphate buffer at different pHs and at 37 ℃. The pH-responsive nanocomposites were tested as biocompatible nanocarriers for controllable doxorubicin (DOX) delivery in biological model MDA-MB-231 cells. The results show that breast cancer cells show lower cell viability when exposed to doxorubicin-loaded nanocarriers compared with control or a doxorubicin culture, suggesting that the loaded nanocarrier has greater anticancer effect than free doxorubicin (without nanocarriers). We conclude that this new type of drug carrier is a unique colloid which has promising potential for technological applications such as advanced drug delivery systems, wastewater remediation and as a catalyst for green organic reactions in water.