SiO_2-Based Hybrid Materials Encapsulating a Natural Product for Targeted Drug Delivery

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Abstract.

Natural products obtained from plant sources offer a valuable alternative to traditional synthetic drugs for the prevention and treatment of cancers and bacterial infections. However, the administration of these molecules presents limitations due to their low solubility and absorption in the human body. This issue requires the synthesis of an inert biocompatible system that allows for controlled release in situ, where the molecule needs to exert its biological activities [1]. In this scenario, hybrid materials based on SiO_2 with quercetin (Qu) encapsulated have enabled the development of a biomaterial for drug delivery applications. This approach efficiently addresses the challenges related to the degradation of the organic molecule while retaining its well-established anticancer and antibacterial benefits [2]. Quercetin encapsulated-silica was synthesized via sol-gel method using two approaches: one utilizing an acid catalyst (SiO_2-HNO_3+5% Qu) and one without a catalyst (SiO_2+5% Qu) to achieve the same hybrid with an eco-friendly approach. The encapsulation efficiency of the silica matrix for both hybrid systems was analyzed, and a release study was conducted using UV-visible spectroscopy in physiological conditions (pH 7.4) and cancer conditions (pH 5.0). Subsequently, the antibacterial activity was evaluated using the Kirby-Bauer test. The *in vitro* release study showed that quercetin controlled release is pH-dependent, with a better release capacity observed for the SiO_2+5% Qu system. Nevertheless, the antibacterial activity was better for the system synthesized in the presence of the catalyst, also due to the release of nitrate ions in the bacterial medium.

References.

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