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Abstract

Characterizing the Biological Behavior of Fe_3O_4 Nanoparticles Conjugated with Acridine Orange using In Vitro Co-culture Systems Relevant to Skin, Lung and Gut Barrier Models †

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Abstract: Fe_3O_4 nanoparticles (NPs) can be conjugated with acridine orange to create a hybrid nanomaterial with unique properties, such as the magnetic characteristics of magnetite and the fluorescence of acridine orange, making them useful for a variety of applications, including cell imaging, drug delivery, and magnetic separation. In this context, we aimed to provide a biological evaluation of this type of NPs using in vitro co-culture models of human skin, lungs, and intestine. Fe_3O_4 NPs were obtained by the co-precipitation method from Fe^{2+} and Fe^{3+} (1:2 molar ratio). The concentration of acridine orange in an aqueous NH_4OH solution was 0.00025%. The product was washed several times with ultrapure water, redispersed, and centrifuged thrice at 6000 × g for 10 minutes. Each supernatant was collected, obtaining three different suspensions of NPs. We developed one model of skin barrier using a co-culture of human keratinocytes (HaCaT cell line) and dermal fibroblasts (CCD-1070Sk cell line), one model of intestinal barrier composed of human Caco-2 enterocytes and HT-29-MTX mucus-producing intestinal cells, and one model of pulmonary barrier made of A549 epithelial cells and MRC-5 fibroblasts. Our results showed that none of the NP suspensions influenced the cell viability of the co-culture systems, suggesting their good biocompatibility on short-term exposure (24 hours) according to the cytotoxicity assays performed. In addition, we observed a specific apical-basal cell polarization in the co-culture systems, being maintained after one-day exposure to the three suspensions of NPs. To sum up, Fe_3O_4 NPs conjugated with acridine orange could be promising hybrid nanomaterial with good biocompatibility and special properties for future applications in biomedicine.

Keywords: skin; lung; intestine; co-culture; epithelial barriers; iron oxide nanoparticles

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