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Morphological and Cytotoxic Evaluation in Human Hepatoma Cells (HepG2/C3A) Exposed to Magnetic Nanoparticles

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Magnetic iron oxide nanoparticles are highlighting as promising candidates in the nanobiotechnology in a range of applications, such as magnetic hyperthermia, controlled release of drugs in the treatment of cancer, contrast in magnetic resonance, among others [1]. Thus, many efforts are made to develop magnetic nanoparticles (MNPs) in biomedical applications and the coating of the MNPs is a strategy to improve the biocompatibility and mitigate the possible adverse effects of these particles [2]. Therefore, it is of great importance the deep knowledge of the toxicity of nanomaterials, which can be determined by MTT assay, and also their morphological effects, by SEM. The objective of this work was to evaluate the cytotoxicity and morphological changes in cells of human hepatoma (HepG2/C3A), exposed to the MNPs (Fe_3O_4) and MNPs coated with chitosan (CS-Fe_3O_4), using the MTT assay and SEM. For the MTT assay, the cells were treated with different concentrations of Fe_3O_4 and CS-Fe_3O_4 for 24 h and 48 h. For SEM, cells treated with Fe_3O_4 and CS-Fe_3O_4 were fixed, dehydrated, critical point-dried in CO_2, sputter-coated with gold and observed using a FEI Scios. The MTT assay showed that cells treated with CS-Fe_3O_4 presented no cytotoxicity in all concentrations and incubation periods. However, the treatment with Fe_3O_4 induced a reduction of cellular viability in 24 h and 48 h. Morphological changes were not observed in HepG2/C3A, exposed to the NPMs, demonstrating that the analysis of microscopy was of great importance to note that the cell surface structure was not affected by the interaction with both MNPs. In general, the CS-Fe_3O_4 showed better biocompatibility with possibility in conjunction of therapeutic agents in biomedical applications.

References:
[1] S Behrens, Curr Opin Biotechnol **39** (2016), p. 89.
[2] J Chomoucka et al., Pharmacol Res. **62** (2010), p. 144.
[3] This research was supported by CNPq (Brazil).

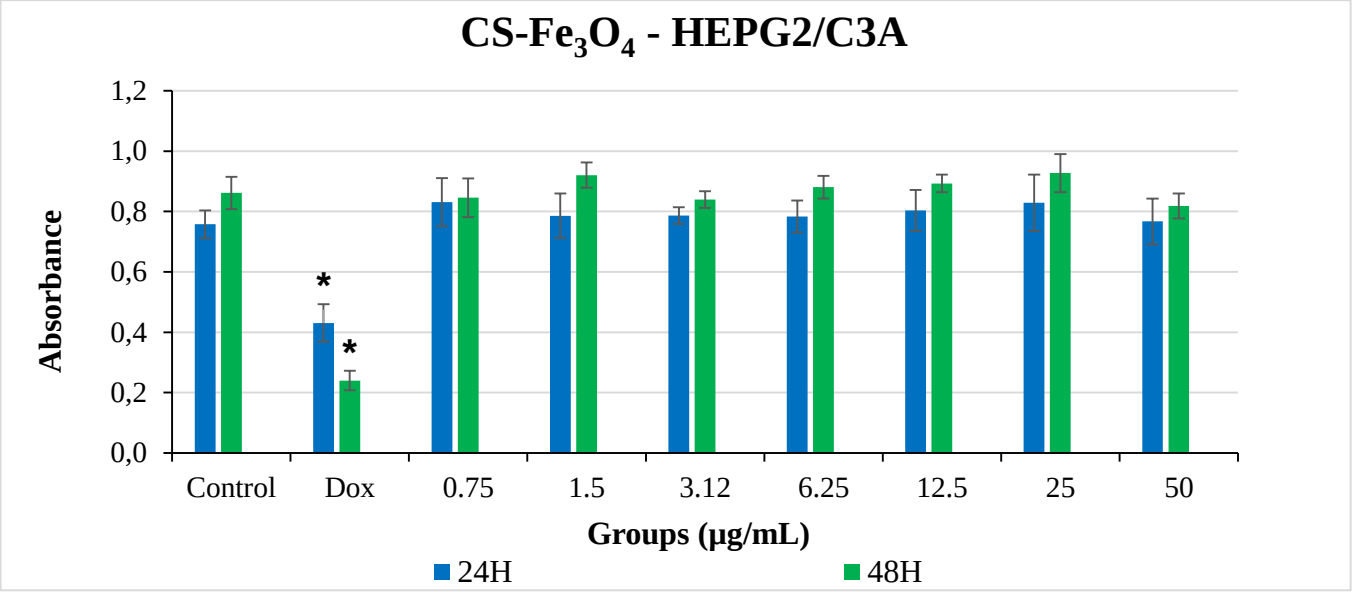

Figure 1. Mean and standard deviation obtained by the MTT test. Groups: Control (DMEM + 10% FBS), and different concentrations of CS-Fe_3O_4 (0.75, 1.5, 3.12, 6.25, 12.5, 25 and 50 µg/mL) were incubated with HepG2/C3A cells for 24 and 48 hours. *Statistically significant difference in relation to control ($p < 0.05$).

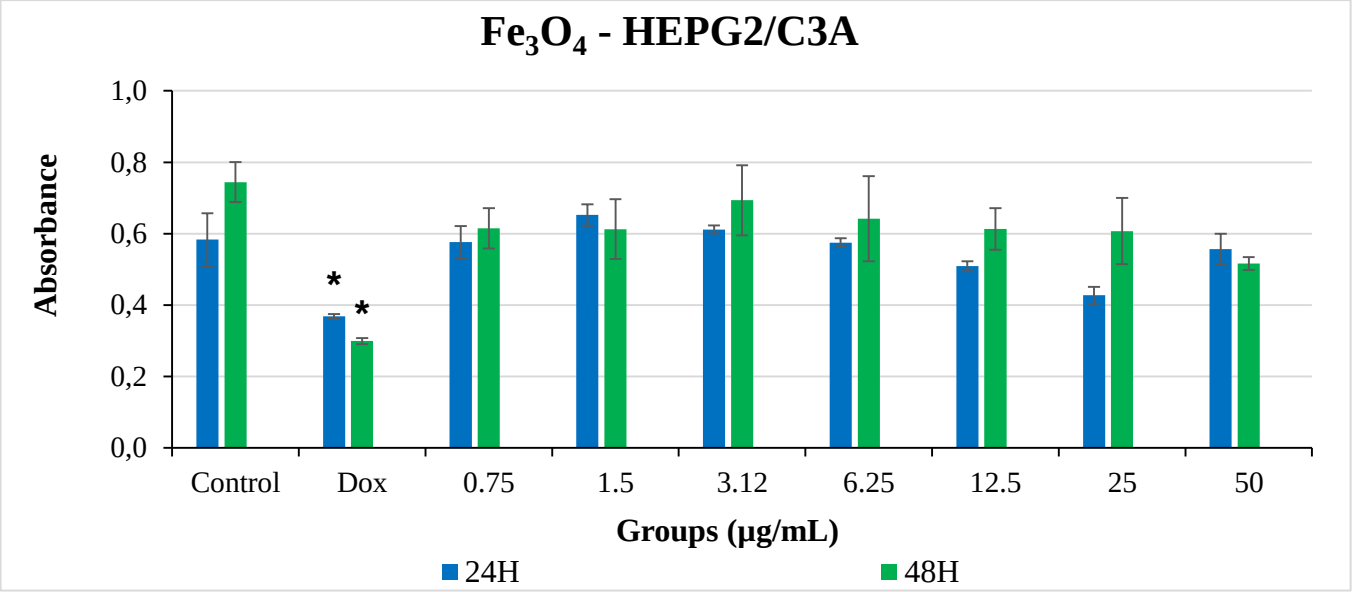

Figure 2. Mean and standard deviation obtained by the MTT test. Groups: Control (DMEM + 10% FBS), and different concentrations of Fe_3O_4 (0.75, 1.5, 3.12, 6.25, 12.5, 25 and 50µg/mL) were incubated with HepG2/C3A cells for 24 and 48 hours. *Statistically significant difference in relation to control ($p < 0.05$).

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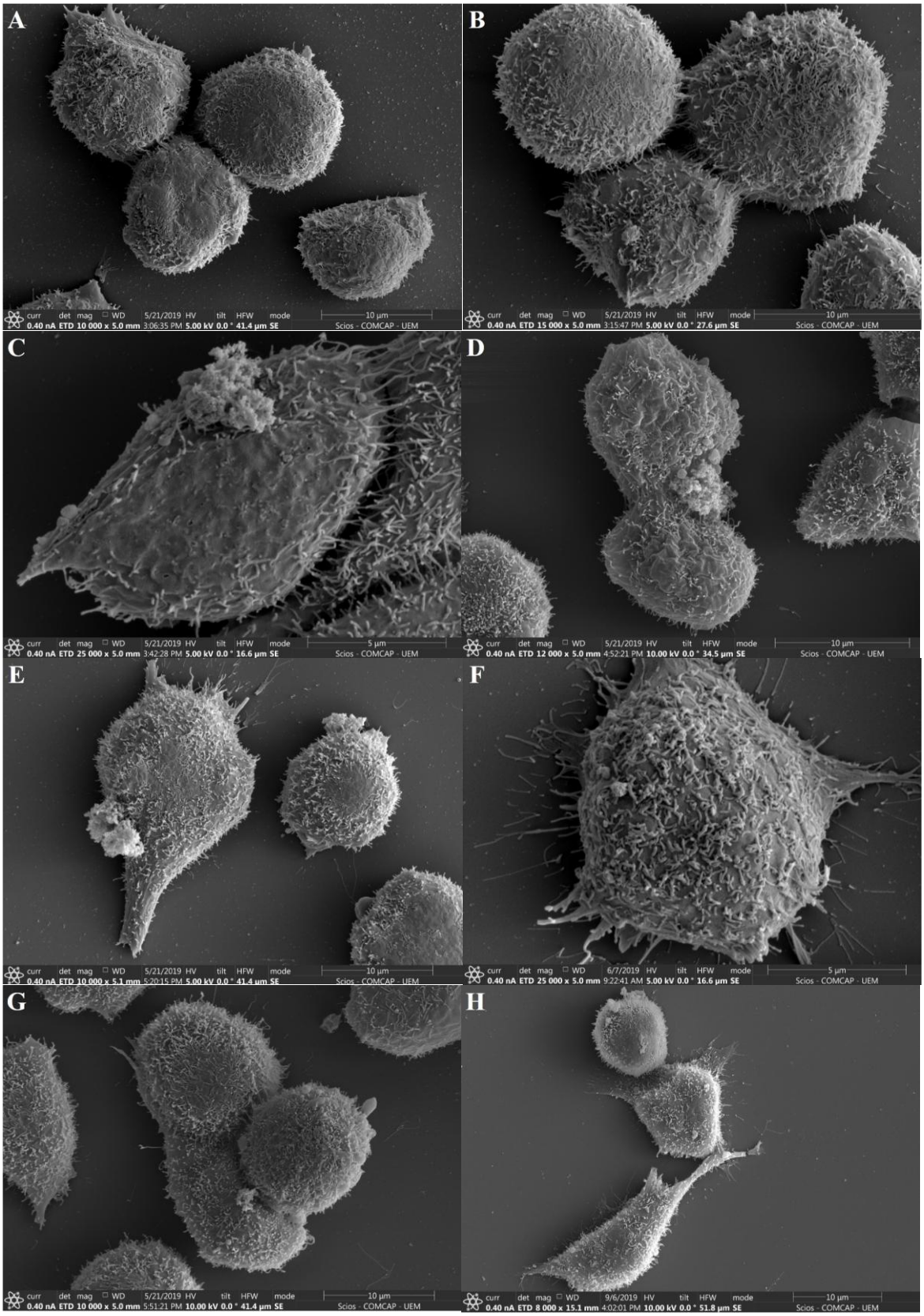

Figure 3. Scanning electron microscopy (SEM) images of HepG2/C3A cells, incubated with different magnetic nanoparticle treatments for 48 hours. (A, B) Control (C) Fe_3O_4 6.25µg/mL; (D) Fe_3O_4 25µg/mL; (E) Fe_3O_4 50µg/mL; (F) CS-Fe_3O_4 6.25µg/mL; (G) CS-Fe_3O_4 25µg/mL; (H) CS-Fe_3O_4 50µg/mL.

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