ICAM2009
11th International Conference on Advanced Materials
Rio de Janeiro Brazil
September 20 - 25

Preparation Characterization and *in vitro* Toxicity Test of Magnetic Nanoparticle associate with microspheres biodegradable as Drug Delivery System to PDT and Hyperthermia

C. B.Vaccari[(1)*], M. M. A. Rodrigues[(1)], **** P.C. de Moraes[(2)], A. C. Tedesco[(1)]

[1] Departamento de Química, Laboratório de Fotobiologia e Fotomedicina, Faculdade de Filosofia, Ciências e Letras de Ribeirão Preto, Universidade de São Paulo, 14040-901 Ribeirão Preto-SP, Brazil; [2] Universidade de Brasília- Instituto de Física

Abstract The goals of this study were to prepare and to test the *in vitro toxicity* of biodegradable microspheres of PHBHV/PCL containing maghemite nanoparticles and photosensitizes as actives compounds . Incorporation of maghemite nanoparticles in the micropheres template, allowing full control of the magnetic content. We also evaluated the dark toxicity and phototoxicity of the samples under magnetic field and light application in a gingival fibroblast cell line as a biological model.

Biocompatible magnetic fluids have been pointed out as a very promising nanosized-based magnetic material, applicable for tumor therapy. The approach has been essentially focused on local hyperthermia (HPT) of biological tissues, induced by the application of low-frequency and low-amplitude AC magnetic fields, and /or light activation using Photodynamic Therapy (PDT). We have investigated the use of biodegradable PHBHV/PCL microspheres as a DDS to encapsulate phthalocyanine dye as a photosensitezers (PS) associated with the magnetic fluid. NzPC (fig.1) were obtained by the method described by Simioni et al. [1]. We evaluate the photobiological activity of the complex using gingival fibroblast cell line (GF) as biological model. The magnetic nanoparticle sample used in this study, is citrate-coated nanosized $CoFe_2O_4$ particles supported in biocompatible polyhydroxybutyrate-co-valerate/poly(ecaprolactone) (PHBHV/PCL) microspheres. The final magnetic nanocomposite is produced while monomers of PHBHV/PCL are poured into the magnetic fluid sample at 37°C, under stirring for one hour. This procedure allowing the encapsulation of the citrate-coated nanoparticles into the polymerized template.Monolayer cultures were grown in Dubleco Eagle's Minimum Essential Medium (DMEM) with 10% of fetal bovine serum (Gibco), 1% L-glutamine, and 1% penicillin–streptomycin (Gibco). The cells were used in the logarithmic phase of growth and maintained at 37° C in humidified 5% CO and 95% air. The methodology used to evaluate the toxicity was the classical MTT assay. To investigate the toxicity and phototoxicity, GF cells were inoculated with the DDS containing the active compounds prepared as previous describe. After incubation for 3 h, the cells was washed and the cell culture dish was complete with new DMEM medium. In the experiment with AC magnetic field, the application occurs after preparation using the same procedure described above. The AC magnetic field used in these studies was applied via a portable apparatus operating at 1 MHz with 40 Oe of field amplitude. Exposure to the AC magnetic field was 3 times of 10 mim at a total time of 1 hour. In the phototoxicity test, the light dose used was 10.0 J/cm^2 [1] isolated from a visible diode laser (Eagle, Quantum Tech, Brazil) operating at 675 nm. The incubation with 5 uM of the NzPC photosensitezers used the same procedure described early. The studies of phototoxicity together with the application of the AC magnetic field showed that the system presents a good response with low percentage of cell viability after treatment. (Fig 2).Our data suggest that the magnetic DDS samples investigated here are biocompatible and could be used as material basis for biological applications, especially using the hyperthermia protocol at the same time that could be used for PDT treatment.

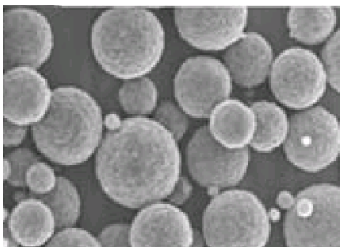

Figure 1: Evaluation PHBHV/PCL microspheres encapsulate a phthalocyanine, NzPC

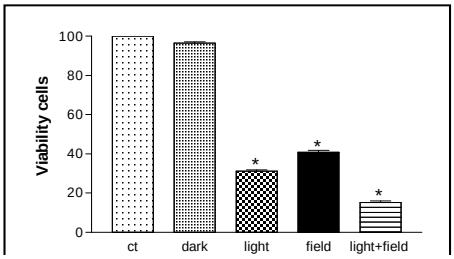

Figure 2: Evaluation of the cellular viability for GF cells incubated with micropheres PHBHV/PCL containing maghemite nanoparticle, in the dark, in the presence of light (10 J/cm^2), in the presence of AC magnetic field and in the presence of light and AC magnetic field.

References:

[1A. R. Simioni _ C. Vaccari _ A. C. Tedesco , PHBHV/PCL microspheres as biodegradable drug delivery systems (DDS) for photodynamic therapy (PDT), J Mater Sci (2008) 43:580–584