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ABSTRACTS BOOK

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SUPERPARAMAGNETIC IRON OXIDE NANOPARTICLES COVERED WITH METHYLENE BLUE FOR ANTIMICROBIAL PHOTODYNAMIC THERAPY

Paula Haddad[1], Victor Toledo Saulo[1], Martha S. Ribeiro[2], Saulo T. Pereira[2], Tania M. Yoshimura[2]
[1]Universidade Federal de São Paulo, Departamento de Química, Brazil. [2]Universidade de São Paulo, Centro de Lasers e Aplicações, IPEN-CNEN/SP, Brazil.

The present study is focused on the preparation, characterization and application of methylene blue (MB) containing silica-coated superparamagnetic iron oxide nanoparticles (SPIONs) on photodynamic therapy (PDT). The photossensitizer MB when exposed to light reacts with molecular oxygen and generates singlet oxygen, which causes irreversible damages to tumor and microbial cells. SPIONs were prepared by co-precipitation of iron (II) and (III) chlorides in the presence of a weak base. The surface of nanoparticles was covered with a double layer of silica, tetraethylortosilicate and sodium silicate, generating the hybrid material SPIONs-silica-MB. As synthesized, SPIONs were characterized by Fourier transform infrared spectroscopy, X-ray diffraction, and SQUID magnetic measurements. X-ray powder diffraction technique nanoparticles samples confirmed the formation of the magnetite. By using the Scherrer equation for 311 reflection it was observed that the average crystallite sizes were 14 nm in solid state. Infrared spectrum showed characteristic bands of iron- oxygen, besides other bands associated to silicate groups. The nanocomposites presented magnetic behavior at room temperature due to the presence of the magnetite core. Indirect measurements of singlet oxygen release SPIONs-silica-MB were performed using a red laser beam (660 nm) and a yellow reagent, 1,3-Diphenylisobenzophuran. An absorption decay in UV-vis region was observed indicating spontaneous singlet oxygen release at levels required for biomedical applications. Thus, we evaluated the photodynamic activity of SPIONs-silica-MB on Escherichia coli, a Gram-negative bacterium responsible for many common bacterial infections, including urinary tract infection. Approximately $1x10^6$ colony forming units of E. coli were suspended in a 0.5 mg/mL SPIONs-silica-MB PBS solution (resulting in a final concentration of 50 µM MB) and were irradiated using a red laser (l= 660 nm) over an orbital shaker to prevent precipitation, during 10 min. Our light source provided 100 mW of optical power, irradiance of 46 mW/cm^2, delivering a radiant exposure of 27.6 J/cm^2. Either SPIONs or SPIONs-silica-MB were prepared with E. coli suspensions to test toxicity in the dark, which resulted negative. Our results

have shown that bacteria were completely eradicated following photodynamic treatment. These findings provide insights to explore SPIONs-silica-MB for antimicrobial PDT.

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Presenting authors email: haddadps@gmail.com