ELECTROCHEMICAL SYNTHESIS OF MAGNETITE NANOPARTICLES COATED OF METHYLENE BLUE

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Methylene blue is a photosensitizer used in photodynamic therapy because this drug can generate singlet oxygen [1]. This very aggressive chemical species will very rapidly react with any nearby biomolecules which can irreversibly damage the treated tissues. On the other hand, these nanoparticles could also be used as magnetic resonance imaging contrast agent for tumour detection or for hyperthermia therapy [2]. The result is a single particle platform that combines therapy and diagnostic possibilities at the same time.

Our proposal is to oxidize electrochemically Fe to form magnetite nanoparticles in the presence of ammonium surfactants and methylene blue. The nanoparticles generated are coated by these compounds where the surfactants prevents them from aggregating, methylene blue confers them with fluorescent properties

The system consists of a two neck electrochemical cell where two Fe electrodes of purity 99.5% were placed. These two electrodes must be at a distance of approximately 1 cm. One of the electrodes was used as a sacrificial anode and was subjected to a current of 100 mA/cm^2; its oxidation resulted in the formation of magnetite [3].

The generated material was characterized by characterized by microscopy (TEM and fluorescence confocal) and spectroscopic techniques (X-ray diffraction, Raman, UV-Vis, and FT-IR).

The results show that when the reaction takes place only in the presence of surfactant the average size of nanoparticles is about 30 nm; when the concentration of surfactant is lower, and the concentration of methylene blue is increased, nanoparticles size increases, to values of about 70 nm. When only methylene blue is used as the electrolyte, there is no formation of nanoparticles. This is due to the polymerization of methylene blue on the surface of the Fe, preventing further oxidation of the metal. The nanoparticles formed in the presence of methylene blue were fluorescent when tested by a confocal microscopy. X-ray spectra of these material indicated the presence only of magnetite and no impurities was observed. The analyses by UV-visible and FT-IR spectroscopy confirmed the presence of methylene blue in the generated nanoparticles.

References:

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Aknowlegments

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