Investigation of Induced Single-Walled Carbon Nanotube Aggregation in Biologically Relevant Solvents

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Carbon nanotubes require an amphiphilic functionalization in order to enhance dispersion in aqueous solutions. It is hypothesized that the stability and mobility of single-walled carbon nanotubes (SWCNTs) suspensions is related to the characteristics of the solvent in which the nanotubes are formulated. Solvents studied include: fetal bovine serum (FBS), which is a cell culture medium rich in proteins; and artificial seawater, which contains monovalent ions in the form of dissolved sodium chloride as well as divalent ions such as calcium and magnesium. The trends of aggregation in biological and marine environments may play a role in the consideration of SWCNTs as sensors in those aforementioned environments. Aggregation tends to affect the near-infrared (NIR) wavelength peak value(s) emitted by SWCNTs, most often by shifting them in the positive direction (a "red-shift"). This would discourage the use of solvents which highly aggregate SWCNT samples in sensing applications due to inaccurate wavelength data. SWCNTs were immobilized through a spin-coating technique which deposits nanotubes in solution on a hydrogel platform formulated with poly-(ethylene) glycol-diacrylate as the base polymer. NIR spectroscopy and photography was used in the capturing of images on this hydrogel and machine learning was used in the analysis of those pictures to quantify aggregate sizes.

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