DETERMINING NANOTOXICITY OF C₆₀ FULLERENES IN ORGANIC SOLVENTS USING THE BACTERIA ESCHERICHIA COLI

Jessica Joy Jenkins¹, Sean Cook², Winfred Aker² and Huey-Min Hwang²

¹Division of Natural Sciences, Tougaloo College, Tougaloo, MS 39174
²Department of Biology, Jackson State University, Jackson, MS 39217

Abstract: C₆₀ fullerene is highly insoluble in water and in most solvents. This physical property complicates the task of quantifying its cytotoxicity. Organic solvents in which the solubility of C₆₀ is known have been tried but with irreproducible results, making the selection of a proper solvent difficult. This dilemma imposes the need for added measures to determine the cytotoxicity of this proliferating nanoparticle. In this study we determined the cytotoxicity in different organic solvents with the normal sonication procedure but also with the addition of the non-ionic surfactant Tween 80 (0.04%) to enhance dispersal. We used E. coli (ATCC#25254) to determine cytotoxicity of C₆₀ in six organic solvents (N,N- dimethylformamide, pyridine, DMSO, methanol, ethanol, and propanol). The concentrations of C₆₀ fullerene were at 1 ppm, 10 ppm, 25 ppm, 50 ppm, and 100 ppm respectively. Our hypothesis was that C₆₀ cytotoxicity to E. coli increases with solvent solubility. Each solvent experiment was conducted at least twice. The final concentration of the test solvents (1%) was chosen according to C₆₀ solubility and biocompatibility with the bacteria culture. The solubility of the C₆₀ in the 1% test organic solvents was verified with spectrophotometric analysis. The biological endpoint response was measured with viability (in terms of LD₅₀) and general metabolic activity after exposure to C₆₀ (in terms of ID₅₀). Results indicated that LD₅₀ ranged from 30 ppm to more than 400 ppm and ID₅₀ from 4 ppm to greater than 400 ppm. The lowest in each case was produced by DMSO. Values did not correlate with solubilities and N,N- dimethylformamide produced high (over 400) for LD₅₀ and indeterminably high for ID₅₀ which was unexpected. Solvent solubility alone could not account for the cytotoxicity observed in this study.

Keywords: Nanotoxicity; C₆₀; E. coli; LD₅₀; N,N- dimethylformamide

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