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TITLE: INHALATION TOXICITY AND LUNG TOXICOKINETICS OF C-60 FULLERENE NANOPARTICLES AND MICROPARTICLES

PUBLISHED: January-08

CITE: Baker, G. L.; Gupta, A.; Clark, M. L.; Valenzuela, B. R.; Staska, L. M.; Harbo, S. J.; Pierce, J. T.; Dill, J. A. Toxicological Sciences 2008, 101, 122-131.

ABSTRACT: While several recent reports have described the toxicity of water-soluble C-60 fullerene nanoparticles, none have reported the toxicity resulting from the inhalation exposures to C-60 fullerene nanoparticles or microparticles. To address this knowledge gap, we exposed male rats to C-60 fullerene nanoparticles (2.22 mg/m(3), 55 nm diameter) and microparticles (2.35 mg/m(3), 0.93 mu m diameter) for 3 h a day, for 10 consecutive days using a nose-only exposure system. Nanoparticles were created utilizing an aerosol vaporization and condensation process. Nanoparticles and microparticles were subjected to high-pressure liquid chromatography (HPLC), XRD, and scanning laser Raman spectroscopy, which cumulatively indicated no chemical modification of the C-60 fullerenes occurred during the aerosol generation. At necropsy, no gross or microscopic lesions were observed in either group of C-60 fullerene exposures rats. Hematology and serum chemistry results found statistically significant differences, although small in magnitude, in both exposure groups. Comparisons of bronchoalveolar (BAL) lavage fluid parameters identified a significant increase in protein concentration in rats exposed to C-60 fullerene nanoparticles. BAL fluid macrophages from both exposure groups contained brown pigments, consistent with C-60 fullerenes. C-60 lung particle burdens were greater in nanoparticle-exposed rats than in microparticle-exposed rats. The calculated lung deposition rate and deposition fraction were 41 and 50% greater, respectively, in C-60 fullerene nanoparticle-exposed group than the C-60 fullerene microparticle-exposed group. Lung half-lives for C-60 fullerene nanoparticles and microparticles were 26 and 29 days, respectively. In summary, this first in vivo assessment of the toxicity resulting from inhalation exposures to C-60 fullerene nanoparticles and microparticles found minimal changes in the toxicological endpoints examined. Additional toxicological assessments involving longer duration inhalation exposures are needed to develop a better and more conclusive understanding of the potential toxicity of inhaled C-60 fullerenes whether in nanoparticle or microparticle form.