Role of Surface Chemistry in the Toxicological Properties of Manufactured Nanoparticles

Prabir Dutta

Supporting/Contributing Agency: NIOSH

Professors Dutta and Waldman are studying the correlation between the surface reactivity of nanoparticles and their toxicity. The experimental approach focuses on three classes of extensively used nanoparticles: (1) catalysts used in the manufacture of gasoline, (2) titania used in paints, and (3) carbon used in tires, inks, and other applications. They have found that the inflammatory response seems to track the size of the particle, with well-dispersed nanocarbon particles producing about an order-of-magnitude increase in free radical activity and inflammation.

Figure 6.1 shows an electron micrograph of a particle within a cell showing that damage has occurred around the cell. The iron on the surface of the carbon particles is important. Knowledge of the reactivity of the surface sites will provide new strategies for reducing risks of occupational hazards, as well as minimizing toxicity of new man-made particles.

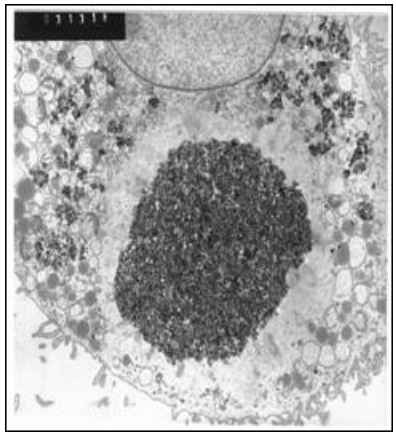

Figure 6.1. *Caption*

In another study, Dutta and Waldman are investigating the use of nanoparticles as reporters for measuring intracellular events. They have recently shown that the oxygen concentration within a cell can be measured, thus allowing for the measurement of free radical species that could be important in diseased states.

References/Publications

Ruda-Eberenz, Toni A.; Nagy, Amber; Waldman, W. James; Dutta, Prabir K. (2008). Entrapment of ionic tris(2,2'-bipyridyl) ruthenium(II) in hydrophobic siliceous zeolite: O_2 sensing in biological environments. *Langmuir* 24(16), 9140-9147.

Waldman, W. J., Kristovich, R. , Knight, D. A., Dutta, P.K. 2007. Inflammatory properties of iron-containing carbon nanoparticles. *Chemical Research in Toxicology* 20, 1149-1154.