AUTHORS: Lam CW, James JT, McCluskey R, Hunter RL.

TITLE: PULMONARY TOXICITY OF SINGLE-WALL CARBON NANOTUBES IN MICE 7 AND 90 DAYS AFTER INTRATRACHEAL INSTILLATION.

PUBLISHED: January-04

CITE: Toxicol Sci. 2004 Jan;77(1):126-34. Epub 2003 Sep 26. 14514958 Lam CW, James JT, McCluskey R, Hunter RL.

ABSTRACT: Nanomaterials are part of an industrial revolution to develop lightweight but strong materials for a variety of purposes. Single-wall carbon nanotubes are an important member of this class of materials. They structurally resemble rolled-up graphite sheets, usually with one end capped; individually they are about 1 nm in diameter and several microns long, but they often pack tightly together to form rods or ropes of microscopic sizes. Carbon nanotubes possess unique electrical, mechanical, and thermal properties and have many potential applications in the electronics, computer, and aerospace industries. Unprocessed nanotubes are very light and could become airborne and potentially reach the lungs. Because the toxicity of nanotubes in the lung is not known, their pulmonary toxicity was investigated. The three products studied were made by different methods and contained different types and amounts of residual catalytic metals. Mice were intratracheally instilled with 0, 0.1, or 0.5 mg of carbon nanotubes, a carbon black negative control, or a quartz positive control and euthanized 7 d or 90 d after the single treatment for histopathological study of the lungs. All nanotube products induced dose-dependent epithelioid granulomas and, in some cases, interstitial inflammation in the animals of the 7-d groups. These lesions persisted and were more pronounced in the 90-d groups; the lungs of some animals also revealed peribronchial inflammation and necrosis that had extended into the alveolar septa. The lungs of mice treated with carbon black were normal, whereas those treated with high-dose quartz revealed mild to moderate inflammation. These results show that, for the test conditions described here and on an equal-weight basis, if carbon nanotubes reach the lungs, they are much more toxic than carbon black and can be more toxic than quartz, which is considered a serious occupational health hazard in chronic inhalation exposures.