Epoxy composite dusts with and without carbon nanotubes cause similar pulmonary responses, but differences in liver histology in mice following pulmonary deposition - DTU Orbit (09/11/2019)

Epoxy composite dusts with and without carbon nanotubes cause similar pulmonary responses, but differences in liver histology in mice following pulmonary deposition

Background: The toxicity of dusts from mechanical abrasion of multi-walled carbon nanotube (CNT) epoxy nanocomposites is unknown. We compared the toxic effects of dusts generated by sanding of epoxy composites with and without CNT. The used CNT type was included for comparison.

Methods: Mice received a single intratracheal instillation of 18, 54 and 162 μg of CNT or 54, 162 and 486 μg of the sanding dust from epoxy composite with and without CNT. DNA damage in lung and liver, lung inflammation and liver histology were evaluated 1, 3 and 28 days after intratracheal instillation. Furthermore, the mRNA expression of interleukin 6 and heme oxygenase 1 was measured in the lungs and serum amyloid A1 in the liver. Printex 90 carbon black was included as a reference particle.

Results: Pulmonary exposure to CNT and all dusts obtained by sanding epoxy composite boards resulted in recruitment of inflammatory cells into lung lumen: On day 1 after instillation these cells were primarily neutrophils but on day 3, eosinophils contributed significantly to the cell population. There were still increased numbers of neutrophils 28 days after intratracheal instillation of the highest dose of the epoxy dusts. Both CNT and epoxy dusts induced DNA damage in lung tissue up to 3 days after intratracheal instillation but not in liver tissue. There was no additive effect of adding CNT to epoxy resins for any of the pulmonary endpoints. In livers of mice instilled with CNT and epoxy dust with CNTs inflammatory and necrotic histological changes were observed, however, not in mice instilled with epoxy dust without CNT.

Conclusions: Pulmonary deposition of epoxy dusts with and without CNT induced inflammation and DNA damage in lung tissue. There was no additive effect of adding CNT to epoxies for any of the pulmonary endpoints. However, hepatic inflammatory and necrotic histopathological changes were seen in mice instilled with sanding dust from CNT-containing epoxy but not in mice instilled with reference epoxy.

General information
Publication status: Published
Organisations: National Food Institute, Division of Risk Assessment and Nutrition, Department of Micro- and Nanotechnology, National Research Centre for the Working Environment, University of Warmia and Mazury in Olsztyn, European Centre for the Sustainable Impact of Nanotechnology, European Commission Joint Research Centre Institute
Number of pages: 20
Publication date: 2016
Peer-reviewed: Yes

Publication information
Journal: Particle and Fibre Toxicology
Volume: 13
Issue number: 1
Article number: 37
ISSN (Print): 1743-8977
Ratings:
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 9.4 SJR 2.755 SNIP 2.154
Web of Science (2016): Impact factor 8.577
Web of Science (2016): Indexed yes
Original language: English
Keywords: Nanoparticles, Nanomaterials, CNT, Nanocyl NC7000, Sanding dust, Epoxy, Matrix nanocomposite, Inflammation, DNA damage, Liver histology, Lifecycle

Electronic versions:
art_3A10.1186_2Fs12989_016_0148_2.pdf
DOIs:
Source: FindIt
Source ID: 2306196513
Research output: Contribution to journal › Journal article – Annual report year: 2016 › Research › peer-review