

times (for a total of 24 different samples). Quantitative comparison of relative protein abundances was achieved by spiking an <sup>18</sup>O-labeled "universal reference" into each individually processed unlabeled sample as an internal standard, enabling simultaneous application of both label-free and isotopic label quantification across the sample set. Clustering analysis of 42 plasma proteins that presented significant quantitative proteomics difference dependent on surface modifications of nanoparticles resulted in distinctive patterns that classified the nanoparticles based on their surface properties and size. In addition, temporal data indicated that the formation of the stable protein "corona" that was isolated for the quantitative analysis was at equilibrium within 5 min. The comprehensive quantitative proteomics results obtained in this study have potential implications towards predicting nanoparticle biocompatibility. Portions of this research were supported by the Pacific Northwest National Laboratory Directed Research Development program, ES016212, and RR018522.

**PS 1489 EFFECTS OF CERIUM OXIDE NANOPARTICLES ON GLYCINE MAX GROWN IN HYDROPONICS.**

A. De La Rosa<sup>1</sup>, J. R. Peralta<sup>1</sup>, J. Gardea-Torresdey<sup>1</sup> and J. Terry<sup>2</sup>. <sup>1</sup>Chemistry, University of Texas at El Paso, El Paso, TX and <sup>2</sup>Physics, Illinois Institute of Technology, Chicago, IL.

Cerium oxide nanoparticles (NP) have a high level of UV absorption and antioxidant behavior, making them great candidates for sun screens and beauty products. Nanoceria have also been found useful in treating cancer and glaucoma attributed to their antioxidant properties. The increased use of these NP underscores the importance of understanding the environmental fate and toxicity. So far, information about nanoceria toxicity to plants is scarce. In this study, soybean plants were treated for 14 days in a modified Hoagland solution containing varying concentrations of CeO<sub>2</sub> NP (0, 500, 1000, 2000, and 4000 mg/L). The objectives are to determine the effect of CeO<sub>2</sub> NP on plant growth as well as monitor the uptake, deposition, and biotransformation of CeO<sub>2</sub> NP. Leaves, stems, and roots of the treated soybean plants were analyzed separately using ICP-OES and X-ray absorption spectroscopy (XAS). The ICP-OES results showed cerium concentrations in roots varying from 37068- 74774 mg kg<sup>-1</sup> for the treatments varying from 500- 4000 mg CeO<sub>2</sub> L<sup>-1</sup>. In soybean stems, the highest accumulation occurred at 4000 mg L<sup>-1</sup>, with a cerium concentration of 3028 mg kg<sup>-1</sup>. While in soybean leaves, the highest accumulation occurred at 1000 mg L<sup>-1</sup> with a cerium concentration of 1048 mg kg<sup>-1</sup>. In soybean stems and roots, the cerium concentration increased as the external concentration increased. The XAS results suggest that soybean absorb and store the nanoceria without any biotransformation. Future directions include the use of transmission electron microscopy to determine the location of the nanoparticles within the soybean tissues; therein determining the mechanism by which the uptake and deposition of nanoparticles occurs.

**PS 1490 EFFECTS OF 12-WEEK-INHALATION EXPOSURE TO ETHYL TERT-BUTYL ETHER (ETBE) ON BEHAVIOR AND BRAIN IN C57BL/6J AND ALDH2(-/-) MICE.**

R. Hojo, H. Kubota, M. Suda, Y. Yanagiba and R. Wang. *NIOSH, Kawasaki, Kanagawa, Japan*. Sponsor: *C. Tohyama*.

We studied the possible effects of inhalation exposure to Ethyl tert-butyl ether (ETBE) on emotional and motor behavior, and brain histology in C57BL/6J (wild type, WT) and Aldh2(-/-) (knock out, KO) mice. Female and male C57BL/6J and Aldh2(-/-) mice in testing groups were exposed to either one of 0, 500, 1750 or 5000ppm of ETBE with inhalation for 12 weeks (6 hours/day, 5 days/week). Openfield test was conducted to examine emotion and activity of mice after ETBE exposure. Rota rod test was also induced for measuring motor function and motor coordination of mice. On the last day of these behavioral tests, animals were euthanized with overdose of anesthetic. Specimens of the brains were examined for histological modification with Immunohistochemistry staining. The c-fos positive cells in selected areas of the brain, forebrain, hippocampus, striatum, accumbens, and amygdale, of exposed-animals were counted and compared with animals from the control group. The results in behavioral tests indicated that ETBE inhalation affected on both tests, but only for male animals. In the openfield test, activity of exposed animals in both WT and KO showed tendency of decreased activity with a dose-dependent manner. In the rota rod test, motor function of exposed groups were significantly lower than that in control group, again only in male. In the brain histological examination, the numbers of c-fos positive cells in all brain areas did not show clear differences between exposed and control animals. The results of this study indicated that there were some toxic effect on the behavior but brain histology. ETBE inhalation has possible toxic effects to differently affect with sex. Male animals showed higher sensitivity to ETBE.

**PS 1491 OXIDATIVE STRESS ASSOCIATED WITH ULTRAFINE MODEL PARTICLE SYSTEMS CONTAINING CHEMISORBED ENVIRONMENTALLY PERSISTENT FREE RADICALS.**

M. A. Kelley<sup>1</sup>, V. Y. Hebert<sup>1</sup>, S. A. Cormier<sup>2</sup>, B. Dellinger<sup>3</sup>, S. Lomnicki<sup>3</sup> and T. R. Dugas<sup>1</sup>. <sup>1</sup>Pharmacology, Toxicology and Neuroscience, Louisiana State University Health Sciences Center, Shreveport, LA, <sup>2</sup>Pharmacology & Experimental Therapeutics, Louisiana State University Health Sciences Center, New Orleans, LA and <sup>3</sup>Chemistry, Louisiana State University, Baton Rouge, LA.

Particulate matter (PM) is often emitted during thermal processes such as combustion of fuels and wastes. Exposure to PM has been associated with exacerbation of pulmonary and cardiovascular diseases. Oxidative stress may play a role in their mechanism of toxicity. Aromatic compounds often chemisorb to the surface of metal-oxide-containing PM following combustion, resulting in formation of surface-stabilized environmentally persistent free radicals (EPFR). Our objective was to investigate whether model EPFRs, synthesized as surrogates for PM formed during combustion, redox-cycle to generate reactive oxygen species (ROS). ROS production of model EPFRs was measured in silico by incubation with a fluorescent probe. ROS production was markedly increased for chemisorbed particle systems. Moreover, ROS levels were significantly elevated in Hep-2 cells exposed to EPFR. To validate these findings, hydroxyl radical generation was measured using an HPLC-based scavenging assay. Hydroxyl radical levels were elevated in EPFR incubated in silico and were further increased in the presence of thiols or ascorbate (AA). Further, hydroxyl radical production was also detected in EPFR incubated together with bronchoalveolar lavage fluid (BALF), verifying that EPFR-mediated ROS production is maintained in biological fluids. Finally, the effect of chronic exposure of neonatal rats to EPFR was examined. AA levels in plasma and BALF of exposed rats were measured to indirectly assess EPFR-induced oxidant production. Although plasma AA levels in treated rats were comparable to controls, levels of AA in BALF were elevated nearly 3.5-fold by particle exposure, suggesting a possible compensatory response to EPFR-mediated ROS production. P42ES013648.

**PS 1492 IDENTIFICATION OF SYSTEMIC MARKERS FROM A PULMONARY CARBON NANOTUBE EXPOSURE.**

T. Hulderman, A. L. Liston, R. Salmen-Muniz, S. H. Young, P. C. Zeidler-Erdely, V. Castranova, P. P. Simeonova and A. Erdely. *NIOSH, Morgantown, WV*.

Currently there is expanding interest, from the perspectives of occupational health surveillance and future epidemiological research, in early monitoring of worker exposure to engineered nanomaterials. Here, we highlight quantitative systemic markers in mice after a single exposure to carbon nanotubes (CNT) (multi-walled (MW) CNT or single-walled (SW) CNT). Mice were exposed by pharyngeal aspiration to 40µg and harvested at 24 hr, 7 and 28d post exposure. Mice were sacrificed and the following parameters were analyzed: whole blood gene expression, blood and bronchoalveolar lavage (BAL) differentials, serum protein profiling by immunoplex and proteomics, and gene expression analysis in the lung and extra-pulmonary tissues including aorta, heart and liver. Early effects of pulmonary CNT exposure include a rapid but transient increase in inflammatory blood gene expression (IL-1β, CXCL2) and serum cytokines (IL-6, IL-5, CCL11). This was followed by an acute phase response including CRP, SAA-1, SAP and haptoglobin as shown by elevated serum protein levels and liver gene expression. Beyond 24hr there was a consistent increase in both blood and BAL eosinophils. These data correspond well with early increased serum IL-5 and CCL11 after MWCNT exposure. At 28d, serum acute phase proteins with immune function including complement C3, apolipoprotein A-I and A-II, α2-macroglobulin, serotransferrin and liver carboxylesterase N were increased. The systemic markers correlated well with existing literature showing end-point measurements of pulmonary CNT exposure and adverse cardiovascular effects and enhanced allergic response.

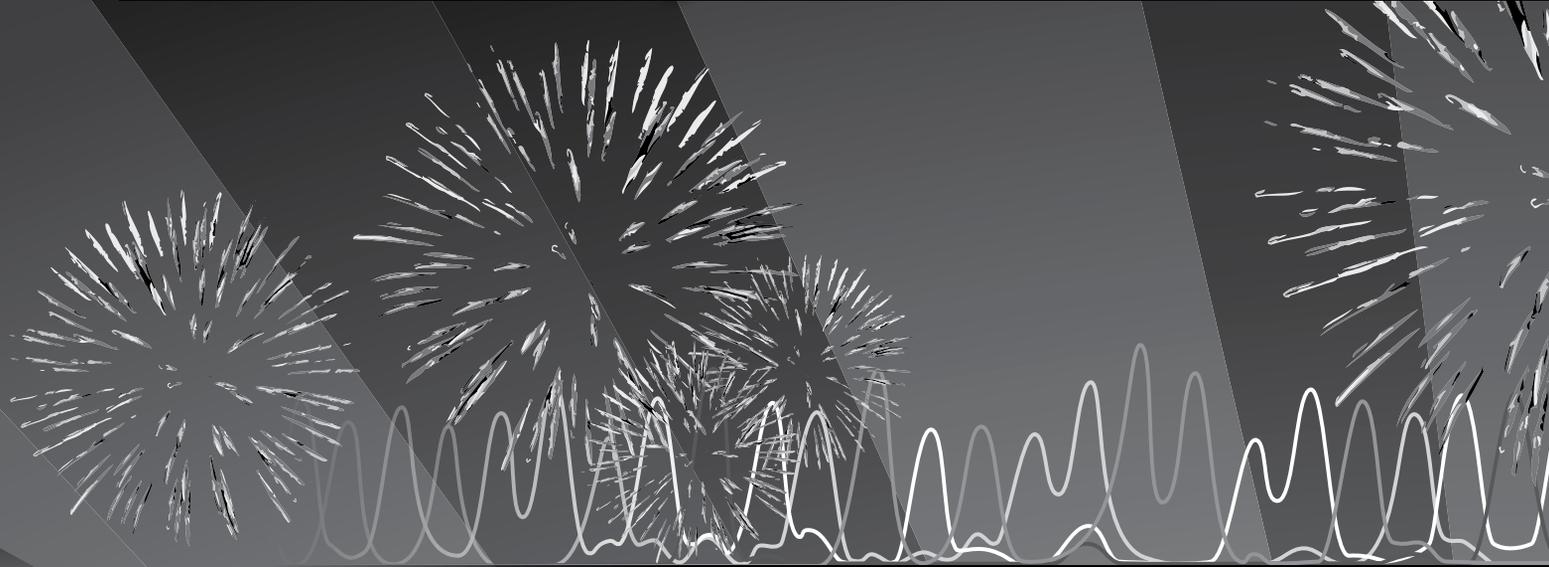
**PS 1493 IN VITRO VASCULAR TOXICITY OF METAL OXIDE NANOPARTICLES.**

M. Odegaard and K. Dreher. *Environmental Public Health Division, U.S. EPA, Research Triangle Park, NC*.

Engineered nanoparticles (NPs) are designed to possess unique physicochemical properties, but may also produce atypical and unforeseen exposure scenarios with adverse health effects. The ability of NPs to translocate into systemic circulation following either inhalation or ingestion makes the vascular system a prime target for potential adverse health effects. The purpose of the current studies was to screen a variety of commercially-available TiO<sub>2</sub> (6 types) and CeO<sub>2</sub> (2 types) NPs varying in size and composition for vascular endothelial cell (EC) toxicity. A moderate-

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# Preface

This issue of *The Toxicologist* is devoted to the abstracts of the presentations for the Continuing Education courses and scientific sessions of the 50th Annual Meeting of the Society of Toxicology, held at the Walter E. Washington Convention Center, March 6–10, 2011.

An alphabetical Author Index, cross referencing the corresponding abstract number(s), begins on page 578.

The issue also contains a Key Word Index (by subject or chemical) of all the presentations, beginning on page 606.

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