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*The occupational hygienist and the integration
of environment, health and safety*

BOOK OF ABSTRACTS

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caused a dose and time dependent increase in apoptosis, in fact 1.98 µg/ml had no effect on cell apoptosis, whereas 2.4 µg/ml induced apoptotic death in about 50% of cells 24 h after incubation. There was also a time-dependent NOC induced apoptosis from 24 to 48 h. Further evidence that the subdiploid population are truly apoptotic cells come from annexin V-FITC/PI assay. Cells treated with NOC 2.4 µg/ml for 48 h were found to be 3.5 % in early apoptosis stage and 96.2% in late apoptosis stage. These data suggest that NOC induces growth inhibition and massive apoptosis as revealed by FACS analysis using DNA fragmentation and hypodiploidism and confirmed by annexin V-FITC/PI assay.

[ABSTRACT ID: 262]

OXIDATIVE POTENTIAL OF FINE AND ULTRAFINE PARTICLES IN OCCUPATIONAL SITUATIONS

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INTRODUCTION

For risk assessment of ambient or occupational particles, mass is often used to evaluate the biological effects. However, this metric is disputed, and the redox properties were suggested to better explain the biological activity of fine, ultrafine and nano-particles. Such an oxidative potential parameter could constitute a novel, integrative and more refined metric for hazard evaluation. In this study, we tested an acellular in vitro assay (the dithiothreitol (DTT) assay) in different occupational situations.

OBJECTIVES

(1) To evaluate sampling requirements for fine/ultrafine particle allowing measurement of their oxidative potential; (2) to apply the methodology to occupational situations where particle from combustion sources are generated; (3) to test the association with the oxidative potential of selected particle constituents.

MATERIALS AND METHODS

First, sampling parameters (type of filters and loaded amount) and storage conditions affecting the DTT measurements were investigated. Based on these results, a methodological approach was defined and applied in two occupational situations characterised by diesel and other combustion particles (toll station in a tunnel and mechanical bus repair yard). The particle bulk content of organic/elemental carbon and metals (iron and copper) as well as adsorbed organics (six polycyclic aromatic hydrocarbons and four quinones) were also determined.

RESULTS

Teflon filters loaded with diesel particles were found more suitable for the DTT assay, due to their better chemical inertness. Quartz filters were less suitable because after storage durations larger than 150 hours, an increased reactivity toward DTT was observed. The DTT-reactivity on Teflon was linearly correlated to the loaded mass (tested from 200 to 1000 µg/filter).

On average, particles collected in mechanical yard showed similar DTT consumption rates than particles from toll stations.

In both work situations, the DTT consumption rate was associated with iron as well as organic carbon content. In addition, quinones, copper, elemental carbon and surface area (SMPS measurements) were associated with DTT reactivity, but only for particles collected at the toll station.

DISCUSSION AND CONCLUSIONS

These results demonstrate the feasibility of this method to determine the oxidative potential of fine/ultrafine particles in occupational situations. The particle oxidative potential was very variable. Its dependence on the working day and work situation may be explained by the physico-chemical characteristics of the particles, as suggested by the association of the reactivity with the total iron and organic content.

This approach seems useful for hazard assessments of work places where workers are exposed to ambient and manufactured fine, ultrafine and nano-particles.

[ABSTRACT ID: 597]

SIZE AND CHEMICAL CHARACTERIZATION OF PARTICULATE MATTER. EVALUATION OF INDOOR AND OUTDOOR CONTRIBUTE TO PERSONAL EXPOSURE

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OBJECTIVES

The aim of the study was to evaluate personal exposure to particulate matter (PM) in a group of subjects living in Padova (Italy), and to study the relationships with indoor and outdoor PM concentrations. We also performed a chemical characterization of different PM fractions.

METHODS

We selected 10 volunteers, 5 smokers and 5 non-smokers. For each subject, four 24-h concurrent samplings (personal, residential indoor and outdoor, workplace indoor) were carried out in two seasons (winter and summer), using a Personal Cascade Impactor Sampler (PCIS) that collects PM in five fractions (10-2.5, 2.5-1, 1-0.5, 0.5-0.25, <0.25 µm). PM₁₀, PM_{2.5} and PM₁ were determined as a sum of the fractions <10, 2.5 and 1 µm respectively. The ionic soluble components were determined by Ion Chromatography. Elemental analysis was performed by ICP-MS.

RESULTS

PM concentrations were higher in winter than in summer in all fractions and in all samplings of studied subjects. The distribution of PM in five different fractions did not show a fixed ratio. Particles <0.5 µm were always present in high concentration in both seasons, while the coarse fraction was higher in summer, particularly in outdoor. PM <0.5 µm represented about 70% of the personal PM₁₀, in both seasons, with a great influence of the smoking habit. Good correlations emerged between personal and residential indoor PM₁₀, PM_{2.5} and PM₁ concentrations in both seasons. Correlations between personal and residential outdoor concentrations and between residential indoor and outdoor concentrations were not statistically significant. The soluble inorganic component was higher in winter than in summer (31% vs. 14% of PM); nitrates, ammonium and sulphates were more present in the smallest PM fractions, while Ca²⁺ and Mg²⁺ in the coarse one. Nitrates were more represented in winter, with outdoor concentrations twice in comparison to the indoor and personal samplings. Sulphates showed similar levels in both seasons, though in summer the percentage ratio on the total ions was higher than in winter in all samplings. Nitrates and sulphates were well correlated with PM₁₀, PM_{2.5} and PM₁ in outdoor samplings, while only nitrates showed good correlations with PM in personal samplings. On the total of the PM mass, the metal content ranged from 0.08% in winter to 1.17% in summer. Fe, Al and Zn were the most represented metals in both seasons, though in summer showed a more variable size distribution. Ni, As, Cd, Pb and V were less represented in comparison to those above reported, but they have a greater toxicological significance.

CONCLUSIONS

Our results highlighted the importance to have a reliable tool for a gravimetric and size PM evaluation in diverse microenvironments, which differently contribute to personal exposure. Data on chemical composition of ambient and non-ambient PM components allow a characterisation of personal exposure and provide a contribution for a better evaluation of the health effects.