THE EFFECT OF ULTRAFINE PARTICLE PRODUCED BY OFFICE EQUIPMENT TO PERIPHERAL MONONUCLEAR BLOOD CELLS

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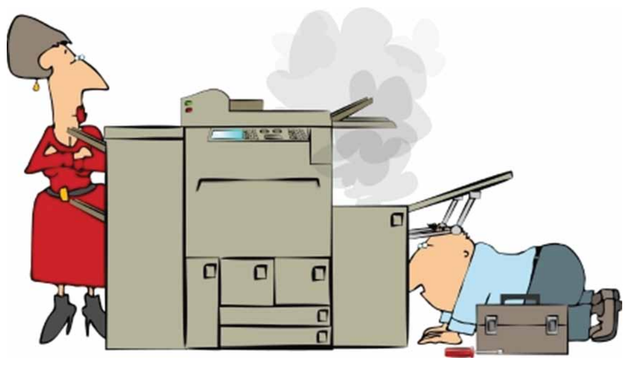


Purpose

There are lots of studies about indoor air quality testing connected with pollution of offices equipment in world, but there is still lack of real information about concentration of ultrafine particle in the indoor air.

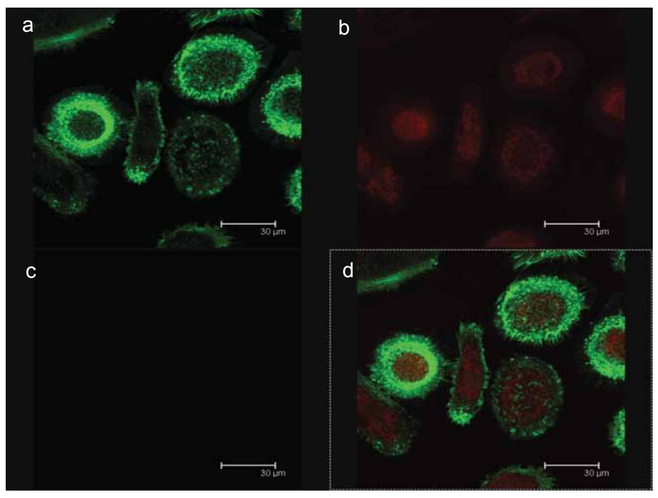
The aim of study was to evaluate the exposure of ultrafine particle concentration detected in the indoor air of offices to human peripheral blood mononuclear cells - PMBC (include macrophages).

Methods

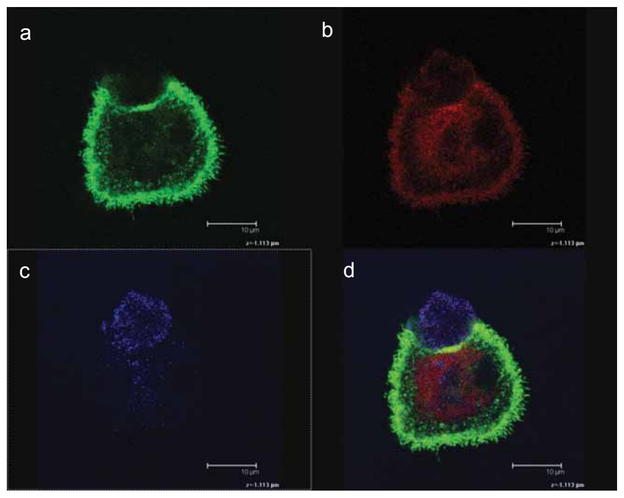
The particles were collected from surfaces of printers/copy's machines and the material of particles for experiment was prepared in physiological solution. The Ficoll-Paque™ PLUS gradient was used to distribute PMBC from human blood samples (N=4). The experiment between particles and PMBC was done in 6-well cell culture plates: 2 plates – control (non-particles and media – RPMI + 10% FBS); 2 plates – highest concentration of particles in indoor air (0.05 mg/ml) and 2 plates – lowest concentration of particles in indoor air (0.03 mg/ml). The plates were hold at +37°C and 5% CO2 conditions. After 72 h cells were lysate using TRIzol to divided RNA and then complementary DNA. The IL-6 was detected by semi-qualities PCR and electrophoreses in 1.5% agarose gel what was treated by ethidium bromide solution after all. The PMBC were colored by MitoTracker Red CMXRoS and Alexa Fluor 488 phalloidin, but for cells' visualization was used confocal microscope.

Results

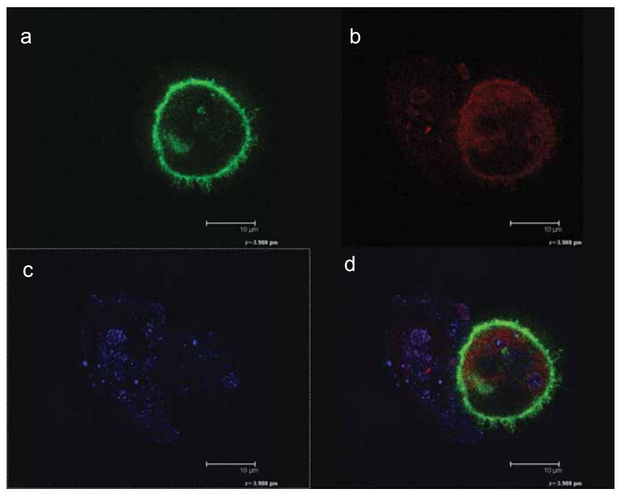
The dust particles were evaluated on the PMBC's surface and into the cells. The mitochondria were located mainly around the cells' nucleus. There was mainly obtained diffuse localization of ultrafine particles in cells (see Picture 2). Besides, the exocytosis from cells was estimated, because around cells were identified mitochondria (see Picture 3 and Picture 4). Therefore these cells are seriously damage and it could cause necrosis of PMBC. The cells' actin was observed surround the ultrafine particles, therefore localization of particles in mitochondria is possible.



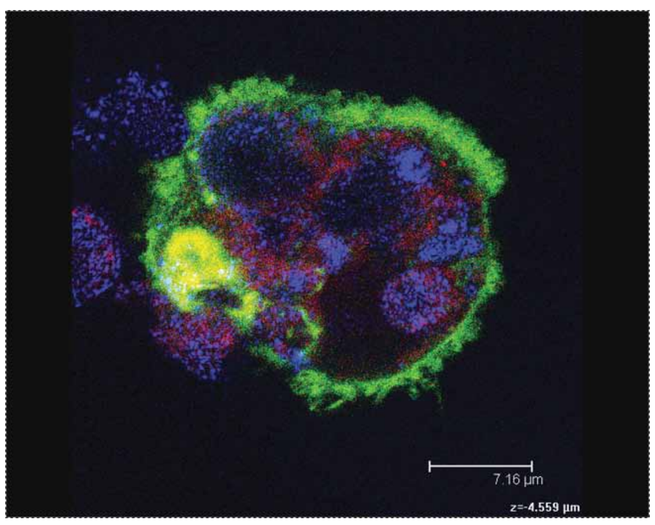
Picture 1. Confocal microscope image of control samples: a) the green filter - cell actin b) red / orange - mitochondria c) blue - dust particles (not) d) all structures together.



Picture 2. Confocal microscope image of experiment samples: a) the green filter - cell actin b) red / orange - mitochondria c) blue - dust particles (not) d) all structures together.

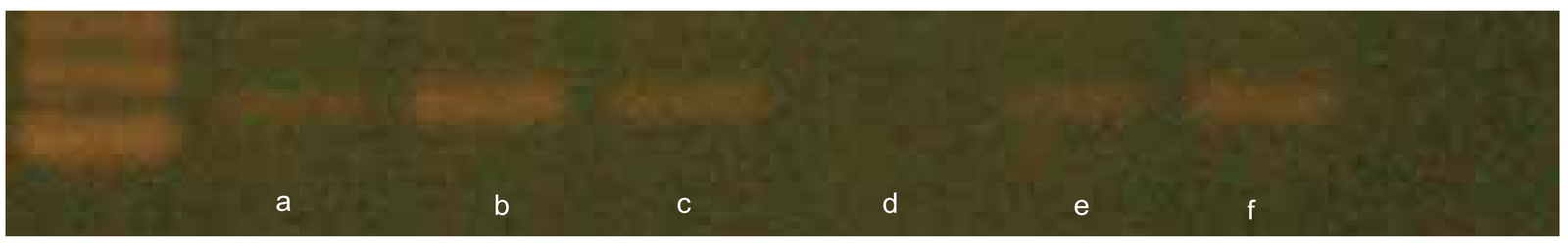


Picture 3. Confocal microscope image of experiment samples: a) the green filter - cell actin b) red / orange - mitochondria c) blue - dust particles (not) d) all structures together - exocytosis.



Picture 4. Confocal microscope image of experiment samples – exocytosis.

The IL-6 is one of pro-inflammatory marker, what show to acute process in cells and macrophages have significant role in the process of IL-6 producing. The expression of IL-6 depended of experimental concentrations in cell culture media shows highest expression at highest concentration, but in one case highest IL-6 expression was at lowest concentration. This study was pilot study and show main details what need to take account and to focus on (see Picture 5).



Picture 5. IL - 6 expression in the gel: control and two different concentrations of particles' exposure (a and d - control, b and e - 0.05 mg/ml in c and f - 0.03 mg/ml).

Conclusions

1. The dust particles (include nanoparticles) caused by office equipment are found in the peripheral blood mononuclear cells and their placement in cells were diffuse.
2. The exocytosis and/or cell fragmentation were obtained in the peripheral blood mononuclear cells after exposure to dust particles.
3. The damaged cells' segments with mitochondria were eliminated from exposed cells during exocytosis process.
4. IL-6 expression in experimental samples is more pronounced in the case of the largest exposure (higher concentrations).
5. The studies should be continued, with several inflammatory markers and their complexes in assessing and determining the actual particle concentration in the blood.

2010/0200/2DP/2.1.1.2.0/10/APIA/VIAA/006