INVESTIGATION OF THE DNA-DAMAGING EFFECTS OF BLACK TONER POWDERS IN CULTURED HUMAN EPITHELIAL A549 LUNG CELLS

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Background. The adverse effects of photocopier toner powders by inhalation of the powder itself or of emissions during laser printing have, until now, been considered to be minimal. However, several recent reports have suggested possible significant adverse health effects from toner dust inhalation. The aim of this study was to evaluate the cytotoxic and genotoxic potential of three commercially available toner powders in vitro.

Methods. For the study of DNA damage human lung carcinoma epithelial A549 cells were exposed to toner-powder suspensions and to their dimethylsulfoxide (DMSO) extracts and subjected to the alkaline single-cell gel electrophoresis (COMET assay and to the in-vitro cytochalasin block micronucleus test (CB-MNvit). Cytotoxic effects of the toner samples were assessed by the lactate-dehydrogenase (LDH) assay. Benzo[a]pyrene and the mineral quartz DQ12 were taken as positive controls. Furthermore, the influence of size, shape and composition of the toner powders on their biological effects was investigated.

Results. All three toner powders induced LDH leakage and DNA damage and formed micronuclei although to a varying extent. The overall study suggests that the investigated toner powder samples based on carbon black and iron oxide are cytotoxic as well as genotoxic in vitro. In comparison to Doerentruper quartz DQ12 the magnitude of the toxicity of the toner powders were less to equal.

Conclusions. From the results of the physical and chemical characterization of the investigated toner powders we assume that metals and metalloids as components from the iron oxide (magnetite) are responsible for the cytotoxic and the PAHs as components from carbon black are responsible for the genotoxic effects.