

Cytotoxic and genotoxic effects of three representative reprographic toner dusts and their dimethyl sulfoxide (DMSO) extracts on cultured human epithelial A 549 lung cells in vitro

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Abstract

In today's information society, the handling of toners for photocopiers or printers has become an everyday task. In principle, these toners do not pose any health hazards. However, some people have reported to react sensitively when exposed to toner dust, displaying allergic reactions of the skin, eyes and respiratory tract. Furthermore, the reported results concerning the mutagenicity and genotoxicity of reprographic toners are inconsistent. In this study the cytotoxic and genotoxic potency of three representative black reprographic toner dusts (A, B, C) were investigated by exposing human cells (A548) in vitro. For comparison, the known genotoxic compounds benzo[a]pyrene (BaP) and quartz DQ12 were studied. Cultured human epithelial A549 lung cells were exposed to toner particles in suspension or to their dimethyl sulfoxide (DMSO) extracts at final concentrations corresponding to 80 µg toner dust/cm² up to 1000 µg toner dust/cm² for 24 h at 37°C. Cytotoxicity was assessed by the lactate dehydrogenase (LDH) assay, whereas genotoxicity was assessed using the micronucleus assay and the alkaline single-cell gel electrophoresis (comet assay). The toner particles and the toner extracts (except toner A) of all three toners tested showed significant cytotoxicity. Furthermore, all three toners as particles and as extracts (except toner A) were able to cause significant DNA damage in the comet assay and to induce micronuclei formation in the micronucleus assay, although to a different extent. Taken together, our results have shown that the three reprographic toner dusts tested were cytotoxic and genotoxic in A549 human lung cells using LDH assay, micronucleus assay and SCGE assay. To evaluate a possible human health risk further studies are necessary.