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Toxicity of different types of layered silicates

Abstract *

Background: The highly attractive properties of layered silicates (e.g. clays) have resulted in continuous expansion of these materials in a wide range of applications. However, their potential toxicological effects on human health are not fully investigated. The health concerns, regarding layered silicates, are associated with their: (i) nanoscale size, (ii) high aspect ratio resulted from their platelet geometry (thickness of about 1 nm and length and/or width of up to several microns) and (iii) chemical composition.

Methods: The potential hazard of a wide range of synthetic layered silicates (SLS) and natural layered silicates (NLS) was investigated through *in vitro* toxicological studies using mouse monocyte macrophage cell line (J774A.1) and human primary macrophages, following 24 h exposure. Different end points such as cytotoxicity, secretion of cytokines and impact of SLS and NLS particles on cell morphology was examined. The panel of particles tested consists of SLS and NLS varying in different physicochemical properties such as size, charge, chemical composition.

Results: All types of NLS and SLS induce dose-dependent cytotoxic effect and secretion of pro-inflammatory cytokine, but the degree of induction varied depending on the type of layered silicate. Moreover, the light microscopic, SEM and TEM examination revealed that treatment of macrophages with layered silicates caused the formation of extensive vacuoles. Vacuole formation and vacuoles size distribution were both time and dose dependent.

Conclusions: These results demonstrate potential hazard on human health via macrophage toxicity of SLS and NLS.

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