Ecotoxicology study of main nanofillers used in packaging materials

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Abstract

In recent years, rapid development of Nanotechnology has gained public attention as applications of nanomaterials in many areas, including industry, biomedical science, agriculture and public health, are increasing rapidly. In packaging industry, nanotechnology has gained great interest as well.

Nanomaterials have been identified as promising materials for the development of different packaging materials. Nanocomposites are polymers reinforced using organic or inorganic nanometer-sized phase (nanofiller). As fillers, materials at the nanometer scale are able to improve mechanical, thermal, barrier and other functional properties of polymeric packaging materials.

Environmental exposure to nanomaterials is inevitable as their production and use increase, becoming part of our daily lives. It has raised concerns that their release into the environment may pose a serious threat, but research findings on their potential environmental effects are yet limited.

The main goal of this work is to provide a better understanding of the ecotoxicity of some nanomaterials, selected according to their broadest commercial interest for application in the packaging industry as nanofillers. Selection includes: metal (Ag), metal oxides (ZnO, SiO_2), $CaCO_3$ and clays.

Physicochemical characterization was carried out for nanofillers at solid state and test mediums.For ecotoxicological characterization, invertebrate organisms living in the tree main environmental compartments have been tested, including *Daphnia magna* (freshwater), *Brachionus plicatilis* (marine/esturine) and *Heterocypris incongruens* (freshwater sediment). Optimized acute/short chronic tests has been carried out, based on standardized tests, ISO 6341:2012, ASTM E1440-91 and ISO 14371, respectively. As these standards are well established for traditional chemicals, require some modifications to account for nanomaterial's particular behavior. Toxkits™ from MBT Inc. (Gent, Belgium) were employed for carrying out ecotoxicological assessment.

References

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Figures

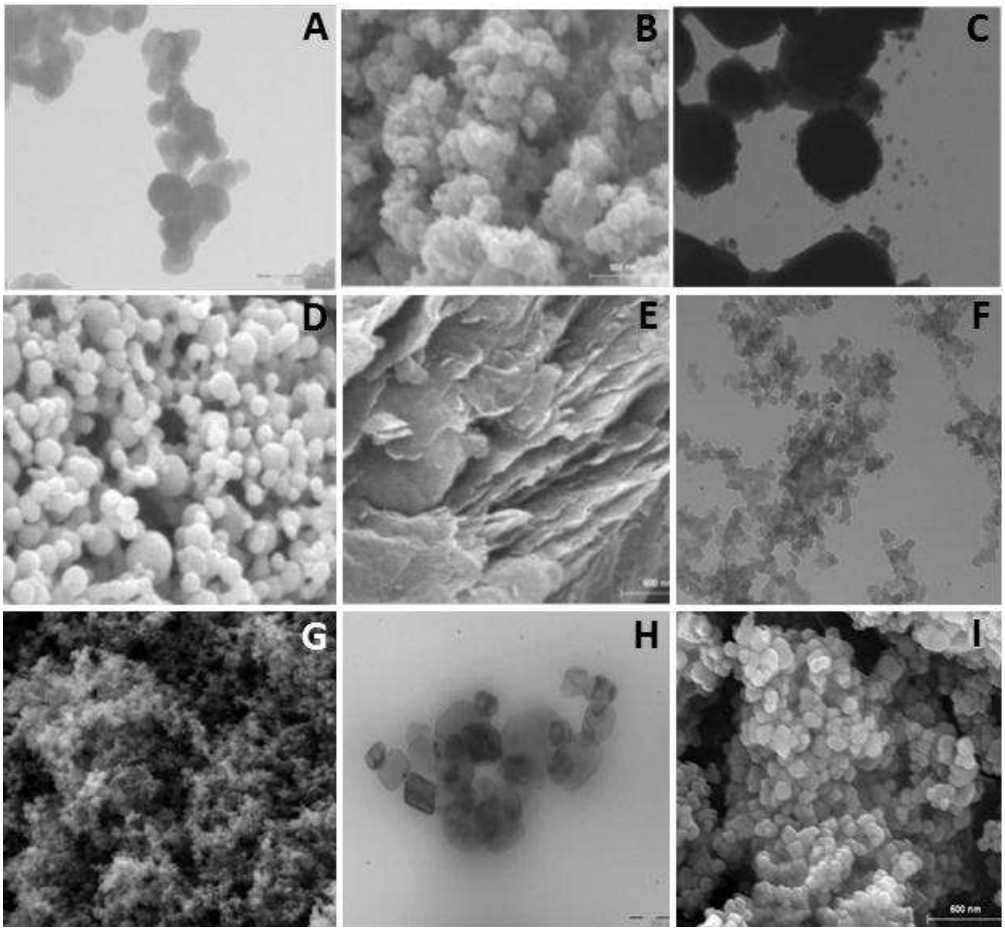

Figure. Representative electron micrographs of selected nanofillers: (A)TEM nanoZnO, (B)SEM nanoZnO, (C)TEM Ag nanoparticles, (D)SEM Ag nanoparticles, (E)SEM nanoclay, (F)TEM SiO_2 nanoparticles, (G)SEM SiO_2 nanoparticles, (H)TEM nano$CaCO_3$ and (I)SEM nano$CaCO_3$.

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