

TOXICOLOGY AND APPLIED PHARMACOLOGY

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Environmental hazards of novel photovoltaic perovskites

The $\text{CH}_3\text{NH}_3\text{PbI}_3$ perovskite is currently the most promising compound in photovoltaic (PV) technologies for making highly efficient solar cells due to its high effectiveness in converting light into electricity, simple fabrication procedure and low price. Several companies are already building perovskite based PV devices for commercialization in the near future. Nevertheless, this material contains Pb and safety concerns during PV device fabrication and transportation have not yet been addressed. Not only direct human exposure is an issue, but its release into the environment, soil and waterways, after failure of large area solar cells also represents major health risks. To overcome this problem, the scientific community suggests replacing the Pb with Sn, which is considered to be a non-toxic element. Here, we report on an extensive toxicity study of the two most promising photovoltaic perovskites $\text{CH}_3\text{NH}_3\text{PbI}_3$ and $\text{CH}_3\text{NH}_3\text{SnI}_3$. The zoom-in *in vitro* studies on epithelial and neuroblastoma cell cultures show severe toxic effects of both materials: modification of the genes upon perovskite exposure, biochemical and structural changes. The zoom-out *in vivo* studies on model living organisms (*C. elegans* and *Drosophila melanogaster*) show changes in life cycle and early death even at low concentration of perovskite uptake. The results are conclusive and encourage the scientific community to conduct further tests on more complex organisms, but especially to search for new materials which do not represent high level health hazards.

Biography

Laszlo Forro holds the Chair of Nanostructures and Novel Electronic Materials at Ecole Polytechnique Fédérale de Lausanne, Switzerland. He is leading an interdisciplinary research activity, ranging from novel electronic materials, through functional nanostructures to biomaterials. He puts strong emphases on the study of health hazards of nanostructures like carbon nanotubes, graphene, boron nitride nanowires and lately of photovoltaic perovskites. He is a Member of the Hungarian Academy of Sciences, Member of the Croatian Academy of Sciences, Member of the Serbian Academy of Sciences and Arts and Doctor Honoris Causa of the University of Szeged, Hungary.

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