Dermal absorption of Zn from sunscreen ZnO particles in humans

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Zinc oxide (ZnO) nanoparticles (NP) in sunscreens provide protection against UV exposure. Most dermal penetration studies of NP concluded that the NP reside near the surface of the skin. Using a ^{68}Zn isotope (>99%) and MC-ICP-MS we detected small increases of ^{68}Zn in the blood of human females following dermal and UV exposure over 5 days to a sunscreen containing 68ZnO NP (~30nm) compared with a sunscreen with larger ^{68}ZnO particles (~100nm) ([1,2]. There was no difference in ^{68}Zn concentrations in the blood of males exposed to either sunscreen. The overwhelming majority of applied ^{68}Zn was not absorbed, although blood and urine samples from all subjects exhibited small increases in levels of tracer ^{68}Zn. The amount of tracer detected in blood after the 5-day application period was ~1/1000th that of total Zn in the blood compartment. Tracer levels in blood continued to increase beyond the 5-day application phase in contrast to those in urine. In an earlier pilot study over 5 days of 3 adults with minimal UV exposure, employing ^{68}ZnO enriched to only 51% in a different formulation, small increases in ^{68}ZnO in blood were also detected [3]. A follow up investigation using the same samples and methods was carried out at Imperial College. There was excellent agreement between the data sets from the 2 laboratories [4].

[1] Gulson & Wong (2006), *Environ. Health Perspect.*, 114, 1486-1488. [2] Gulson, McCall, Korsch, Gomez, Casey, Oytam, Taylor, McCulloch, Trotter, Kinsley, & Greenoak (2010), *Toxicol Sci*, 118, 140-149. [3] Gulson,Wong, Korsch, Gomez, Casey, McCulloch, Trotter, Stauber, & Greenoak (2012), *Science Total Environ*, 20, 313-318.[4] Larner, Gulson, McCall, Oytam, Rehkamper (2014), *J Anal At Spectrom*. 29, 471-477.