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Thematic Session: Nano: health, environment & risks
Keywords: Titanium dioxide, nanoparticles, human placenta, E171 food additive

Basal Ti level in the human placenta and meconium and evidence of a materno-foetal transfer of food-grade TiO_2 nanoparticles in an *ex vivo* placental perfusion model

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Titanium dioxide (TiO_2) is broadly used in common consumer goods, including as a food additive (white pigment, E171 in Europe). The E171 contains TiO_2 nanoparticles (NPs), partly absorbed in the bloodstream and accumulating in several systemic organs[1,2]. Prenatal exposure to TiO_2-NPs in rodents resulted in alteration of placental functions and a materno-foetal transfer, with toxic effects on the foetus[3]. However, no human data are available for the potential materno-foetal transfer of food-grade

TiO_2-NPs. We analysed $Ti(O_2)$ content of human placentae at term and meconium (first stool of newborns) using inductively coupled plasma mass spectrometry (ICP-MS) and scanning transmission electron microscopy (STEM) coupled to energy-dispersive X-ray (EDX) spectroscopy. Using an *ex vivo* placenta perfusion model, we also assessed the transplacental passage of food-grade TiO_2 particles.

ICP-MS analysis evidenced the presence of Ti in all placentae (0.01 to 0.48 mg/kg of tissue) and in 50% of the meconium (0.02-1.50 mg/kg), suggesting a materno-foetal transfer of Ti. STEM-EDX observation confirmed the presence of TiO_2-NPs in placental tissues and meconium, in addition to iron, tin, aluminium, silicon and zinc. In placenta perfusion experiments, confocal imaging and SEM-EDX analysis of foetal exudate confirmed a low transfer of food-grade TiO_2 particles to the foetal side, barely quantifiable by ICP-MS, with 70% to 100% of the TiO_2 particles < 100 nm.

Altogether, these results show a materno-foetal transfer of TiO_2 particles, food-grade TiO_2 being a potential source for foetal exposure to NPs. These data emphasize the need for risk assessment of chronic exposure to TiO_2-NPs during pregnancy.

References (max. 5):
1. Pele et al. 2015
2. Heringa et al. 2018
3. Rollerova et al. 2015

Acknowledgment: