

Basal Ti level in the human placenta and meconium and evidence of a materno- foetal transfer of food-grade TiO₂ nanoparticles in an ex vivo placental perfusion model

Adèle Guillard, Eric Gaultier, Christel Cartier, Laurent Devoille, Johanna Noireaux, Laurence Chevalier, Mathieu Morin, Flore Grandin, Mz Lacroix, Christine Coméra, et al.

► **To cite this version:**

Adèle Guillard, Eric Gaultier, Christel Cartier, Laurent Devoille, Johanna Noireaux, et al.. Basal Ti level in the human placenta and meconium and evidence of a materno- foetal transfer of food-grade TiO₂ nanoparticles in an ex vivo placental perfusion model. C’Nano 2020, Dec 2020, Toulouse, France. hal-02945386

HAL Id: hal-02945386

<https://hal.inrae.fr/hal-02945386>

Submitted on 9 Oct 2020

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L’archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d’enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Basal Ti level in the human placenta and meconium and evidence of a materno- foetal transfer of food-grade TiO₂ nanoparticles in an ex vivo placental perfusion model

Adèle Guillard, Eric Gaultier, Christel Cartier, Laurent Devoille, Johanna Noireaux, Laurence Chevalier, Mathieu Morin, Flore Grandin, Mz Lacroix, Christine Coméra, et al.

► **To cite this version:**

Adèle Guillard, Eric Gaultier, Christel Cartier, Laurent Devoille, Johanna Noireaux, et al.. Basal Ti level in the human placenta and meconium and evidence of a materno- foetal transfer of food-grade TiO₂ nanoparticles in an ex vivo placental perfusion model. C’Nano 2020, Dec 2020, Toulouse, France. hal-02945386

HAL Id: hal-02945386

<https://hal.inrae.fr/hal-02945386>

Submitted on 22 Sep 2020

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L’archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d’enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

C'Nano 2020

The Nanoscience Meeting

TOULOUSE

Centre des congrès Pierre Baudis

December, 8, 9 and 10



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 TiO₂ nanoparticles in an *ex vivo* placental perfusion model

Guillard A¹, Gaultier E¹, Cartier C¹, Devoille L², Noireaux J³, Chevalier L⁴, Morin M⁵, Grandin F¹, Lacroix MZ⁶, Coméra C¹, Cazanave A¹, de Place A⁵, Gayrard V¹, Bach V⁷, Chardon K⁷, Bekhti N⁸, Adel-Patient K⁸, Vayssière C^{5,9}, Fiscaro P³, Feltin N², de la Farge F¹, Picard-Hagen N¹, Lamas B¹, Houdeau E¹

1. *Toxalim UMR1331 (Research Centre in Food Toxicology), Toulouse University, INRAE, ENVT, INP-Purpan, UPS, Toulouse, France*
2. *Department of materials, LNE, Trappes, France*
3. *Department for biomedical and inorganic chemistry, LNE, Paris, France*
4. *Group Physic of Materials, GPM-UMR6634, CNRS, Rouen University, Rouen, France*
5. *Department of Obstetrics and Gynecology, Paule de Viguier Hospital, CHU Toulouse, Toulouse, France*
6. *INTHERES, Toulouse University, INRAE, ENVT, Toulouse, France*
7. *Péritox UMR-I 01 (Perinatality and Toxic Risk), Jules Verne University, Amiens, France*
8. *Université Paris Saclay, CEA, INRAE; Département Médicaments et Technologies pour la Santé (DMTS), SPI, 91191 Gif-sur-Yvette, France*
9. *UMR 1027 INSERM, Team SPHERE, Toulouse III University, Toulouse, France*

Titanium dioxide (TiO₂) is broadly used in common consumer goods, including as a food additive (white pigment, E171 in Europe). The E171 contains TiO₂ nanoparticles (NPs), partly absorbed in the bloodstream and accumulating in several systemic organs^{1,2}. Prenatal exposure to TiO₂-NPs in rodents resulted in alteration of placental functions and a materno-foetal transfer, with toxic effects on the foetus³. However, no human data are available for the potential materno-foetal transfer of food-grade

C'Nano 2020

The Nanoscience Meeting

TOULOUSE

Centre des congrès Pierre Baudis

December, 8, 9 and 10



TiO₂-NPs. We analysed Ti(O₂) 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 TiO₂ 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 TiO₂-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 TiO₂ particles to the foetal side, barely quantifiable by ICP-MS, with 70% to 100% of the TiO₂ particles < 100 nm.

Altogether, these results show a materno-foetal transfer of TiO₂ particles, food-grade TiO₂ being a potential source for foetal exposure to NPs. These data emphasize the need for risk assessment of chronic exposure to TiO₂-NPs during pregnancy.

References (max. 5):

1. Pele et al. 2015
2. Heringa et al. 2018
3. Rollerova et al. 2015

Acknowledgment: