

Effects of engineered nanoTiO₂ on aquatic species

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INTRODUCTION

The widespread use of Nanoparticles (NP), namely titanium dioxide nanoparticles (TiO₂-NP), in e.g. self-cleaning surface coatings, solar cells, water treatment agents and topical sunscreens, increase the environmental exposure raising concerns on their potential impact. Research on the safety, fate, behavior and biological effects of these particles on organisms and ecosystems are needed once ecotoxicological data are still scarce.

objective

ecotoxicity evaluation of TiO₂-NP using a battery of assays covering different trophic levels and also giving some insight on fish tissue histology.

material

TiO₂-NP (Aeroxide[®] P25) - two phase composition:
• anatase (65%)
• rutile (35%)

Aqueous suspensions prepared by sonication.

TiO₂-NP nominal concentrations

- bacteria - *Vibrio fischeri* (15min) - [0 - 81.9] mg/L
- alga - *Pseudokirchneriella subcapitata* (72h) - [0 - 20] mg/L
- crustacean - *Daphnia magna* (48h) - [0 - 90] mg/L
- fish - *Carassius auratus* (21 d) - [0 - 100] mg/L

bioassays

- Intestine tissue histological observations in fish by optic microscopy

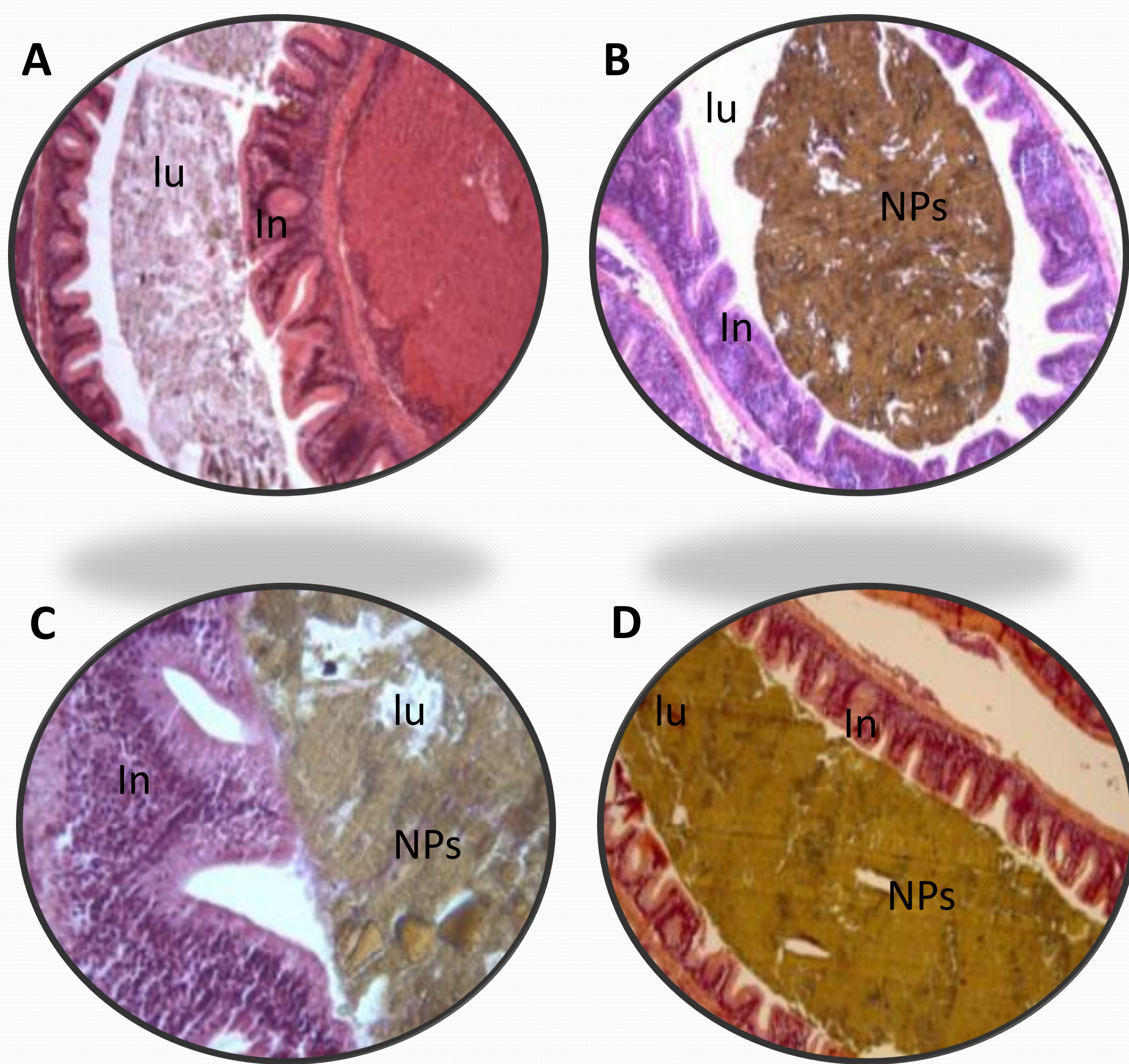


Fig. 1 - Intestine of *C. auratus*. Control fish (A); Accumulation of nanoparticles inside intestine lumen of fish exposed to different concentrations of TiO₂ (B) 10 mg/L for 14d; (C) 100 mg/L for 21d; (D) 100 mg/L for 14d. Legend: In (Intestine tissue); NPs (nanoparticles aggregates); lu (intestine lumen).

CONCLUSIONS

Although different responses from different organisms were observed, at sublethal or lethal levels, when exposed to TiO₂-NP, potential long term environmental effects of nanoparticles should not be neglected.

Results Highlights

- toxicity tests met control and test acceptability criteria
- no acute toxicity for *V. fischeri*
- no chronic toxicity for *C. auratus*
- most sensitive species to TiO₂ was the alga *P. subcapitata*
- changes in intestinal tissues in about 60% of fish exposed to 100 mg TiO₂ /L
- presence of NP aggregates in exposed fish intestine lumen
- no conclusion on the NP internalization by intestine cells.