Behavior of cerium oxide nanoparticles in presence of pharmaceuticals compounds on aquatic specimens

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Introduction

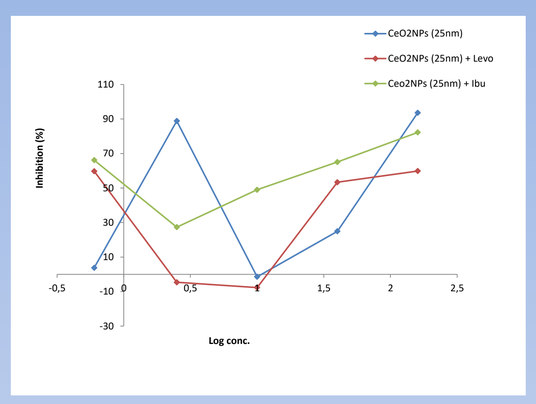
Nanoparticles, in particular metal oxide nanoparticles, have found extensive usage in a wide range of services and industries. Subsequently, they can be released into environment and finally end up in water bodies. That may suppose a potential risk to aquatic environment, exerting toxic effects at the level of cells, tissues or the whole organisms[1,2].

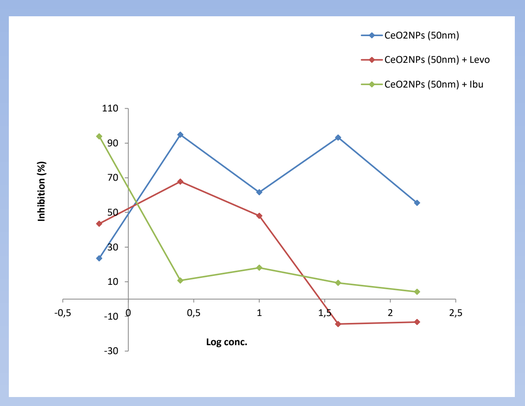
The present study, evaluate the toxicity behavior of cerium oxide nanoparticles (CeO2NPs) on three aquatic specimens- algae *Pseudokirchneriella subcapitata*, luminescent bacteria *Vibrio fisheri*, and activated suldge, by exploring concentration-dependent effect and changes induced due to the presence of Ibuprofen (Ibu) or Levofloxacin (Levo).

Materials and methods

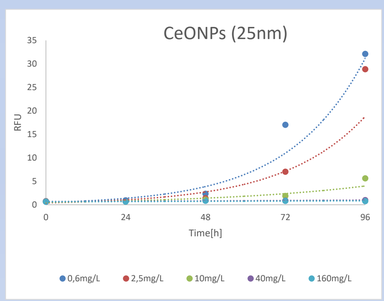
- Endpoints:
  - 72h algae growth-inhibition,
  - marine bacteria-luminiscence reduction
  - 24h sludge enzymatic activity and oxidative stress
- Nanoparticles concentration ranged from 0.6 to 160 mg L−1.
- The particle size and the ζ-potential of NPs in the culture media were measured to analize the relation between stability profile and the observed toxicity behavior.

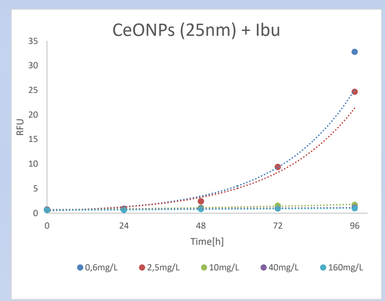
Results and discussion

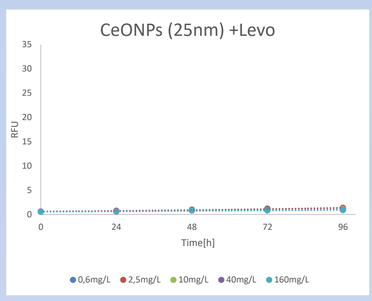


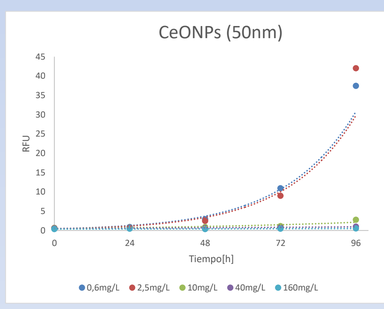


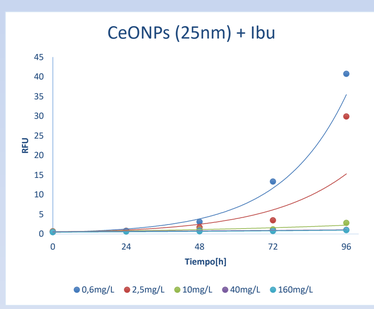
✓ Short-term exposure produced significant reduction of luminescence intensity in marine bacteria. The presence of both, Ibu or Levo, reduced the negative effects of single nanoparticles in *Vibrio fisheri*.

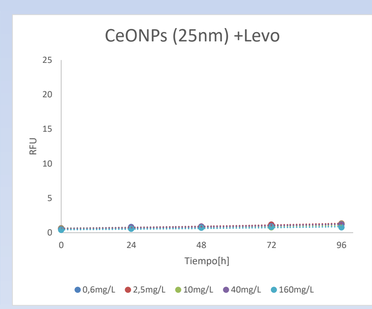












✓ CeO_2 nanoparticles leading to growth inhibition in algae. The presence of Ibu did not produced significant changes, while Levo showed drastic negative effect in algae growth.

Conclusions

Results indicated that algae was more strongly affected than the marine bacteria and activated sludge, respectively. These can be attributed to the culture media and organisms structural characteristics.

References

[1] Neale PA, Jamting AK, O'Malley E, Herrmann J, Escher BI. 2015. Behaviour of titanium dioxide and zinc oxide nanoparticles in the presence of wastewater-derived organic matter and implications for algal toxicity. Environmental Science: Nano 2:86-93.
[2] Sahle-Demessie E, Changseok H, Amy Z, Bill H, Heidi G. 2016. Interaction of engineered nanomaterials with hydrophobic organic pollutants. Nanotechnology 27:284003.

Acknowledgement

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