



Universiteit
Leiden

The Netherlands

Toxicity, bioaccumulation and trophic transfer of engineered nanoparticles in the aquatic environment

Yu, Q.

Citation

Yu, Q. (2023, January 31). *Toxicity, bioaccumulation and trophic transfer of engineered nanoparticles in the aquatic environment*. Retrieved from <https://hdl.handle.net/1887/3514042>

Version: Publisher's Version

License: [Licence agreement concerning inclusion of doctoral thesis in the Institutional Repository of the University of Leiden](#)

Downloaded from: <https://hdl.handle.net/1887/3514042>

Note: To cite this publication please use the final published version (if applicable).

**Toxicity, bioaccumulation and trophic
transfer of engineered nanoparticles
in the aquatic environment**

Qi Yu

于 棋

© 2022 Qi Yu

Toxicity, bioaccumulation and trophic transfer of engineered nanoparticles in the aquatic environment

PhD Thesis at Leiden University, The Netherlands

ISBN: 9789051914528

All rights reserved. No parts of this publication may be reproduced in any form without the written consent of the copyright owner.

Cover design: Qi Yu, Yuchen Liu

Photos: Qi Yu

Printed by: Printsupport4U, The Netherlands

**Toxicity, bioaccumulation and trophic transfer of
engineered nanoparticles in the aquatic environment**

Proefschrift

ter verkrijging van
de graad van doctor aan de Universiteit Leiden,
op gezag van rector magnificus prof.dr.ir. H. Bijl,
volgens besluit van het college van promoties
te verdedigen op dinsdag 31 januari 2023
klokke 11.15 uur

door

Qi Yu

Geboren te Heilongjiang, China

in 1992

Promotores:

Prof.dr.ir. W.J.G.M. Peijnenburg

Prof.dr.ing. M.G. Vijver

Dr.ir. T. Bosker

Promotiecommissie:

Prof.dr.ir. P.M. van Bodegom

Prof.dr. N.J. de Voogd

Dr. S.H. Barmentlo

Prof.dr. M.S. Sepúlveda

Prof.dr. Z. Wang

Table of contents

Chapter 1

General introduction 1

Chapter 2

Effects of humic substances on the aqueous stability of cerium dioxide nanoparticles and their toxicity to aquatic organisms 39

Chapter 3

Effects of natural organic matter on the joint toxicity and accumulation of Cu nanoparticles and ZnO nanoparticles in *Daphnia magna* 66

Chapter 4

Accumulation kinetics of polystyrene nano- and micro-plastics in the waterflea *Daphnia magna* and trophic transfer to the mysid *Limnomysis benedeni* 108

Chapter 5

Trophic transfer of Cu nanoparticles in a simulated aquatic food chain 140

Chapter 6

General discussion 176

Summary 187

Samenvatting 191

Curriculum vitae 196

Publication List 197

Acknowledgement 199