A network perspective reveals decreasing material diversity in studies on nanoparticle interactions with dissolved organic matter

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ENP* environmental fate model

*engineered nanoparticle  suspended particulate matter
the role of DOM*

*dissolved organic matter

Aiken et al. (2011)
Louie et al. (2016)
“Additional studies are also needed to assess interactions among a **broader variety of chemical classes** of macromolecules in the environment, including humic substances, polysaccharides, and proteins.”¹

“….there is a **clear predominance of humic acids** followed by fulvic acids, mostly standard materials. This raises the question of the environmental representativeness of such compounds. When used, **proteins are also mostly standard materials isolated from various organisms and rarely from natural waters or soil.**”²

¹Louie et al. (2016)
²Philippe and Schaumann (2014)
how to quantify diversity?
available data

~950 pairs of studied DOM and nanoparticles from 260 experimental papers
bringing it all together

∀ experiments
research focus on certain materials

PM
1 Fe₂O₃
2 ZnO
3 Ag
4 cit–Ag
5 TiO₂

DOM
a river humic acid
b river fulvic acid
c river total DOM
d peat soil humic acid
e aldrich humic acid

Sani-Kast et al. (2017)
a decrease in the number of newly studied materials

Sani-Kast et al. (2017)
focus on simplified systems

a
- coated PM
- PM with unspecified coating
- DOM

b
- Number of DOM types
- p value = 0.00195
  - coating not specified
  - coated

Sani-Kast et al. (2017)
conclusions
experimental design is not explained by certain research needs
acknowledgements

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references


