



Nanoparticles:

Are they emerging contaminants in drinking water (sources)?

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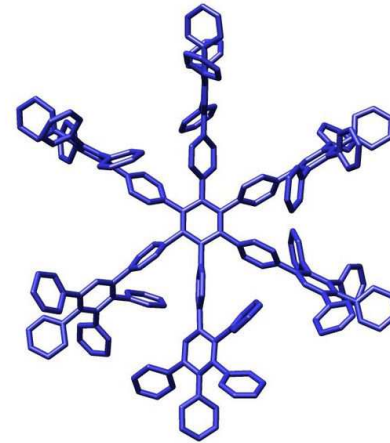
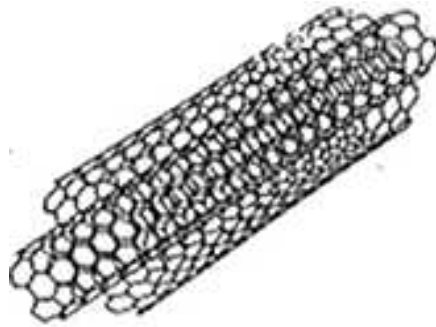
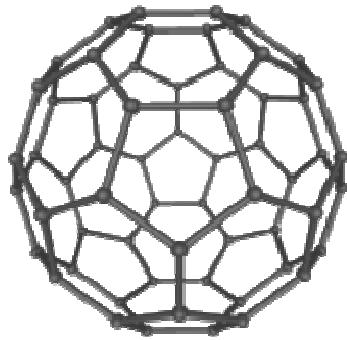
What are nanoparticles?

- By definition particles that are smaller than 100 nm
- They can be organic or inorganic
- They can be purely metallic or oxides

Their physical properties
differ significantly from the
bulk material



A few examples



Metallic: Ag, Au, Pt, Pd

Oxides: CuO, Fe₂O₃, Al₂O₃, CeO₂, TiO₂, SiO₂

Where are they coming from?

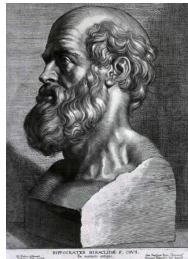
Consumer products



Consumer electronics



Medicine



Chemical industry

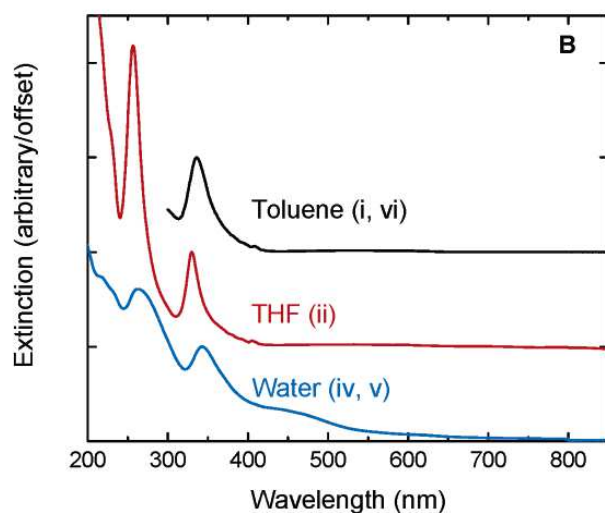
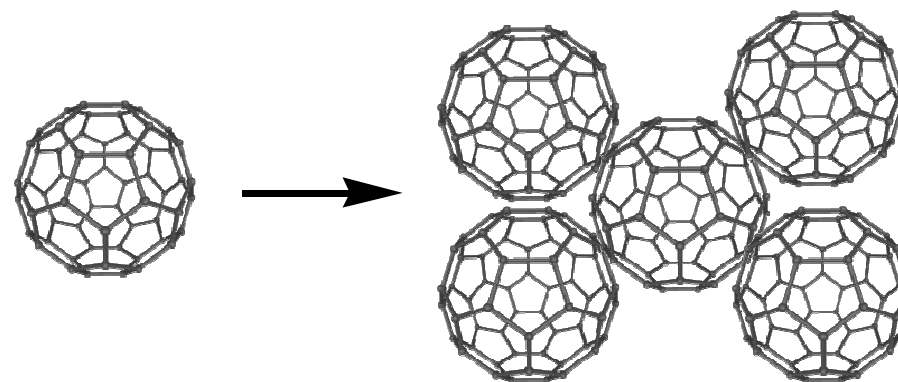
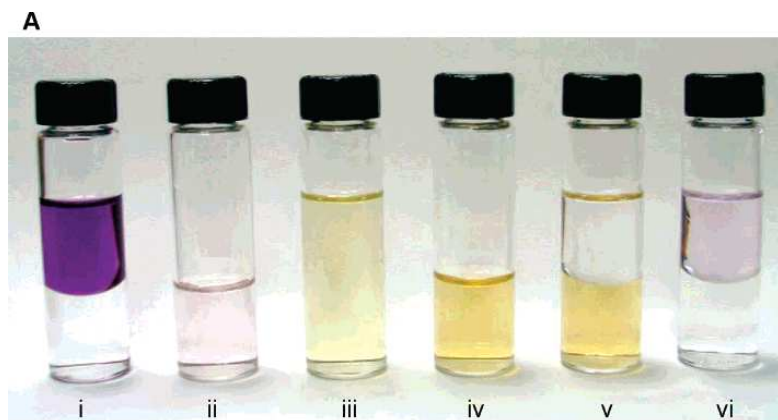


Why should they be classified as emerging contaminants?

- They are released into the environment
- Biodegradability is questionable
- Toxicity could be demonstrated

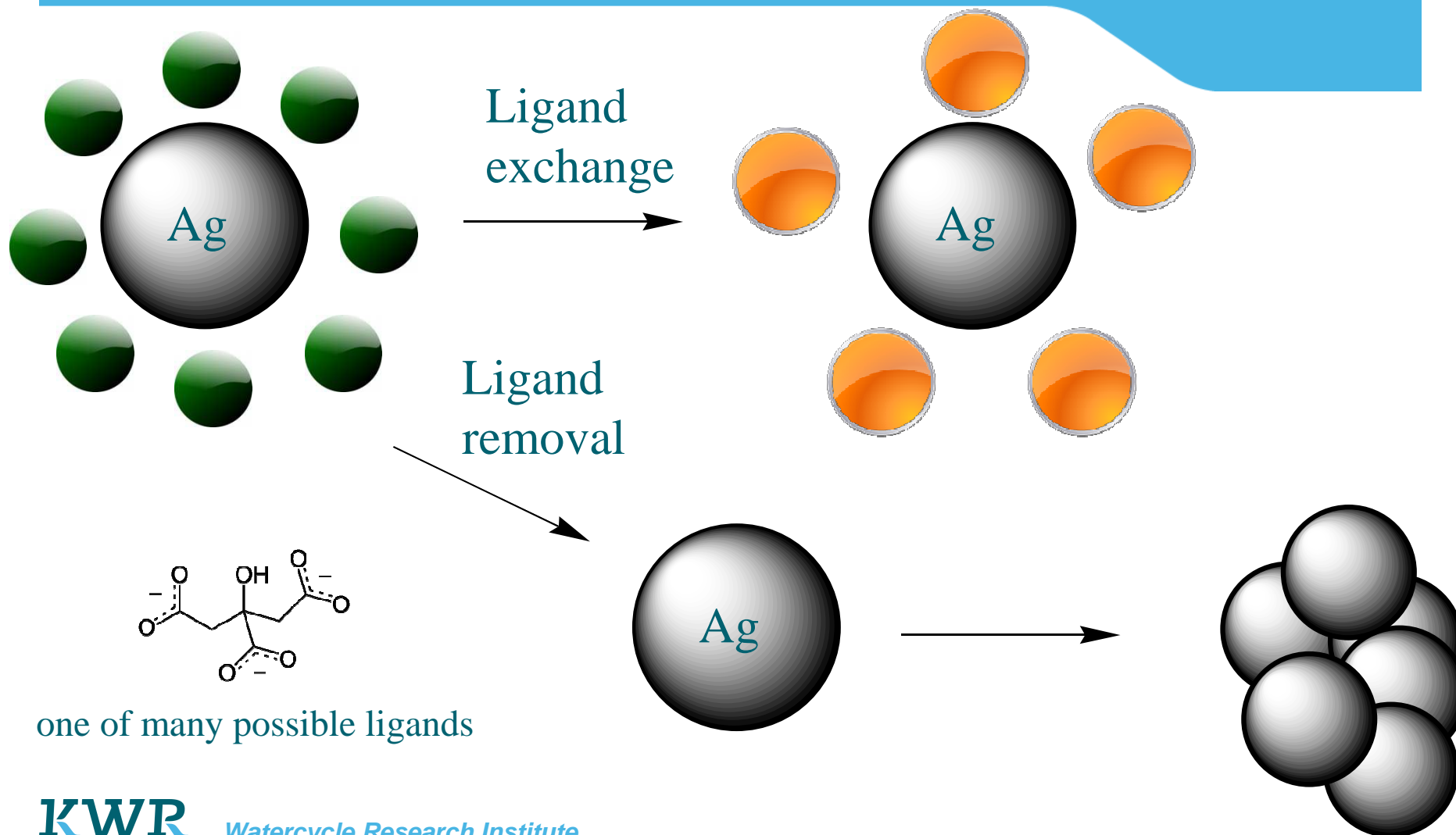


How do they behave?



Fortner, J. D.; Lyon, D. Y.; Sayes, C. M.; Boyd, A. M.; Falkner, J. C.; Hotze, E. M.; Alemany, L. B.; Tao, Y. J.; Guo, W.; Ausman, K. D.; Colvin, V. L.; Hughes, J. B., C60 in Water: Nanocrystal Formation and Microbial Response. *Environ. Sci. Technol.* **2005**, *39*, (11), 4307-4316.

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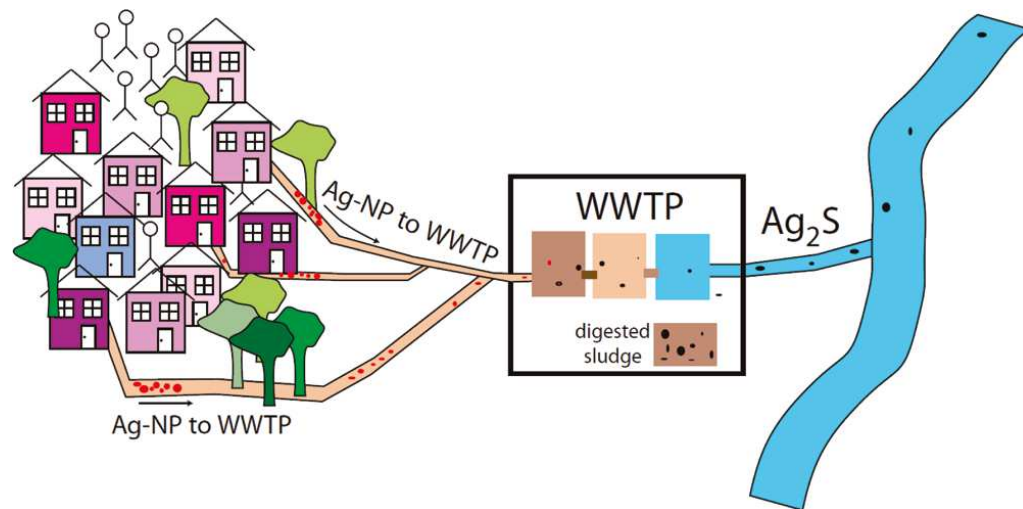


Do we need extra water treatment steps in the plant?



Or even better: before they enter the plant?

Kaegi, R.; Voegelin, A.; Sinnet, B.; Zuleeg, S.; Hagendorfer, H.; Burkhardt, M.; Siegrist, H., Behavior of metallic silver nanoparticles in a pilot wastewater treatment plant. *Environ. Sci. Technol.* **2011**, *45*, (9), 3902-3908.



How can we analyse them?

| | Concentration | Particle Size | Particle Distrib. | Shape | Composition |
|------------|---------------|---------------|-------------------|-------|-------------|
| ICP-MS | Yes | Indirectly | | | Yes |
| FFF-ICP-MS | Yes | Yes | | Yes | Yes |
| UV/VIS | Yes | Yes | Yes | | |
| TEM | | Yes | Yes | Yes | |
| DLS | | Yes | Yes | Yes | |