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Tracing nanoparticles in the sub-ppb range

Silica particles with encapsulated DNA (SPED) as ecological sensors

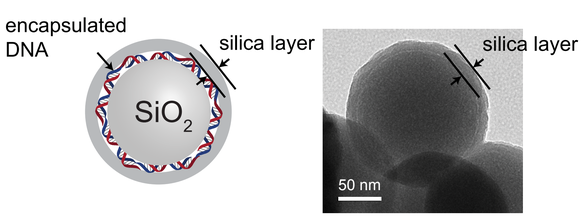
Working principle

1 Protecting the DNA label

Free DNA

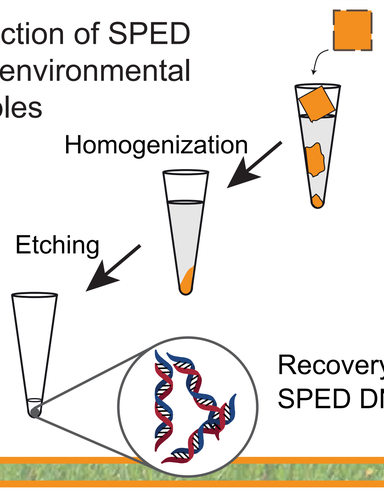
Functionalized SiO_2 particle

DNA is protected by immobilization on the surface of cationic charged silica particles onto which a dense silica layer is deposited.



2 Release of SPED to environment

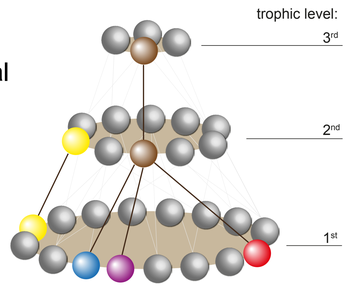
3 Extraction of SPED from environmental samples



Recovery of SPED DNA label

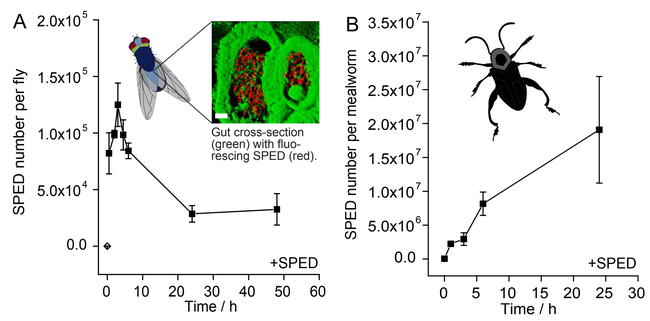
4 Real-time quantitative PCR analysis and information reconstruction

Ecological network:

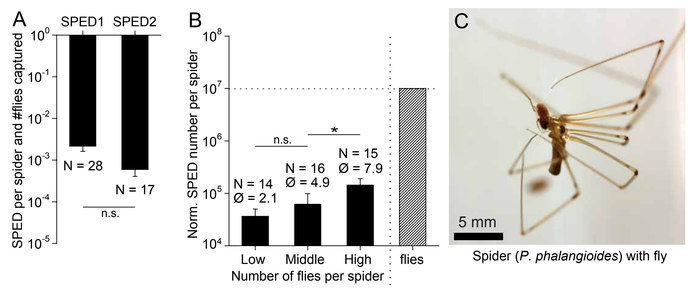


Results & Conclusion

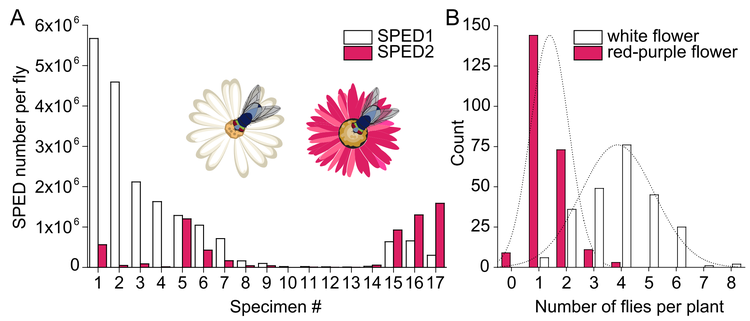
- SPED are taken up by (A) flies (*D. melanogaster*) and (B) meal beetle larvae (*T. molitor*).
- SPED remained persistent in the flies gut system over several days.



- SPED were readily (A) transferable and (B) quantifiable from the bottom to the top of a (C) two-level food chain (fly - spider).



- SPED proved to be a fast and accurate analysis method to investigate the flower preference of fly pollinators (*L. caesar*).



- SPED simplify the analysis of nanoparticle bio-distribution patterns and ecological networks.
- The material is non-toxic, chemically inert and resistant against ROS and high temperatures (< 200 °C).
- By changing the DNA sequence, an endless number of different SPED can be generated.
- SPED are chemically adaptable to different ecosystems and quantifiable in the sub-ppb range via quantitative real-time PCR.

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