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ORAL PRESENTATION - Radiolabelling of engineered nanoparticles –different strategies for Ag⁰-NP, TiO₂-NP and MWCNT

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Radioactive tracers provide a simple and effective tool for transport studies of nanoparticulate materials within environmental samples at laboratory scale. Compared to classical approaches radiolabelling of nanoparticles (NP) offers advantages in sensitivity and selectivity together with the possibility of in-situ imaging of transport phenomena. Particularly with regard to quantitative evaluation for transport studies radiotracers allow an easy differentiation between the elemental/nanoparticulate background concentration and the NP-derived input into an environmental sample. The limiting factor of the use of radiotracers is the possible alteration of experimentally relevant physical/chemical properties of the NP due to the radiolabelling and also the stable binding of the tracer on the NP. Depending on the experimental needs (half-life, decay-mode/radiation), different labelling methods are available.
The study aims at the comparison/evaluation of radiolabelling methods for Ag⁰-NP, TiO₂-NP and MWCNT:

(1) direct activation of NP due to cyclotron irradiation:
- Ag⁰-NP: ¹⁰⁷Ag(p,3n)¹⁰⁵Cd –> ¹⁰⁵Ag / ¹⁰⁷Ag(p,p2n)¹⁰⁵
- TiO₂-NP: ⁴⁸Ti(p,n)⁴⁸V
- MWCNT: ¹²C(p,3d)⁷Be

(2) self-diffusion of radioisotopes:
- Ag⁰-NP: ^{105,110m}Ag
- TiO₂-NP: ^{44,45}Ti

(3) radioiodination
- MWCNT: ^{125,131}I

(4) recoil labelling:
- Ag⁰-NP: ⁷Li(p,n)⁷Be
- TiO₂-NP: ⁷Li(p,n)⁷Be
- MWCNT: ⁷Li(p,n)⁷Be

The direct irradiation and the recoil labelling were carried out at a Scanditronix MC40 cyclotron [1, 2], self-diffusion experiments were carried by means of a Cyclone® 18/9 (IBA molecular) [3]. The methods were tested with respect to labelling yield, achievable activity concentration, pH-dependent stability of the labelling and the influence on NP-properties. Data thus obtained enable an appropriate selection of radiolabelling methods for different experimental applications.

References

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