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Preparation of [⁴⁸V]TiO₂ labelled nanoparticles for biokinetics studies.

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Engineered nanoparticles are of current interest in many applications (e.g. industry, medicine, energy). As they are produced in ever higher quantities, the need to assess their biokinetics and toxicity becomes more and more important. The aim of this study was to prepare stable, radiolabelled bioavailable TiO₂ nanoparticles to assess their in vivo biokinetics. The preparation of [⁴⁸V]TiO₂ nanoparticles by direct proton irradiation is described.

Irradiations were performed on the Scanditronix MC-40 cyclotron at JRC Ispra, Italy with a 5 μA proton beam of 23.5 MeV energy. After 16 hours irradiation, a commercial sample of TiO₂ (ST-01, Ishihara Corp. Japan) yielded approx. 40 MBq of ⁴⁸V activity at EOB. Half of the irradiated material was processed two weeks after EOB to size-select and purify the labelled nanoparticles from free ⁴⁸V by centrifugation and filtration. This yielded 855 kBq of final suspension of fine [⁴⁸V]TiO₂ labelled nanoparticles (Z average = 105 nm) without free ⁴⁸V. In vivo results in a rat model indicated good ⁴⁸V label stability with less than 1% of the administered dose eliminated by renal excretion, compared to ionic ⁴⁸V with approximately 50% renal clearance.

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