

Toxicokinetic study following intratracheal instillation or oral gavage of [⁷Be]-tagged carbon black into rat lungs

Two grades of carbon black (CB), Monarch[®] 1000 and Printex[®] 90, were radioactively labelled with ⁷Be (beryllium) using proton beam irradiation. To remove soluble radiolabel from the ⁷Be-CBs, a triplicate of solvents: i.) EtOH/H₂O ii.) HCl iii.) artificial lysosomal fluid (ALF) was applied to consecutively wash the test items. Approx. 0.3 mg of the purified ⁷Be-CBs was intratracheally instilled to lungs of Wistar rats, thus, the toxicokinetics was followed without induction of lung overload. In feces, ⁷Be-CBs were detected up to day 3 post-treatment at significant levels, i.e. 7.2%. In urine, a smaller percentage of 1.8% was observed. In blood the test items were not detected. At day 20 post-instillation, the ⁷Be-CBs were exclusively found in lungs and in very small amounts in the lung-associated lymph nodes (LALN), not in other organs/tissues. Separation of leukocytes and cell-free supernatant of a bronchoalveolar lavage by centrifugation revealed that the ⁷Be-CBs were exclusively located in the cell sediment.

The same dose was administered by oral gavage. In feces, the ⁷Be-CBs were detected up to day 3 post-treatment at 55.3%. In urine, however, a small percentage of 0.5% was observed. In blood and other organs the ⁷Be-CBs were not detected.

In conclusion, the results indicate that the ⁷Be-CBs act as microscaled agglomerates, not as individual nanoparticles, and display no potential to translocate beyond the lung or the gastrointestinal tract into the blood compartment. This finding is consistent with the behaviour of poorly soluble particles. Overall, ⁷Be-CBs were not systemically available after deposition in lungs.