

Potassium Octatitanate Whiskers

T Oyabu et al. J Occup Health (2006) Vol.48 p 44-48

The Effect of Lung Burden on Biopersistence and Pulmonary Effects in Rats Exposed to Potassium Octatitanate Whiskers (POW) by Intratracheal Instillation.

Potassium Octatitanate whiskers are bio persistent and cause significant lung inflammation.

Potassium Octatitanate whiskers ($K_2Ti_8O_{17}$) (POW) are typically of 5 μm in length and are classified as refractory ceramic fibres (aka Fybex). They are used as an asbestos substitute. Potassium Titanate $KTiO_2(OH)$, is physically distinct material with many overlapping applications.

Interest in the carcinogenicity of POW has persisted since the early 1980s. It is not specifically categorised as a carcinogen by IARC. Refractory ceramic fibres are subject to exposure standards; 1 fibre/ml according to EH40 2005.

A key measure of lung disease potential is bio-persistence. That is, the time taken for the fibre to be cleared from the deeper recesses of the lung. For the purposes of labelling, fibres which persist more than 40 days (half life) may need to be labelled as carcinogenic [strictly, only if they are longer than 20 μm , Directive 97/169/EC].

Experiments with respirable fibres and powders show that lung clearance rates depend on lung burden. Often, a threshold burden is determined, beyond which fibre clearance is significantly lowered and risk of fibrosis significantly increased. Determination of such response thresholds should be valuable in setting exposure standards.

Potassium Octatitanate has been extensively studied. Its presence in rodent lungs produces a strong inflammatory reaction, comparable with crocidolite.

This experiment involved the instillation of known body burdens of POW into rat lungs and the subsequent measurement of mass clearance rates.

It was found that mass clearance rates decreased steadily with increased dose. Half lives were 10, 15, 20 and 42 months for initial doses of 0.5 mg, 1.0 mg, 2.0 mg and 5.0 mg respectively. No threshold effect was observed.

Comment

Instillation is used as a first pass experiment to determine, roughly, the level of exposure of interest. However, instillation is very unlike inhalation exposure and often produces unrepresentative results.

Materials containing POW of length greater than 20 μm should be labelled as carcinogenic. Exceptions could be made if the material is completely encapsulated. Exposure to significant burdens of POW at 5 μm should be expected to cause fibrosis. The definition of significant burden is not precisely known, but generic occupational exposure limits apply.