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Modelling the Fenton reaction of amphibole asbestos

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In this work a sample of UICC crocidolite and a sample of fibrous tremolite were leached up to 1 week both in a simplified Gamble's solution at acidic pH and in a phosphate buffered medium at neutral pH, in presence of H_2O_2. Surface chemical modifications were monitored by XPS spectroscopy. Subsequently, the generation of HO• radicals following reaction of both pristine and leached fibres with H_2O_2 (Fenton reaction) was investigated by spin trapping/EPR spectroscopy, with the aim of better clarifying the relationships between possible surface alteration occurring *in vivo* and chemical reactivity of amphibole asbestos. Moreover, the generation of HO• radicals was monitored on thermally treated fibres after leaching in phosphate buffered medium at neutral pH and in presence of H_2O_2 to investigate how chemical reactivity may be modulated by Fe oxidation state.

Results showed that, for both amphibole asbestos, the surface alteration following incubation in the modified Gamble's solution does not alter HO• radical generation. Interestingly, leaching in phosphate buffered solution in presence of H_2O_2 induced a progressive increase in HO• release for crocidolite fibres, whereas a strong reduction was observed for asbestos tremolite. This behaviour is likely due to the quicker alteration of the crocidolite surface due to the interaction with H_2O_2, as indicated by XPS analysis. In particular, the oxidation induced by H_2O_2 promotes the dissolution of the first atomic layer of the crocidolite structure and the following occurrence on its surface of new reactive Fe centres, particularly under the form of Fe(II), of which the bulk is richer than the oxidized surface. Accordingly, the heated samples showed a reduced, but not suppressed by thermal oxidation, chemical reactivity, with no significant evolution following incubation in phosphate buffered medium at neutral pH and in presence of H_2O_2.