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A minero-chemical investigation of dental alginates in relation to their health effects

Tommaso Baroni[1], Maurizio Romanelli[1], Elena Belluso[2], Silvana Capella[2], Fabio Capacci[3], Giordano Montegrossi[4], and Francesco Di Benedetto[5]

[1]Univ. Florence, Dept. of Earth Science, Italy (tommaso.baroni@unifi.it)
[2]Univ. Turin, Dept. of Earth Sciences and Interdepartmental Centre for Studies on Asbestos and other Toxic Particulates "Giovanni Scansetti", Italy
[3]formerly at Health Agency of Florence, Italy
[4]Institute for Geosciences and Earth Resources, CNR, Florence (Italy)
[5]Univ. Ferrara, Dept. Physics and Earth Sciences, Italy

A case of severe silicosis was described in association with the production and use of dental alginates [1]. This evidence suggests a potential underestimated source of exposure to toxicants for workers, in a professional branch where silica-related risk has not been yet considered.

In the present study, we undertook a thorough characterisation of two commercial silica-based dental alginates. X-ray Powder Diffraction (XRPD) was used to establish the mineralogical composition, in combination with SEM-EDS analysis, in order to assess particle size, morphology and chemistry of the dental alginates components. Finally, preliminary room-temperature EPR investigations were carried out to identify selected paramagnetic species, namely Fe(III) and radicals. The results point to the presence of an extensive amount of diatomaceous earth, clearly identified by micromorphology, primarily formed by cristobalite, which results as the most abundant crystalline phase in XRPD. The presence of such abundant cristobalite amount results from the high-temperature transformation of amorphous silica during the calcination process to which diatomaceous earth (originally amorphous) had been subjected. Subordinate amounts of associated phases such as gypsum, talc, magnesium oxide (besides potassium hexafluorotitanate and Na/K alginates) were observed. A relevant fraction of an amorphous-to-cryptocrystalline silica fraction was also identified. In terms of size distribution, all the different components are represented by particles of different shapes with size <100 μm [2]. While the associated phases pertain to the inhalable fraction, the presence of a significant amount of complete diatoms shells with diameter < 10 μm and abundant scattered fragments < 4 μm sets the cristobalite into the thoracic and respirable fraction categories [2].

Based on the obtained results, we warmly support the reconsideration of dental alginates in terms of the definition of their health risks, mostly consisting of a very harmful silica polymorph, as cristobalite. Interesting parallelisms can be fostered with the well-known epidemiological studies on the cohorts of workers of the diatomaceous earth [3-5]. In particular, two different contexts of exposure can be identified: the step when dry mixing of the individual components of the mixture

are blended together (industrial production of commercial materials) and when workers clean the metal mould of the dental cast from the hardened alginate composite.

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