

Quantitative Determination of 'Organic Germanium' in Nutritional Supplementations

Erwin Rosenberg

Vienna University of Technology, Institute of Chemical Technologies and Analytics,
Getreidemarkt 9/164 AC, A-1060 Vienna, Austria, E.Rosenberg@tuwien.ac.at

Organic germanium compounds, and in particular *bis*-carboxyethyl germanium sesquioxide (= commonly also named germanium sesquioxide or Ge-132), has for long been under discussion as a nutritional supplement and even a therapeutic agent cancer, immunodeficiency, and other infectious diseases (1). While its beneficial effect for human health has not been demonstrated in a convincing way yet, it continues, however, to be sold via the internet in formulations of different form, e.g. as pure compound, as solution or as tablets. While the beneficial effect of germanium supplementations to the human diet may be arguable, and at least no adverse effects could be observed with the intake of this drug even at higher dosages and for extended periods of time, this is not true for the inorganic forms of germanium, notably germanium oxide (GeO₂). Germanium oxide exhibits pronounced renal toxicity, and has been reported to have led to a number of casualties in the case of regular uptake (2). This clearly points out the need for the speciation of germanium and its (organic) compounds.

Different analytical approaches have been reported in the literature. These are based on ion chromatography (with optical emission (3) or ICP-MS detection (4)), or on the differential determination of the elemental and organic bound form after digestion (5). None of these actually confirms the presence of germanium sesquioxide rather than by the element specific response of the detector, and the agreement of the retention time with the one of authentic standards.

We present here a novel approach for the determination of inorganic germanium and germanium sesquioxide, based on liquid chromatographic separation on an ion exchange column (Phenomenex Rezex RHM) with ESI-MS detection. While elemental germanium is unretained on this particular column, Ge sesquioxide can be detected in the form of its monovalent anion, whereby the exact mass of the detected anion, as well as its fragmentation pattern confirm the identity of the Ge sesquioxide.

It appears to be important to analyse the samples containing Ge sesquioxide promptly after preparation, as the drug tends to hydrolyse to the monomeric subunit, and this can further condense to more complex systems containing two, three or more Ge atoms (6).

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