

## Determination of Germanium sesquioxide (Ge-132) by gas chromatography with microwave-induced plasma atomic emission after derivatisation

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Although germanium-containing dietary supplements have been on the market for more than 30 years now, they only recently became popular as remedies for certain diseases. Organogermanium compounds are considered to promote health and cure diseases. They are moreover described as antioxidants and immunostimulatory medicine, e.g. inhibiting the progress of cancer and AIDS and destroying cancer cells [1,2]. In most cases, germanium is used in the form of beta-carboxyethylgermanium sesquioxide ((GeCH<sub>2</sub>CH<sub>2</sub>COOH)<sub>2</sub>O<sub>3</sub> or “Ge-132”), and as spirogermanium, germanium-lactate-citrate or in other unspecified forms. For humans, germanium is not essential and in general the toxicity of the mentioned organogermanium compounds is low. Acute and chronic toxic effects of inorganic germanium dioxide have been demonstrated [3]. It is obvious that especially inorganic germanium has a higher potential of negative effects. Therefore, a widespread analytical product control is indispensable.

Analytical methods for the analysis of Ge-132 presented so far have the shortcoming that they either do not speciate the individual form of Ge present in the sample, or speciation is done, however, without being able to determine the actual form of organogermanium compound present, since this is, e.g., only determined by the difference in the hydride generation signal [4], or by ICP-MS [5].

We present here a completely new approach to the determination of Ge-132, based on derivatisation by chloroformate reagents and subsequent analysis by gas chromatography with atomic emission detection (GC-AED) or mass spectrometry (GC-MS). This approach provides the convenience of aqueous phase derivatisation of the analyte by ethylchloroformate and element- or compound specific detection of the formed derivative which is extracted into a suitable organic solvent. The structure of the derivative could be tentatively identified by GC/MS (and complementary LC/MS measurements) as Cl<sub>3</sub>GeCH<sub>2</sub>CH<sub>2</sub>COOCH<sub>2</sub>CH<sub>3</sub> which is formed through hydrolysis of the Germanium sesquioxide and its subsequent reaction with ethyl chloroformate. The proposed reaction was useful for quantitative analysis down to low ng amounts of organogermanium compound (as Ge), by far sufficient for the monitoring of organogermanium levels in nutritional supplements.

### References:

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