



Measuring the Bioaccessibility, Bioavailability and Chemical Form of Lead in Old Dutch Town Soils

Mark Cave (1), Joanna Wragg (1), Martine Bakker (2), Simon Chenery (1), Charles Gowing (1), and Amanda Gardner (1)

(1) British Geological Survey, Groundwater Directorate, Nottingham, NG12 5GG, United Kingdom, (2) National Institute for Public Health and the Environment, P.O. Box 1 [U+2502]3720 BA Bilthoven The Netherlands

INTRODUCTION

Measuring the bioavailability of potentially harmful elements has received much attention in the current literature with particular interest in Pb. Measuring techniques can take the form of in-vivo studies, in-vitro tests and geochemical tests which look at the chemical form Pb in the soil. In this study the bioavailability of Pb in soils from seven Dutch towns has been estimated using all three approaches.

METHODS

Soils were sampled from the towns of Leiden, Utrecht, Rotterdam, Maastricht, De Ryp and the Haigh. The bioavailability of Pb in the soils was determined using a study conducted on juvenile swine (Van Kesteren et al., 2014). Assessment of the bioaccessible Pb was undertaken using the Unified Barge Method (UBM) (Denys et al. 2012). The Chemometric Identification of Substrates and Element Distributions (CISED) method was used to measure the fractionation of Pb in the soils (Cave et al. 2015).

RESULTS AND DISCUSSION

The CISED extraction identified between 8 and 13 distinct geochemical components in the soils. For Leiden, Utrecht, Rotterdam, De Ryp and The Haigh these components have a common theme of three elements namely Pb, Al and P. For each of these towns there is good agreement between the in-vivo bioavailability and the UBM bioaccessibility and the Pb containing component contains > 65 % of the total Pb. For Maastricht the main Pb bearing fraction is dominantly Al and Si and the UBM bioaccessibility gives a low value compared to the in-vivo study. The Pb/Al/P fraction suggest the Pb in these soils may be in the form of plumbogummite ($\text{PbAl}_3(\text{PO}_4)_2(\text{OH})_5 \cdot \text{H}_2\text{O}$) (Adams et al., 1973). It appears that this Pb fraction is bioavailable as shown by the in-vivo and in-vitro results. The Pb in the aluminosilicate phase in Maastricht is far less bioavailable and there is poorer agreement between in-vivo and in-vitro results (Van Kesteren et al., 2014).

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