

PREDICTING ARSENIC BIOAVAILABILITY IN MODERATELY CONTAMINATED SOILS

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Introduction

The primary risk pathway of concern for Arsenic (As) contaminated soils is incidental soil ingestion. Taking into account the bioavailability of As in soil can have a drastic influence on human health risk assessments. However, the most important bioavailability adjustments are made in soils with moderate (<1,500 mg/kg) total As. When limited to a moderate total As concentration, two commonly used gastrointestinal in vitro methods; the OSU-IVG (Basta et al. 2007) and SBRC (Juhasz et al. 2007) under predict bioavailable As in gold mine tailings from California. The aim of the current study is to accurately measure and predict bioavailable As in moderately contaminated soils.

Methods

Twenty-two soils with <1,500 mg/kg total As were provided from two studies: Department of Defense's Strategic Environmental Research and Development Program (SERDP) (project ER-1742) and California Department of Toxic Substances Control (DTSC) Training Research and Technical Assistance Grant. Relative bioavailable (RBA) As was calculated using the UEF from the test material divided by the UEF from a sodium arsenate reference material. 90% confidence intervals were calculated using Fieller's Theorem (Brattin & Casteel, 2013). Gastrointestinal in vitro methods were conducted according to Basta et al. (2007), SBRC method of Juhasz et al. (2007), and the California Bioaccessibility method (CAB) developed under the DTSC Training Research and Technical Assistance Grant

Results

The in vitro As extracted in the OSU-IVG and SBRC methods was significantly less than the As extracted in the CAB method and RBA As, especially in soils for gold mining sites in California. A summary of the resulting in Vitro –In Vivo Correlation (IVIVC) for SERDP and DTSC Study Soils is presented in Table 1.

Table 1. In Vitro –In Vivo Correlation (IVIVC) for SERDP and DTSC Study Soils with moderate (<1,500 mg/kg) total As content

Method	slope	intercept	r ²
CAB GE	0.79	4.9	0.92
OSU-IVG GE	0.96	12.5	0.55
OSU-IVG IE	0.52	21.3	0.17
EPA 9200	1.7	8.8	0.42

Conclusion

The results of the IVIVC demonstrate that only the CAB method is highly predictive of RBA As in these study soils containing <1,500 mg/kg total As. In addition, this regression equation includes soils with widely varying As sources, indicating that the modified OSU-IVG may be applicable to both goldmining and non-goldmining sites.

References

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