

Accepted Manuscript

Extractive recovery and valorisation of arsenic from contaminated soil through phytoremediation using *Pteris cretica*

Valentine C. Eze, Adam P. Harvey



PII: S0045-6535(18)31100-7

DOI: 10.1016/j.chemosphere.2018.06.027

Reference: CHEM 21559

To appear in: *Chemosphere*

Received Date: 28 February 2018

Accepted Date: 04 June 2018

Please cite this article as: Valentine C. Eze, Adam P. Harvey, Extractive recovery and valorisation of arsenic from contaminated soil through phytoremediation using *Pteris cretica*, *Chemosphere* (2018), doi: 10.1016/j.chemosphere.2018.06.027

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Extractive recovery and valorisation of arsenic from contaminated soil through phytoremediation using *Pteris cretica*

Valentine C. Eze¹ and Adam P. Harvey¹

¹*School of Engineering, Newcastle University, Newcastle upon Tyne, NE1 7RU, UK.*

Corresponding: Tel.: +44-191-208-5747; E-mail address: v.eze@ncl.ac.uk (Valentine C. Eze)

Abstract

Contamination of ground water and soil by arsenic poses serious environmental challenges globally. A possible solution to this problem is through phytoremediation using hyper-accumulating plants. This study investigates phytoremediation of soil containing $200 \pm 3 \text{ mg kg}^{-1}$ of arsenic using *Pteris cretica* ferns, and the strategies for arsenic extraction from the ferns biomass and subsequent conversions to valuable arsenic products. The *Pteris cretica* ferns achieved maximum arsenic accumulations of 4427 ± 79 to $4875 \pm 96 \text{ mg}$ of arsenic per kg dry biomass after 30 days. Extraction efficiencies of arsenic in the ferns fronds were $94.3 \pm 2.1\%$ for ethanol-water (1:1 v/v), $81.5 \pm 3.2\%$ for 1:1(v/v) methanol-water, and $70.8 \pm 2.9\%$ for water alone. Molybdic acid process was used to recover $90.8 \pm 5.3\%$ of the arsenic, and $95.1 \pm 4.6\%$ of the phosphorus in the biomass extract. Quantitative precipitation of $\text{Mg}_3(\text{AsO}_4)_2$ and $\text{Mg}_3(\text{PO}_4)_2$ occurred on treatment of the aqueous solutions of arsenic and phosphorus after stripping at pH of 8 – 10. The efficiencies of $\text{Mg}_3(\text{AsO}_4)_2$ and $\text{Mg}_3(\text{PO}_4)_2$ precipitation were $96 \pm 7.2\%$ and $94 \pm 3.4\%$, respectively. Arsenic nanoparticles produced from the recovered $\text{Mg}_3(\text{AsO}_4)_2$, using two-stage reduction process, had average particle diameters of $45.5 \pm 11.3 \text{ nm}$. These nanoparticles are potentially valuable for medical applications, while the $\text{Mg}_3(\text{AsO}_4)_2$ could be converted to more valuable forms of arsenic or used as a pesticide, and the $\text{Mg}_3(\text{PO}_4)_2$ in fertiliser. Recovery of these valuable products from phytoremediation biomass would incentivise and drive commercial industries' participation in remediation of contaminated lands.

Keywords: Phytoremediation, hyper-accumulator, *Pteris cretica*, solvent extraction, molybdic acid process, arsenic nanoparticles.

Download English Version:

<https://daneshyari.com/en/article/8850803>

Download Persian Version:

<https://daneshyari.com/article/8850803>

[Daneshyari.com](https://daneshyari.com)