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Phytomining: Investigation on the gold hyperaccumulation capacity of wheat using pot trials and tailings dump material as a substrate

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Finding an environmentally friendly and economically sensible way of reprocessing mine dumps would be very advantageous to mining houses, the communities around the mining operations as well as the biodiversity dependant on the dumps. This desire has given rise to a new type of mine dump exploitation, phytomining. It entails using metal hyperaccumulators for the exploitation of on surface, or near surface low grade ore bodies.

In the past, tests were done on the accumulatory ability and capacity of the nickel hyperaccumulator, *berkheya coddii* [2] and they proved the plants' ability to absorb nickel from the substrate in which it was planted. Furthermore, gold also showed a potential to be phytomined but required the use of complexing agents to leach it out, rendering it soluble and able to be absorbed [2]. This research is aimed at using the wheat plant to absorb gold from gold mine waste dumps.

Table 1: GFFAS results of gold absorption by plants

Plant sample	Gold content(ppm)
Sample 1	0.05
Sample 2	0.08
Sample 3	0.05
Sample 4	0.09
Sample 5	0.06
Sample 6	0.08

In this work, a substrate was prepared by blending samples from a gold tailings dump in the Free State, South Africa. Analytical tests were run to grade the sample. Seedlings of wheat were transplanted into the substrate and allowed to reach their full biomass over a period of six weeks. They were dried in a solar powered dryer for seven days. The dry material was then ashed in borosilicate for 15 hours at a temperature of 550 degrees Celsius. The ash was dissolved in hydrochloric acid and extracted into an organic layer by shaking it with methyl isobutyl ketone for ten minutes. This organic layer was taken for analysis using Graphite Furnace Atomic Absorption Spectroscopy.

The gold content of the sample was quantified to be 0.21 ppm or g/t. The GFAAS showed that the wheat plants placed in the substrate absorbed gold at different concentrations (see table 1). The maximum absorption of the gold was 0.09 ppm (43% yield).

Test work on the absorption of gold has proven successful. The plant species showed an absorption capacity of 43% and an attempt to increase this will be done. It is however, a technology that has not yet been tested on a commercial scale and much research remains to be carried out, particularly in increasing the metal uptake by plants. Only in a few years will we know for certain if phytomining is the answer to economic and ecological beneficiation of mine waste dumps

References

[1] Anderson, C. et al. (2005) Minerals Eng 18: 385-392

[2] Anderson, C. et al (1999) J Geochem Explor 67:407-415

