Basic experiments on phytoremediation by Pteris vittata L. of natural arsenic-polluted soil

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Phytoremediation is the use of plants for the in situ cleanup of contaminated soils, sediments, and ground water. Pteris vittata L. (Chinese brake fern) is a hyperaccumulator on arsenic. Basic experiments on arsenic tolerance on germination and pot-scale experiment of Pteris vittata L. have been investigated for the study of cleaning up of soil containing natural arsenic by phytoremediation.

Arsenic hyperaccumulation and tolerance in gametophytes and spores of Pteris vittata L. (brake fern) have been investigated. Gametophytes are able to grow normally in medium containing 50 to 200 or 300 micro M arsenite and arsenate. In medium containing less than 300 micro M arsenite and 500 micro M arsenate, gametophytes do not almost grow. The highest arsenic concentrations in gametophytes are 1023 and 920mg/kg-DW in medium containing 300 micro M of arsenite and arsenate. The results suggested that gametophytes of the brake fern also has a great potential to be used for phytoremediating soils with low concentration of arsenic.

Pot-scale experiment evaluated phytoremediation by Pteris vittata L. for mudstone from the Hakobuchi Group in the Yubari City, central Hokkaido, Japan, containing arsenic (12.3mg/kg-DW). In this experiment, fronds of Pteris vittata L. were taken after 18 weeks growth in soil. Small fronds are also taken at the appropriate time (9, 12 and 15 weeks). The following properties became clear after examining the experimental results;

(1) The brake fern can growth in the soil made from mudstone containing arsenic.

(2) The highest arsenic concentrations in the frond of Pteris vittata L. growing in the soil are about 3000 mg/kg-DW.

(3) The fern removed arsenic about 15% from mudstone.

(4) Concentrations of arsenic in the fronds decrease after 9 weeks.

Discrepancy between the total amount of arsenic in Pteris vittata L. and decreased from the soil suggests that It can remediate arsenic-polluted soil by phytoextraction and phytovolatilization.