

Strategies and methods of contaminated soil reclamation of heavy metals

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ABSTRACT

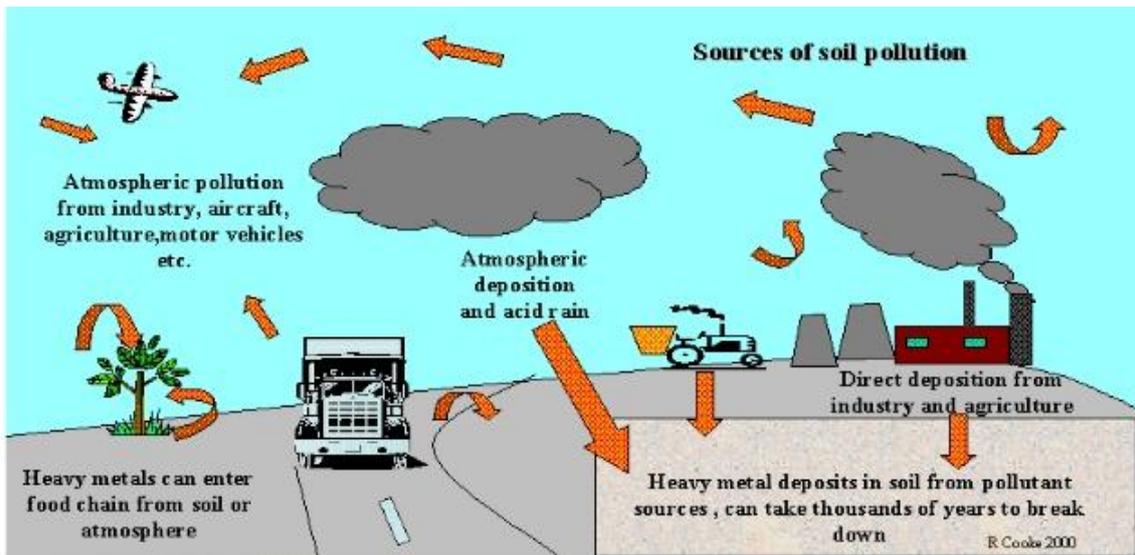
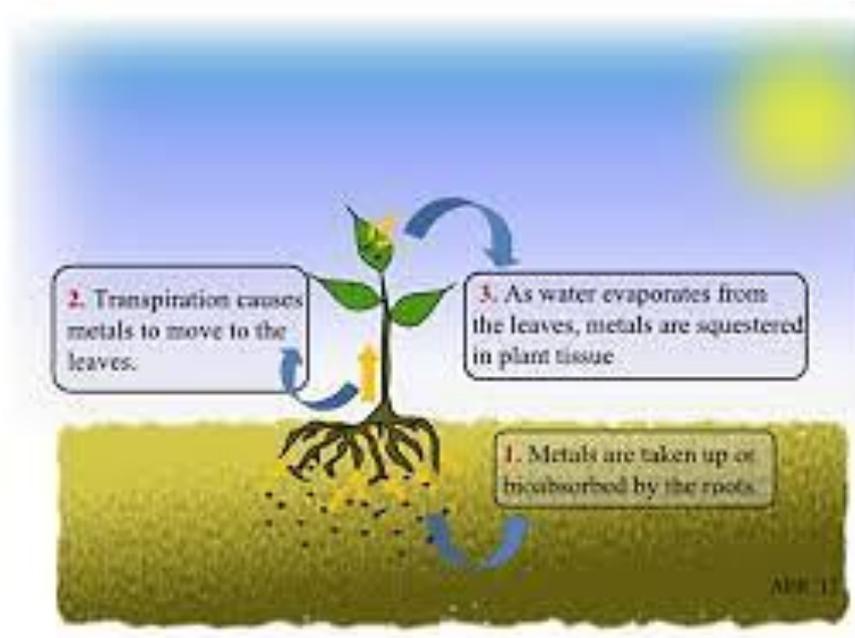
Soil is an essential element of non-renewable natural environment (agroecosystem), which is characterized by certain properties of chemical, physical and biological formed under the influence of the natural process of soil formation. As a result of agricultural and non-agricultural (industrial) human activities such properties may be subject to change; may deteriorate or improve soil fertility. According to Liebig's law of the minimum, of the fertility of the soil determines factor contained in the minimum, eg. Soil made from clays are less fertile than clay soils or dust (despite the greater abundance of nutrients) due to unfavorable water and air. Air scarcity factor here is occurring in at least - an inhibiting factor.

Keywords: heavy metals; soil; plant; arable lands; Police district

1. INTRODUCTION

Methods used for years for the rehabilitation of soils contaminated with heavy metals is based on one of two strategies: immobilization (immobilization) metals in the soil or in their start-up and removal of soil. Methods of contaminants in soil stabilization treatments immobilisation of heavy metals in the soil does not lead to a reduction of the total, although their contents, but effectively reduce the environmental risks. Obtained in this way, the effect of improving the physical and chemical properties of the soil, which until 2007 made the reclamation satisfy the requirements under the Act on the Protection of agricultural and forest land. Metals immobilization treatment should be used particularly where standards are not exceeded soil quality and land, as well as to temporarily reduce the environmental risk of exceedances of standards in areas where surgery to remove excess metal from the soil can not be used in a short time. The effect of immobilization of heavy metals in the soil solid phase can be obtained relatively easily by changing the soil properties which determine the

solubility of metals in the soil, and especially - by adjusting the pH and improving the sorption capacity of the soil.



- The above diagram shows sources of **land pollution**.
- 1) **Atmospheric deposition** and **acid rain**.
- 2) **Direct decomposition** from **industry and agriculture**.
- 3) **Heavy metals can enter food chain from soil**.

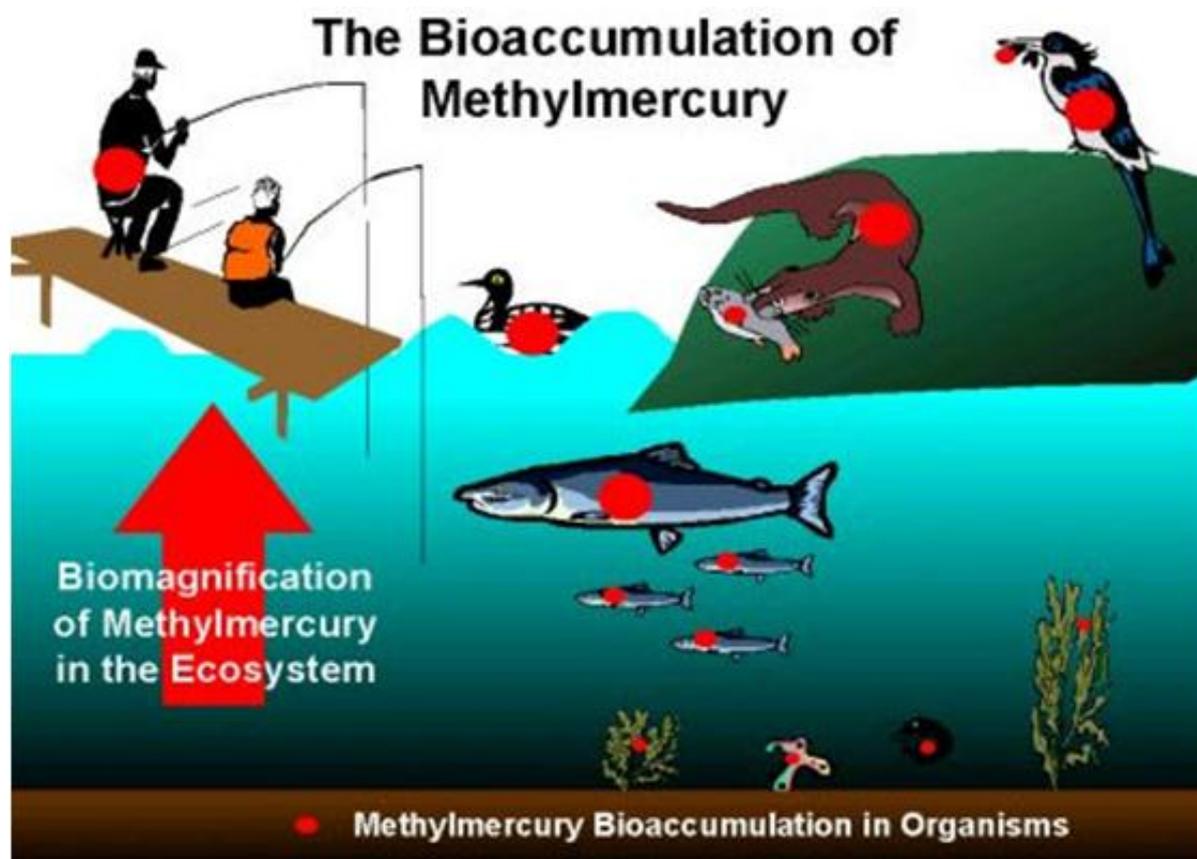
The basic procedure is limiting the mobility of metals de-acidification of soils by liming (McBride 1994 Kabata-Pendias and Pendias 1999 Alloway and Ayres 1999). The effect of reducing the mobility of metals can be obtained, furthermore, by introducing into the soil organic material with high sorption capacity such as peat, granulated or powdered coal and peat, compost and sawdust or wood bark.

Less commonly used method of increasing the sorptive capacity of light soils is the use of additives rich in clay minerals, for example in the form of PEGylation procedure consisting in mixing the surface layer of sandy soil with a more compact material. Chemical sorption of heavy metals in the soil can be assisted by the use of phosphate-containing materials, e.g., Phosphates, or hydroxyapatite (Buczowski et al. 2002, Karczewska 2008).

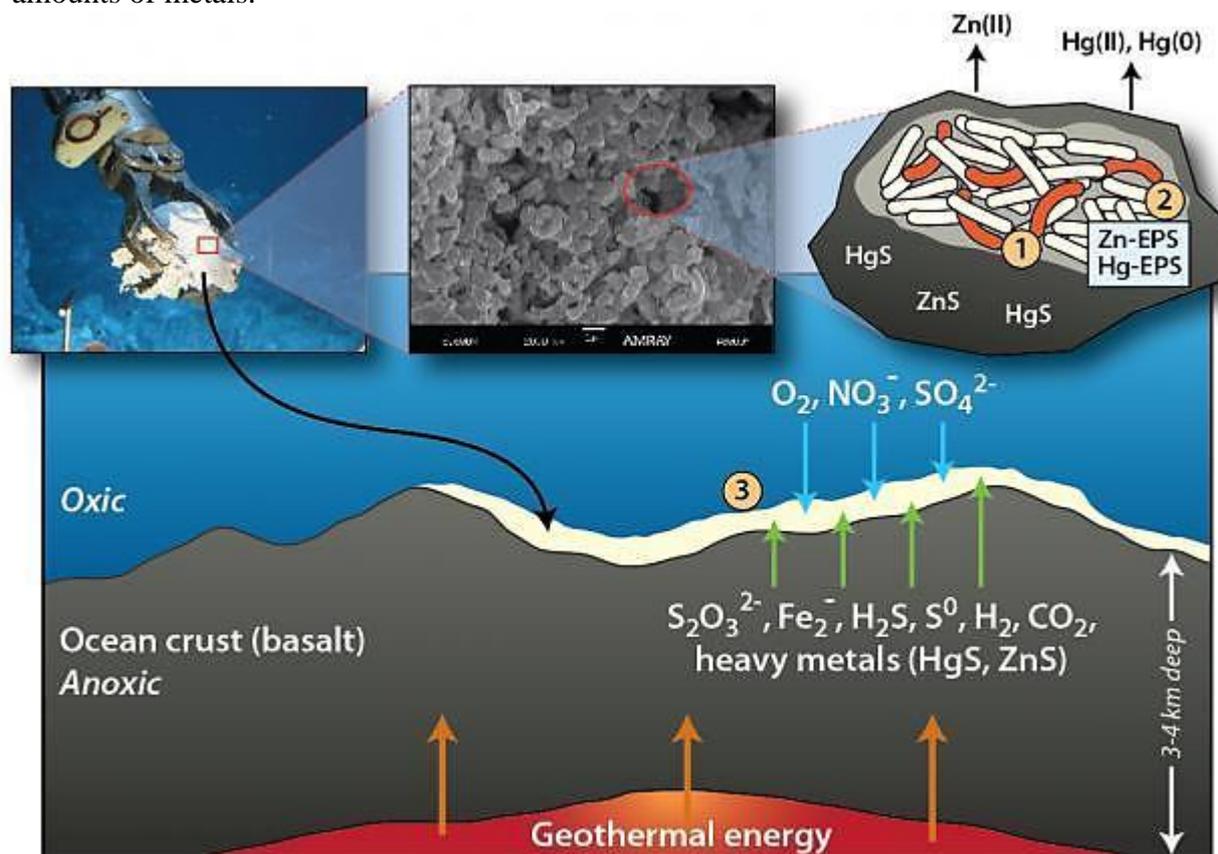
It should be noted that weak organic substance introduced into the soil may contain low molecular weight organic fractions were readily soluble in water and capable of complexing heavy metals, which may cause undesirable increase their solubility.

Among other things, therefore, the provisions of Polish law does not allow the use of sewage sludge to fertilize or reclamation of soils containing high concentrations of heavy metals (Regulation 2002a).

Effective soil surface covering compact pile plant further reduces the effects of polluted soil erosion is a term defined Phytostabilization. Plants have a protective function, anti-erosion, and also stimulate the processes of sorption of metals in soil and water management modifies soil, reducing the risk of leaching of metals. Methods based on the strategy of immobilization of heavy metals in contaminated soils were practically the only one so far used in Poland, a form of reclamation of soils - widely available and economically justified.



Adjust the soil pH allows you to restore the biological life and restore plant cover in areas previously completely devastated, for example due to the impact of emissions of steel, not only in Poland but also in areas of large metallurgical complexes in other countries, such as Sudbury, Tacoma, or Falun Harjavalta. However, due to the persistence of the potential hazard to the environment - the method of immobilization of metal impurities are considered to be temporary and inadequate, especially when quality standards are exceeded soils. Methods for removing contaminants from soils If the content of heavy metals in the soil exceeds the quality standards of soil and land, a treatment that should be carried out in accordance with the requirements of the law, should be removed from the soil abnormal amounts of metals.



This is achieved either by removing the most contaminated layer and depositing it in the landfill of hazardous waste (which does not fully comply with the principles of comprehensive protection of the environment), or by reducing the concentration of pollutants in the soil. In special situations, a procedure involving the deep to plough heavily contaminated surface layer of soil can lead to a condition consistent with the requirements of quality standards, but it is in fact half-measure, which slightly improves.

The technical process of cleaning (decontamination) can be addressed in two ways: in situ - at the place where the pollution or ex situ - outside the place of pollution, in stationary or mobile soil treatment plant. In order to start the metal from the solid phase of the soil and its removal are most commonly used mechanism for elution (extraction), sometimes assisted electrochemically. Engineering methods for cleaning soils with heavy metals has raised a number of claims, not only due to their high costs, but in fact the radical interference in the

properties of the soil. Purification processes make soil devoid of dead material of living organisms, often with altered or completely destroyed structure. To reproduce the biological life then it is necessary to long-term use of biological methods of reclamation. In the light of research in the world since the early nineties to remove excess heavy metals from soils high hopes for, and binds to continue with the use of phytoremediation method, especially phytoextraction. These methods - as a non-invasive, and thus environmentally friendly - have gained wide interest.

The efficiency of phytoextraction of heavy metals from soils, however, is usually very low and no chance of removing significant amount of metals from the soil in the order of several real time - decades. Attempts to increase the efficiency of phytoextraction, for example by using the phenomenon of natural or induced hiper of accumulation, did not produce the desired results so far and are still in the research phase, with no apparent prospects for their use in practice (Karczevska et al. 2008).

2. CONCLUSIONS

The problem of environmental pollution with heavy metals present in Poland locally and relates primarily to industrial areas, but in some areas, in the vicinity of the former or current sources of emissions, water, soil and sometimes show a considerable degree of contamination.

Heavy metals in soils may be a potential source of danger to plants and groundwater, and consequently - can be incorporated into the food chain [Karczevska et al. 2008 Kabata-Pendias 1993]. Downloading trace elements from contaminated soils by plants often exceeds their physiological needs, with the result that an excess of these elements in the soil can act phytotoxic.

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