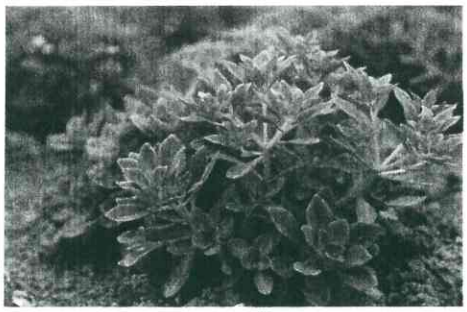
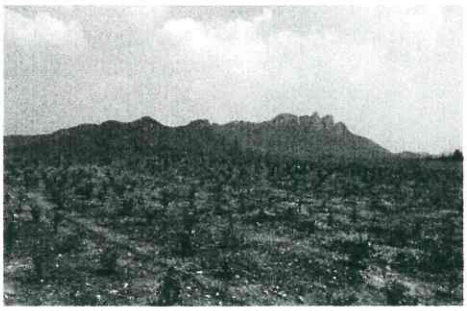
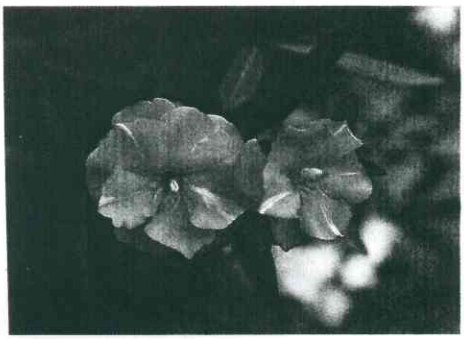
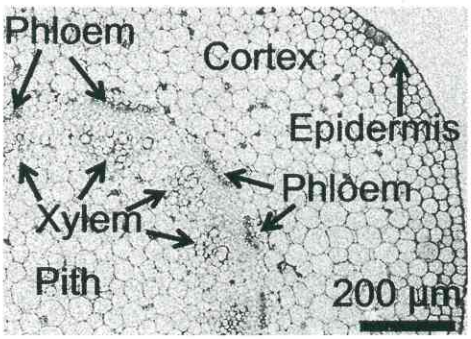
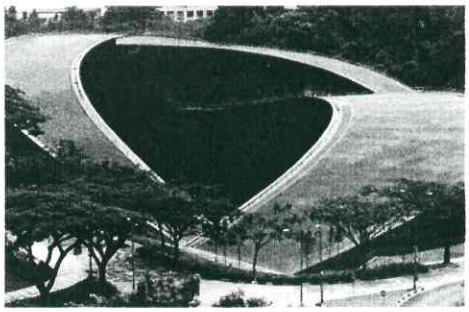
Proceedings of the 13th International Phytotechnologies Conference

——Plant-Based Solutions for Environmental Problems: From Lab to Field






26-29 September, 2016
Hangzhou, China.

Phytoremediation Driven Energy Crop Production – from the Biomass Cultivation to the Residues Management

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Abstract: Whereas heavy metals contaminated soils are unsuitable for food production, energy crops can allow a commercial exploitation of these soils by establishing biofuel feedstock production systems. In addition, the cultivation of plants offers opportunities for site remediation. A field experiment has been carried out at lead, cadmium and zinc contaminated sites located in Poland (arable land) and Germany (former sewage sludge deposit site). The experiment involves testing energy crops: miscanthus (Miscanthus x giganteus), virginia mallow (Sida hermaphrodita), cordgrass (Spartina pectinata), and switchgrass (Panicum virgatum) with an aim to find the optimum one with respect to both energy crop yield and phytoremediation capacity. The collected biomass was investigated and valorized for a set of parameters from the viewpoint of its use as a biofuel feedstock for gasification process. Special attention was paid to the properties related to the environmental safety of the process (e.g. fate of the heavy metals contained both in the biomass and in the ashes after gasification process). To close the "lifecycle of the biomass", the residues (ashes) after thermal conversion were assessed for potential land application as fertilizers.

Level of the bioavailable content of heavy metals in the soil seemed to be the main factor responsible for the differences in metal uptake by the plants. Plant species cultivated at the former sewage sludge deposit site were characterized by low metal concentration in tissues. The highest lead uptake was observed for P. virgatum, while the highest cadmium and zinc concentrations were found for S. hermaphrodita collected from contaminated arable soil. The key findings from the gasification tests performed so far demonstrated that the obtained gaseous fuel could be used to produce energy in different types of installations. Analyzing the post processing residues quality, including the content of heavy metals, macro and microelements, the requirements for using them as fertilizer in agriculture have been met only for ashes after S. pectinata gasification. Nevertheless, ashes after gasification process could be used as an amendment improving soil quality at post-industrial areas.

Research financed by the PHYTO2ENERGY project – 7FP for Research, Technological Development and Demonstration of the European Union, under the Grant Agreement No. 610797.

Key words: phytoremediation, energy crop, biomass thermal conversion