

ASSESSMENT OF THE ENERGY PRODUCTION POTENCIAL FROM PHYTOREMEDIATION DERIVED BIOMASS

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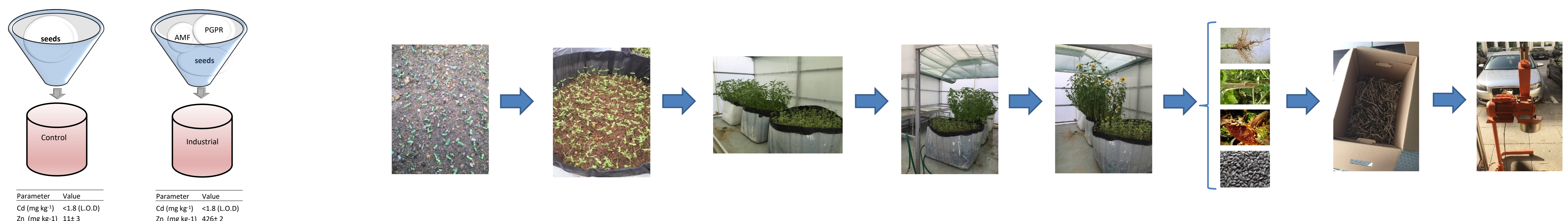
Introduction

There are presently more than 3 million contaminated sites all over EU, according to the EEA (report 25186 EN). Heavy metal (HM) contamination is of particular concern, as metals are not degradable and only transferable from one matrix to another [1]. Phytoremediation, a biologically based technology, is gaining attention from the public and is an attractive low cost alternative for soil requalification, by establishing a vegetation cover which will stabilize the site, avoiding dispersion of contamination and simultaneously removing pollutants present in the brownfield [1]. Although the fate of harvested biomass is a common obstacle for its implementation, it may represent an opportunity for producing energy. However, and although it has been proposed theoretically as an excellent option, the information available in literature concerning practical applications is scarce, despite the considerable degree of success reported [2,3,4].

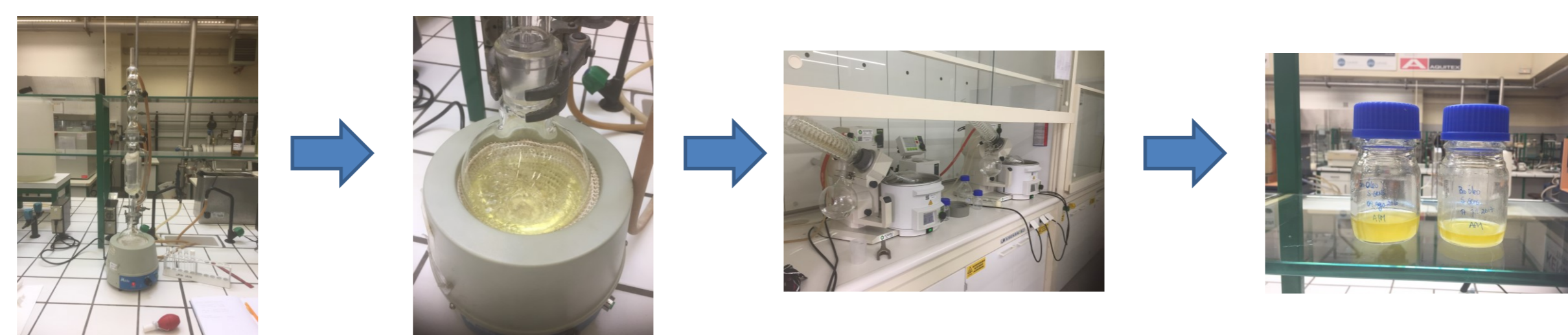
The use of biomass grown in degraded and abandoned soils, not involving agricultural soils for energy crop cultivation, may increase the sustainability of utilizing biomass for energy generation, while it may allow for increasing the available agricultural soil through the consequent gradual decontamination of such brownfields. This work presents a novel integrated strategy comprising the utilization of all plant parts (sunflower) parts for the generation of several energy products.

Methods

Sunflower was propagated on a greenhouse in 2 different treatments: control soil (agricultural) and industrial soil (near an industrial complex at Estarreja, Portugal, where in the past waste and effluents were directly discharged to the soils) inoculated with an arbuscular mycorrhizal fungi (*Rhizophagus irregularis*) and a plant growth promoting rhizobacteria (*Ralstonia eutropha*). Growth occurred for 6 months, after which plants were separated in flowers, stems, roots and seeds, dried and grinded (schematic description below)



Sunflower seeds were used for oil extraction using the Soxhlet method with hexane as a solvent, and then the remaining solvent was removed with the aid of a rotary evaporator (schematic description is shown below)



Results and Conclusions

Table 1. Biomass of sunflower (g)

Treatment	Biomass (g)			
	roots	stems	flowers	seeds
Control soil	33.66	750.12	223.77	62.57
Industrial soil	19.35	620.21	199.36	51.92

- Biomass for all the plant sections is described in Table 1; it is possible to see that sunflower growing in metal contaminated soil presented a slight decrease in the production of biomass of all plant sections, nevertheless the microbiota inoculation of the plants;

- The volume of oil extracted from the collected sunflower seeds is registered in Figure 1; similarly to biomass production, an probably as a consequence of it, volume of oil extracted decreased for plants growing in metal contaminated soils.
- Efficiency of oil extraction was also reduced, from 29% for plants growing in the agricultural soil to 27% for plants growing in the industrial soil

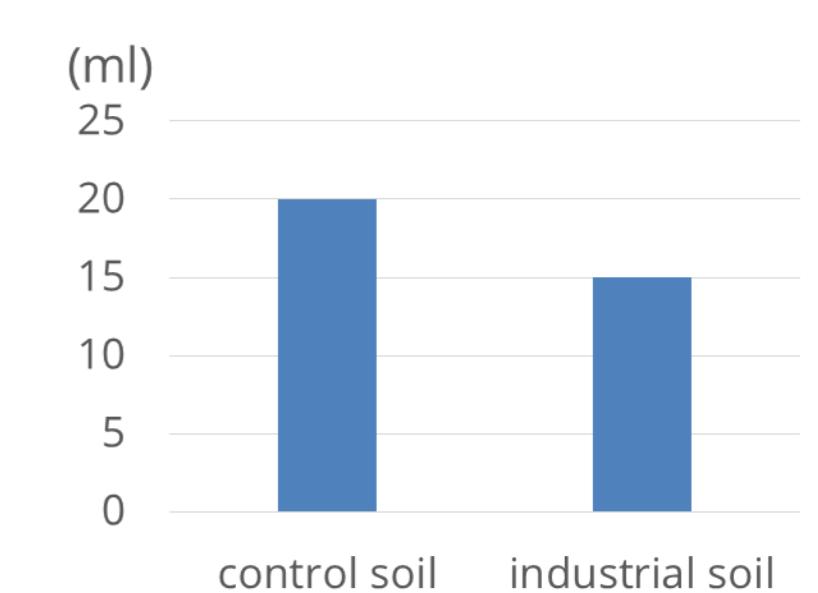


Figure 1. Oil production from sunflower (ml)

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