

Heavy metals (Co, Cr, Cu and Ni) distribution in soils and in natural aromatic and medicinal plants (NAMP) of Vinhais- Bragança massif (NE of Portugal): a preliminary study

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The study area is located in Nordeste of Portugal the region of Vinhais - Bragança is characterized by the presence of mafic and ultramafic rocks. The main purpose of this study was to evaluate the levels of some heavy metals in soils and natural vegetation (belonging to Lamiaceae family) in the region of Bragança.

18 soil, and 24 vegetation samples (14 *Lavandula stoechas* L. and 10 *Thymus mastichina* L.) were collected around Bragança municipality and along a 34 km transect from Bragança to Vinhais and analyzed for heavy metals in order to evaluate spatial distribution and assess for significant differences in metal contents in this two species of NAMP and investigate whether these species can be considered as plant accumulators. The sampling sites were selected to represent "natural" soils, therefore priority was given to forest and unused lands. These soils are mostly Leptosol originated from different parent material. The vegetation collected, both species grow spontaneously in soils, were separated into leaves, stems, roots and flowers when exists. Soils and plants were analyzed in the same way, extraction with aqua regia and analysis by ICP/ES & MS, for 32 chemical elements and pH.

The heavy metal ranges (in mg kg⁻¹) for soils samples are: Co 14–149, Cr 16–491, Cu 24–329, Ni 23–

944. This soils concentration are higher than the values found for the national background or to the value reported as world average. In some cases these concentrations are even higher than the Dutch Intervention Values (or Canadian Soil Quality Guidelines) for soils. For *Lavandula stoechas* L. the maximum concentrations (in mg kg⁻¹) found in leaves are 16 for Co, 86 for Cr, 46 for Cu, and 136 for Ni. The contents in roots are somewhat higher but of the same order of magnitude. For *Thymus mastichina* L. the situation is different with the maximum contents in leaves (16 for Co, 90 for Cr, 76 for Cu, and 117 for Ni, in mg kg⁻¹) at least duplicated the content in roots. This concentrations in vegetation exceeded the levels considered "excessive or toxic" for Cr and Ni (5-30 mgkg⁻¹ and 10-100 mgkg⁻¹ respectively). For *Lavandula stoechas* L. the correlations (Spearman rank order, P<0.005) between element concentrations in soil and leaves are high, all above 0.75. However, for *Thymus mastichina* L., these correlations are lower and not significant (P<0.005) for any of the four elements studied. Finally, it is evaluated if these two species of natural vegetation may have economic interest either used in phytoremediation techniques for removing pollutants from contaminated soils or in aromatic and medicinal plant industries.

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