

Full Length Research Paper

Assessment of metals accumulated in Durum wheat (*Triticum durum* Desf.), pepper (*Capsicum annuum*) and agricultural soils

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Soil contamination by heavy metals is widely spread and concerns have been raised over the potential risks to humans, animals and agricultural crops. Toxic metals are readily accumulated in some plants and may cause a threat to humans and grazing animals. In this study, an assessment on contaminated edible vegetables by heavy metals is made. Two major sites (denoted S1 and S2) where durum wheat (*Triticum durum* Desf.) and pepper (*Capsicum annuum*) are widely cultivated in Algeria have been considered. S1 and S2 have been subjected to chemical characterisation, total metal quantification (Cd, Cu, Zn, Pb, Ni and Co) and sequential extraction as well metal speciation. Total content of the metals in the soils were found to be below the internationally recommended and permissible limits set for agricultural use for all the heavy metals except for Pb (mostly bound to iron and manganese oxides) in S2. Whereas Cd and Zn concentrations were higher in both S1 and S2; Cd, Cu, Zn, Ni and Co were mainly present in residual form, appearing less bio-available. As a consequence, these soils exhibit significant contamination. In the edible portions of durum wheat and pepper, the respective concentrations of Cd and Cu as well as of Pb, Zn, and Ni are found to exceed the permitted limits of the European Standards. The study indicates a potential ecological risk of the contaminated plants by most heavy metals except in the case of Co, causing potential health risk.

Key words: Heavy metals, soil, contamination, sequential extraction.

INTRODUCTION

Soils are major receptacles for heavy metals released from industrial activities; municipal wastewater sludge, urban composts, road traffics, atmospheric deposits and chemicals used in agriculture (phosphate fertilisers, pesticides) and spread out into the environment (Adriano, 1986). Heavy metals are extremely persistent in the environment; they are non-biodegradable and non-thermodegradable and thus readily accumulate to toxic

levels (Sharma et al., 2007). Many soils especially those found in hazardous waste sites are frequently contaminated with heavy metals, including lead, copper, chromium, and cadmium. In addition, they may move also through soils to reach ground waters or may be taken up by plants. It is known that the transfer of metals to food chain is a recognised risk and in order to reduce it, the European Union (Commission of the European Communities, 2001) has established limits for contaminants in foodstuff that include metals such as Cd and Pb.

Vegetables and particularly leafy ones accumulate high amounts of heavy metals (Parida et al., 2003; Clemente et al., 2007). Cadmium is a metal of great environmental concern (Perronnet et al., 2000). It is not essential for life; it is very mobile in soils and is readily absorbed and accumulated in the plants. Therefore, it may alter human health and grazing animals and functioning of

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Abbreviations: cm, Centimeter; m, meter; mm, millimeter; S1, soil 1; S2, soil 2; EC, electrical conductivity; W, water; V, bulk; °C, degree(s) Celsius; h, hours; ml, milliliter; mol L⁻¹, mole liter⁻¹; M, mole liter⁻¹; %, percentage; g, gram; No, numero; mS cm⁻¹, millisecond centimeter⁻¹; mg Kg⁻¹, milligram kilogram⁻¹.