

## IMPACT OF SCRAP TYRE DUMPS ON SOIL CONTAMINATION

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### Introduction

Road traffic has undergone an appreciable rise in recent decades, entailing a considerable increase in the number of scrap tyres. In landfills, stockpiles of tyres may pose human and environmental concerns arising from the emissions of contaminants, leaching, risk of fire spreading, diseases, etc. Since 2003, the storage of scrap tyres is regulated in Spain (MAGRAMA, 2002), however there are still tyre-dumps of that time. The main goal of this study was to carry out a screening campaign to detect irregular concentrations of both inorganic and organic contaminants in scrap tyre dumps, and to compare them with the Reference Generic Values (RGV) to decide about the necessity of a more extended sampling campaign.

### Methods

The studied area is a tyre-dumpsite located between Toledo and Madrid provinces (Spain), stockpiling about 90,000 t of scrap tyres that lies directly upon the soil. The site has a rectangular shape (500 x 240 m<sup>2</sup>) with orientation and inclination along NW-SE. Lithology varies from carbonate to gypsum following the same direction of the dumpsite. Sampling was done in four positions upslope, as control sites, and inside the dumpsite (A), on a lateral (B) and downslope (C). These positions were determined according to the slope, where the surface runoff, and presumably the contaminated leachates, would be found. Samples were taken from the first 10 cm from soil surface, and then were refrigerated, in order to avoid losses of volatile contaminants, and conducted to laboratory. Samples were meshed (<2 mm) and one part of each sample was air drying to be used in the following determinations: particle-size distribution (Robinson's pipette method) and organic carbon (Walkley-Black method). Other part of each soil sample was kept refrigerated until the analysis of: pH, electrical conductivity (EC), cation exchange capacity (CEC), and soluble salts by the ISRIC methods. Cations were quantified by flame atomic absorption or emission spectroscopy and anions by ionic chromatography. A total of 100 organic and inorganic contaminants listed by the Spanish legislation (Ministerio de la Presidencia, 2005; CAM, 2006) were analyzed by a certified laboratory (Eurofins Analytico; The Netherlands) in the refrigerated A, B and C samples (<2 mm). These contaminants belong to metals, mono-aromatic hydrocarbons, volatile halogenated hydrocarbons, acetone, total petroleum hydrocarbons, chlorobenzenes, phenols, polycyclic aromatic hydrocarbons, chlorophenols, polychlorinated biphenyls and chlorinated organic pesticides. These tests are accredited by the Dutch Accreditation Council (RvA). Quality assurance and quality control (QA/QC) measures performed by Eurofins Analytico included blank samples, laboratory control samples (standard reference samples), device controls (calibration, sensitivity, interference), internal standards, and so on (TerrAttesT®soil method).

### Results

Electrical conductivity, pH values and soluble salt contents were in the range for carbonated and gypsum soils. Organic carbon content in B soil sample was the highest value, possibly due to the presence of tyre-debris. The analysis of sample C showed low contents for all contaminants. Some inorganic and organic contaminants from A and B soil samples showed values close or above the RGV (CAM, 2006; Ministerio

de la Presidencia, 2005). Indeed, the A soil sample showed high contents in As (120 mg/kg), V (28 mg/kg) and Be (1.9 mg/kg). The unusual high values of As could be due to an external source of As (rat poison or insecticide) more than the tyre weathering (we could not find similar levels in the bibliography). Vanadium content was similar to that reported by other authors, while our results in Be content were higher than previously observed (Bocca et al., 2009). Nevertheless, the relation between the Be content and tyres presence could not be established and a lithogenic origin cannot be excluded. Soil sample B showed values in some contaminants that were close or above the RGV: Cu (180 mg/kg), Co (28 mg/kg), Sb (2.1 mg/kg), V (27 mg/kg), Zn (1600 mg/kg), fluoranthene (0.19 mg/kg), pyrene (0.75 mg/kg), benzo(a)anthracene (0.03 mg/kg), benzo(a)fluoranthene (0.12 mg/kg), benzo(a)pyrene (0.07 mg/kg), dibenzo(ah)anthracene (0.06 mg/kg) and indene(123-cd)pyrene (0.08 mg/kg). These concentrations are consistent to bibliography (Aatmeeyata, 2010; Bocca et al., 2009 ; Kanematsu et al., 2009 ; Llompарт et al., 2013; San Miguel et al., 2002; Selbes et al., 2015, and Taheri et al., 2011). Results of B soil sample suggest that the source of such contaminants is the tyre debris in soil, whereas the organic compounds could have been volatilized.

## Conclusion

No affection produced by tires was observed in A and C samples, therefore we discard the contamination by leachates generated from the tyres. On the contrary the contaminants were found in B sample, where tyre debris appeared. Therefore, the presence in some areas of tire debris provides a starting point to determine the availability of the chemicals detected and possible factors that could increase them.

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