

Tracing different Construction and Demolition Waste (CDW) environmental impacts through mineralogical and geochemical analyses

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Construction and Demolition Waste (CDW) unsorted-waste streams are characterized by a strong heterogeneity which can sometimes lead to contaminant releases above the legal limits for recovery. In the Mediterranean countries, compared to a pure concrete-derived waste stream, the impurities are for the largest part composed of ceramic-based materials. At the same time, soluble sulphate content and heavy metals released seem to be strongly influenced by the amount of clay brick inside CDW [1]. Beside clay bricks, other types of ceramic building materials are usually found, such as perforated clay bricks, roof tiles, gres, sanitary-porcelains, floor tiles, ancient and industrial clay bricks. Furthermore, the presence of residual cement paste enhances the pH values, which has been proved to promote the leaching process [2]. In our study we conducted an in-depth chemo-mineralogical characterization by analyzing various CDW from two regions in Italy, namely Emilia Romagna (Ferrara) and Umbria (Perugia). The analysis was carried out using X-ray fluorescence (XRF), inductively coupled plasma mass spectrometry (ICP-MS), and X-ray diffraction (XRD) with Rietveld quantitative phase analysis. In addition, in all samples carbon (C) and sulphur (S) contents and, for the first time, the relative isotopic signature ($^{13}\text{C}/^{12}\text{C}$; $^{34}\text{S}/^{32}\text{S}$), have been measured through elemental-isotopic ratio mass spectrometry (EA-IRMS). Leaching analyses, following UNI-EN 12457-2:2004, have been conducted on pure samples and on materials with 50 wt.% mixed CDW hydrated-cement-paste. The leachate solutions have been analyzed with ICP-MS after 24 hours since the start of the leaching. The concentration of contaminant releases is compared with the legal limits that are going to be introduced in Italy in 2023 (End of Life decree).

References:

- [1] Barbudo, Agrela, Ayuso, Jiménez & Poon (2012), *Construction and Building Materials* 28, 129–138.
- [2] Englesen, van der Sloot, Wibetoe, Justnes, Lund & Stoltenberg-Hansson (2010), *Cement and Concrete Research* 40, 1639–1649.