Method for fractional solid-waste sampling and chemical analysis

Chemical characterization of solid waste is a demanding task due to the heterogeneity of the waste. This article describes how 45 material fractions hand-sorted from Danish household waste were subsampled and prepared for chemical analysis of 61 substances. All material fractions were subject to repeated particle-size reduction, mixing, and mass reduction until a sufficiently small but representative sample was obtained for digestion prior to chemical analysis. The waste-fraction samples were digested according to their properties for maximum recognition of all the studied substances. By combining four subsampling methods and five digestion methods, paying attention to the heterogeneity and the material characteristics of the waste fractions, it was possible to determine 61 substances with low detection limits, reasonable variance, and high accuracy. For most of the substances of environmental concern, the waste-sample concentrations were above the detection limit (e.g. Cd > 0.001 mg kg⁻¹, Cr > 0.01 mg kg⁻¹, Hg > 0.002 mg kg⁻¹, Pb > 0.005 mg kg⁻¹). The variance was in the range of 5-100%, depending on material fraction and substance as documented by repeated sampling of two highly different material fractions ("Vegetable food" and "Shoes, leather, etc."). Statistical analysis showed for the "Vegetable food" that the variance could not be attributed to a single step in the procedure, whereas in the case of "Shoes, leather, etc.", the first coarse shredding was the main source of variance (20-85% of the overall variation). Only by increasing the sample size significantly can this variance be reduced. The accuracy and short-term reproducibility of the chemical characterization were good, as determined by the analysis of several relevant certified reference materials. Typically, six to eight different certified reference materials representing a range of concentrations levels and matrix characteristics were included. Based on the documentation provided, the methods introduced were considered satisfactory for characterization of the chemical composition of waste-material fractions. $CPY 2007 Taylor & Francis.

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