



FOURTH INTERNATIONAL SYMPOSIUM ON

**GREEN CHEMISTRY FOR ENVIRONMENT,
HEALTH AND DEVELOPMENT**

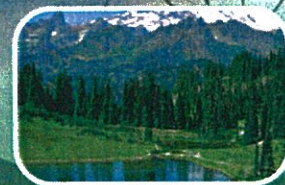
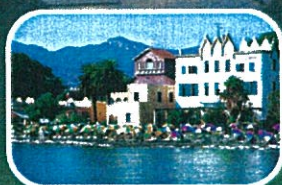


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Environmental Risks of Biomass Ashes Application in Soils

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Abstract

This work presents the potential environmental risks of biomass ashes application in forest soils. The ashes were collected in five industrial biomass thermal plants using different technologies: bubbling fluidized bed combustor and grate furnace. Separated bottom ash (BA) and fly ash (FA) blends composed of samples collected over one year were characterized. The bulk composition of ashes and other characteristics with interest for soil application showed a high variability depending on the ash stream and power plant. The determination of acid neutralization capacity (ANC) was performed according with EA NEN 7371, using a pH STAT titrator, during 3 h at a L/S 50 L/kg, as a quick evaluation method. The evaluation of metal's availability for leaching at fixed pH 7 and 4 was made to provide information on the long-term behavior of the ashes in the environment, regarding heavy metals and also plant nutrients. Also a more detailed pH dependence leachability study was performed based in the CEN/TS 14429 for predicting the leaching behavior under different aggressively scenarios. Using HNO₃ or NaOH final pH values were obtained from pH 3 to pH 12, to establish pH leachability dependence profiles for each element. The leaching behavior of toxic heavy metals (Cu, Cr, Mn, Ni, Pb, Zn) as well as inorganics associated with soluble salts (Al, Ca, Fe, K, Mg, Na) was evaluated allowing to distinguish the different solubility controlled phenomena. The amphoteric behavior of some elements was observed, namely for Pb and Zn, which is characterized by high solubilization at the low and high pH values and moderate or low solubility at neutral or moderate acidic pH. The solubility of K and Na revealed to be nearly independent of the solution pH and the released amounts are mainly availability-controlled. The ANC of fly ashes at pH 4 (3.6–10.2 molH⁺/kg) were higher than that observed for the bottom ashes (1.2–3.0 molH⁺/kg). In addition to the metals leachability evaluation, ashes were also characterized regarding persistent organic pollutants (POP) that may hinder their application, such as polycyclic aromatic hydrocarbons (PAH) and paradibenzodioxines and furanes (PCDD/F). Contents were found to vary wildly with the ash stream, from non-detectable level to high amounts that may endanger nature if spread in soils. Correlations were made with the levels of inorganic carbon/organic carbon in ash and Cl levels in order to understand which easily parameters might be accessed as indirect indicators of such complex POP in order to protect environment during valorization of ashes as forest-soil amendment. The presented approach intends to contribute to a better assessment of the strategies to be applied in the management and valorization of ashes that may prevent spent of natural resources, waste generation, and environmental impact for the sustainable production of forest biomass for energy production.

Keywords: biomass ash; acid neutralization capacity; leaching; PAH, PCDD/F.

Acknowledgments

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In silico model

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Abstract

Two major alternative *in silico* computer models for determining human exposure to the environment. It is available as it further range of doses and *vivo* experiments. equipment production affecting human or

In this work, we biotoxicodynamic (P-ethanol and nicotine) cardiovascular respiratory models together uptake was modelled served (ADME) kinetics (routes of exposure acute responses search to collect parameters together of alternatives to a

Acknowledgment

This research was part of the Integrated In Silico Optimise Safety) Project