Characterisation of wood combustion fly ash in a context of applicability in agriculture

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Energy policy of the European Union aims to move towards the sustainable and green energetics, therefore, identification and exploitation of renewable energy resources is of high importance in all EU member states. One of the types of renewable energy production is cogeneration of heat and power from biomass. Cogeneration becomes more and more topical in the Baltic States as various kinds of biomass, e.g., forestry and agriculture residues, cultivated plants for biomass are rather easy obtainable. For example, in 2015, in Lithuania more than a half (56%) of energy (power and heat) was produced at cogeneration plants. However, increased energy production from biomass, e.g., wood combustion has led to extended amount of combustion residues – ash. Thus, it requires development of environmentally friendly and cost-effective solutions for possible ash utilization, avoiding ash dumping.

The aim of the study was to investigate fly ash samples generated from wood combustion in two cogeneration plants located in Latvia and Lithuania. Characterization of fly ash involved detection of pH, conductivity, loss-on-ignition, total element content and element composition of fractions. After the 3-step speciation analysis of fly ash samples, water soluble, bioavailable and residual fraction were derived. Concentration of elements (Al, As, Ba, Ca, Cd, Co, Cr, Cu, Fe, K, Li, Mg, Mn, Mo, Na, Ni, P, Pb, Sb, Se, Sr, Ti, Tl, V and Zn) was measured using ICP-OES.

Results revealed that fly ash composition depends on type, quality and purity of biomass (wood). High average total amount of Ca (92 g/kg), K (38 g/kg) Mg (12 g/kg), Mn (10 g/kg), P (6 g/kg), Al (3 g/kg), Fe and Na (2 g/kg each) was detected in all ash samples. Most of elements (Al, Ba, Cd, Cu, Co, Mg, Mn, P, Pb, Se, Ti, Tl) more than 90% and Zn, Sr, V more than 80% from the total amount were bound in residual fraction indicating their low bioavailability from fly ash. Only Cr, K, Mo and Ni were found in water soluble or bioavailable fractions in considerable amount (>60%).

Overall assumption is that the wood fly ash can be used in forestry and agriculture in direct applications primary as a source of K and some other micro- and macroelements.

The study was done within the project No.1.1.1.2/VIAA/1/16/029 (*Formula of peat-free soil conditioner with controlled-release fertilizing effect applicable for soil remediation and quality improvement of agricultural production*) and in collaboration between the Laboratory of Environmental Quality Monitoring (University of Latvia) and the Baltic Institute for Regional Development Ltd.

Key words: cogeneration residues, wood fly ash, macroelements, microelements.