

The use of bottom ash coal-cinder as a major component in growing media

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Abstract

Intensified use of coal in power plants and some industries in Israel has created a problem of disposal of the ash generated. Bottom-ash remains at the bottom of the coal fired boiler after combustion. This is a relatively coarse, gritty material, which has the potential to serve as a component in growing media, in contrast to the fly ash that consists of very fine particles.

The physical and chemical properties of bottom ash, from industry and from power plants, were characterized and compared to those of volcanic ash (tuff), which is a widely used container medium in many countries. Bottom-ash particles were found to be stable under an irrigation regime common in the production of vegetables and ornamentals. Particle size distribution of bottom-ash, originating from small energy producing industrial plants, is appropriate for use as is, but cinder from power plants contains a large amount of small particles that should be removed prior to use in growing media. Power plant originating coal-cinder that has been sieved, shows a low level of water content under up to 100 mBar tension, and a high percentage of air space. Addition of compost, produced separated cattle manure improves the water to air ratio.

Bottom ash contains a low level of nutrient elements, and like tuff, adsorbs phosphorous from the nutrient solution. The addition of compost increases the P content of the solution. However, further addition of fertilizers is needed to maintain an appropriate level of nutrients for optimal plant growth.

Analysis of the water extract for toxic elements showed no hazardous levels for humans or plants. Tissue analysis of plants grown in a mixture of coal ash and compost did not contain high levels of any toxic element, and were similar to levels found in plants grown in medium containing tuff. In fact, leachates obtained from pots containing these mixtures met the WHO standards for heavy metals in drinking water.

Experiments in which melon, pepper, tomato, basil, cabbage, lettuce, carnation and croton were grown on media containing coal ash produced high yields, resembling those usually obtained in other growth media.

In addition, mixtures of coal ash and compost used to re-establish 10-15 old oak trees that needed to be transformed from one area to another due to road constructions. The experiment proved that that trees grown on coal ash:compost mixture re-established very successfully when transformed to about 0.5m³ of medium.