

PRELIMINARY ASSESSMENT OF CARBONATION POTENTIAL OF BIOFUEL PELLET AND WOOD CHIP ASH

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This study examines the potential for re-use of biofuel ashes from biofuel boilers and power stations for use in manufacture of artificial aggregates. Currently there are 28 biomass power stations operational in the UK which utilise nearly 20.7 million tonnes of virgin and waste wood products annually to produce power. The combustion process results in the production of ash wastes which may be applied to ground as a conditioner or disposed to landfill. This study assessed wood pellets sources from five companies and fresh wood chips used for a small scale district heating system in the Forest of Dean, Gloucestershire, UK. Ash content was determined by combusting the samples in a 1000 C furnace, the ash was then chemically characterised using x-ray fluorescence and residue mineral structure determined using x-ray diffraction with Retied refinement quantification. The ash residues were subjected to a carbon dioxide atmosphere and CO₂ uptake quantified. The carbonated ash was again x-rayed to determine if changes in mineral structure could be determined. The samples were also examined using SEM. The measured inorganic residue content of the combusted pellet samples was found to range between 0.19 to 0.69% (w/w) and for the wood chip samples the ash content was 0.5% (w/w). Carbon dioxide has previously been shown to aid in the cementation of a number of waste residues including stainless steel, paper ashes, foundry ashes and incinerator ashes. The degree of carbonation is dependent upon the amount of calcium present in the wastes and the mineral form. The measured calcium concentration of the pellet ash ranged between 398,000 mg/kg to 434000 mg/kg and for the wood ash the concentration was 179,390 mg/kg. X-ray diffraction identified the primary mineral phase as lime (CaO). Following carbonation in a CO₂ reaction chamber at ambient room temperature, the dominant mineral phase was found to be calcite. Based upon the measured ash produced by burning wood pellets or wood chip in a furnace, the estimated annual production of waste ash from biomass power plants in the UK is 124,200 tonnes/year. Carbonation technology may modify the mineral structure of this ash allowing for its use in the manufacture of aggregates. This study is continuing by assessing variability between tree species and soil chemistry.

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