



Land Conditioning Products from Bio-energy Generation

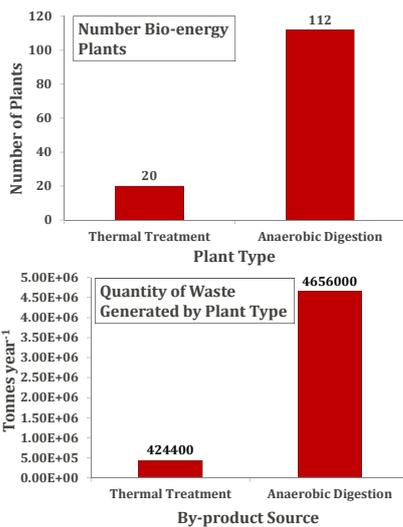
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Developing a suite of novel soil conditioners and plant fertilisers from ash and digestate waste streams originating from biomass energy generation.

1. Project Rationale

Sustainable forms of energy generation using biomass such as gasification and anaerobic digestion (AD) are rapidly growing, and forecast to generate 15% of the UK's energy demand by 2020. AD alone has the potential to deliver over 40 TWh of renewable energy, equivalent to over 10% of the UK's domestic gas demand. As such, waste from energy generation, including ashes and digestate, are produced in large volumes and are likely to grow.

The dominant disposal route for ash from gasification plants is to ash lagoons and landfill; whilst digestates, derived from AD, are typically disposed of to land at no cost. However, in the face of rising pressures on environmental resources, rising landfill taxes and accompanying waste-minimisation legislation, alternative options for waste reuse are increasingly being sought.

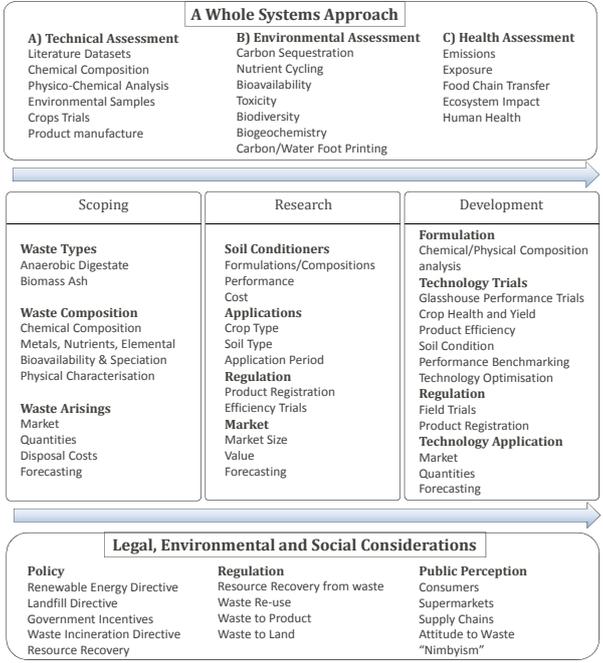


2. Key Aims

The objective of this project is to radically change the way in which biomass energy producers can support a circular economy, through utilising bio-energy waste streams to develop soil conditioners and plant fertilisers, facilitating new ways to mesh commercial ideas with positive environmental benefits. This will be achieved through four aims:

- 1) Assess the environmental impacts of applying a waste derived product to land
- 2) Optimize a novel soil conditioning material derived from bio-energy waste (ash and digestate)
- 3) Develop a land conditioning product with a significantly reduced environmental impact to that of conventional mineral based fertilisers.
- 4) Close the nutrient cycle and ensure food security

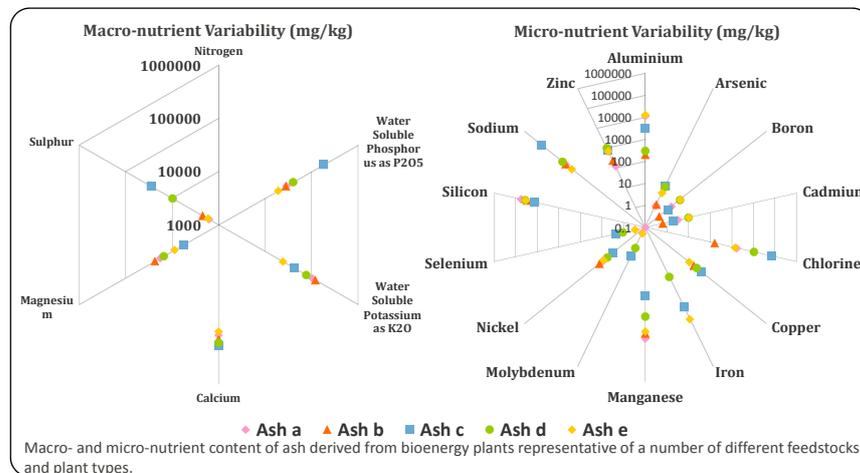
4. Project Development



3. The Technology

Anaerobic digestion (AD) converts organic waste materials into biogas and digestate. Biogas, consisting of methane (60%) and carbon dioxide (40%) can be used to generate heat and power, or purified and injected into the gas network. Digestate can be used as an organic fertiliser and soil conditioner. The AD process is entirely natural and is carried out by micro-organisms already present in the waste streams, which thrive in an oxygen-free environment. Consequently, the process takes place in large, airtight vessels which are designed to maximise biogas generation and recovery.

Gasification is an emerging thermal conversion technology that is being used to generate energy from carbonaceous materials. The process operates under sub-stoichiometric oxygen conditions, using a carbonaceous feedstock, to produce low energy synthesis gas (syn gas), comprising of hydrogen, carbon monoxide, and a process ash. This gas can then be used as a fuel to generate electricity or as a precursor for chemical synthesis and fuel production.



5. Micro- and Macro-Nutrients

Previous studies have demonstrated that biomass-ash and digestate can be useful nutrient sources for crop plants in nutrient limited conditions. Although virtually nitrogen free, ash is rich in many micro- and macro-nutrients. These are profiled for ash from a variety of sources in the star plots (left). Contrastingly, anaerobic digestate is a rich source of trace metals and nitrogen, as well as relatively stable forms of C, which may improve soil structure and enhance C-sequestration within soil. Further work profiling the nutrient content of digestate is currently being conducted.

It is hypothesised that a combination of ash and digestate may be regarded as comprehensive nutrient provider and soil conditioner.

6. Partnering with Business

The project is engaging with strategic industry partners, and operating both academically and commercially throughout the energy from biomass and agrochemical space. This enables:

- Effective understanding of the market
- Meeting the requirements of the end user
- Accelerate product development
- Incorporation of policy and regulation into scientific research

7. The Vision

Widespread adoption of this technology could result in a sustainable substitute for conventional chemical fertilizers, in turn significantly reducing the carbon footprint of the agrochemical industry. Furthermore, utilising the growing waste stream of biomass by-products to promote the growth of crops, including energy crops, will close the production loop for biomass to energy generation enabling a cradle to cradle approach.

