From waste dumping to clean energy: using our landfills for renewable energy

It is widely acknowledged that dumping our waste in landfills is extremely harmful to the environment. Landfills pollute our groundwater, our soils and release biogas (methane and carbon dioxide) into the atmosphere, which contributes greatly to global warming.

It is for this reason that the European Union (EU) set the EU Waste Framework Directive 2008/98/EC, aiming to reinvent how we manage our waste, reducing the amount that we simply dump in landfills. This Directive has greatly influenced how we handle waste in the UK, disposing of it only as a last resort.

Fig. 1. Waste core drilling activity.

This means that the composition of landfill waste has greatly changed since these measures came into place, as more wastes are directed to recycling and recovery schemes. Another outcome of the Directive is that landfills are required to install methane recovery technologies onsite. This means that methane discharged in biogas can be captured and used as a fuel to produce renewable energy, rather than released into the atmosphere to contribute to global warming.

However, the effect of the changes to the composition of landfill waste on biogas and methane release is still not fully understood. In addition, the method currently utilised to test for the methane potential of landfill sites, the biochemical methane potential (BMP) test, is time-consuming and labour intensive.

This study looks at the relationship between biogas production, methane potential and waste composition for 7 UK landfill sites. The study focuses on paper and fines (material under 10 mm in size), as these wastes biodegrade well and so are the best wastes for methane production. The study also looked at the potential of a new method, enzymatic hydrolysis tests (EHT), for testing landfill methane potential. If accurate and effective, this method has great potential as it less time and labour intensive.

Fig. 2. Biomethane potential reactor.

The study found that there was a significant difference in the amount of biogas produced and in the methane potential between landfill sites. This demonstrates the need to test, monitor and identify landfill sites that are best-suited to methane recovery for the production of renewable energy. The study also found that the average methane production decreases as the depth and age of the landfill increase. This suggests that methane recovery should focus on the surface layers of younger landfills. Finally, the study found a strong correlation between the currently used BMP test and the novel EHT test. This suggests that EHT can be used successfully as a more rapid alternative to traditional testing methods.

Overall, this study highlights the need to test for landfill sites that are best suited to methane recovery for the generation of renewable energy. It informs strategy for methane recovery by identifying younger sites and surface layers as having the most potential. It also advocates the use of EHT as a test method, which is faster than current methods and so more practical for landfill operators. This progresses the waste management sector and provides landfills with greater opportunity to make a positive contribution to the environment.

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Publication

Compositional and physicochemical changes in waste materials and biogas production across 7 landfill sites in UK.
Frank RR, Cipullo S, Garcia J, Davies S, Wagland ST, Villa R, Trois C, Coulon F
Waste Manag. 2016 Aug 28