Organic Municipal Waste Treatment

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Component 3.1

Policy Implementation /Tools

- Waste Management Strategy – Targets
- Waste Management Plans – Implementation
- Procurement Strategy & Funding
- Landfill bans
- Taxation – Landfill Tax
- EU driven Legislation

Municipal Waste

- Mixed Dry Recyclables
- Source Separated Organics
- Residual Waste
  - AD
  - In Vessel Composting
  - Open Windrow Composting
  - MBT
  - Waste-to-Energy
  - Refuse Derived Fuel
  - Landfill

Collection Method

- Source Separated Organics
- Combined Non-Recyclables
  - Mechanical Separation – Organics & RDF/Landfill

Kitchen caddies – all scheme types

Kerbside buckets for separate food collection

Co-collection

Combined garden/food waste

Wet Anaerobic Digestion

- When dry matter (DM) concentrations are below 15% the process is described as wet. A wet digester will typically process a slurry of around 10% DM which has the consistency of thin soup and must be constantly stirred to prevent suspended solids from precipitating. Stirring is usually either mechanical in which case a rotating paddle is the preferred method, or gas, in which case the biogas given off is redirected through the substrate to ensure stirring. Wet digesters are nearly always constant flow digesters
- Wet digesters are ideally suited to the processing of low DM feedstock such as farm slurries and source separated food wastes

Dry Anaerobic Digestion

- The material processed during dry AD is normally around 25 – 30% DM and has the consistency of thick porridge. In constant flow digesters this must always be mechanically stirred, not only to prevent settling and unequal pocketing, but also to assist the flow of the material through the reactor.
- Dry digesters are ideally suited to high DM feedstock such as energy crops, garden wastes and mechanically recovered municipal wastes in MBT plants.

Denmark Landfill and Biogas

AD Plants in Europe – Current Situation

- Approximately 250 plants with a capacity of almost 8 million ton of organics treatment capacity
- Anaerobic digestion is already taking care of about 25 % of the biological treatment in Europe - which is estimated at around 20 % of all municipal solid waste disposal in Europe.
- Countries having the largest capacity installed are Germany with about 2 million tonnes of annual capacity, and Spain with 1.6 million tons
- Netherlands and Switzerland are the highest in installed per capita annual capacity of approximately 50,000 tonnes per million people

In Vessel Composting

- A 28-day batch average cycle time is more than 50% less than traditional aerobic compost processes. It includes the active composting process as well as the aeration and circulation system to expedite pathogen kill and control odours
- The finished product meets all Process to Further Reduce Pathogens (PFRP) requirements and is technically classified as finished compost
- Plants require a smaller footprint than traditional systems because there is no requirement for product maturation in windrows. This creates opportunities for comprehensive urban applications as well as lower infrastructure and operating costs
- All odour issues are addressed during the 28-day process
- The material produced at the end of the process contains the lowest moisture content of any available system and produces premium grade, mature compost

Leachate Treatment

- Diversion
- Selective Input
- Recirculation
- Evaporation
- Sequencing Batch Reactors (SBR) - Venturi
- Reverse Osmosis
- Public Sewer System
- Land Application – willow etc.
- Constructed Wetlands

Composting /Anaerobic Digestion of Non Source Separated Waste Materials – MSW

- This is usually carried out as part of an MBT process
- MBT is a residual waste treatment process that involves both mechanical and biological treatment.
- MBT compliments, but does not replace, other waste management technologies such as recycling and composting as part of an integrated waste management system.

Typical aims of MBT plants include the Diversion of biodegradable MSW going to landfill

- Reducing the dry mass of BMW prior to landfill;
- Reducing the biodegradability of BMW prior to landfill;
- Stabilisation into a compost-like output (CLO)
- Conversion into a combustible biogas for energy recovery; and/or
- Drying materials to produce a high calorific organic rich fraction for use as RDF.

Materials Recovered for Energy

- It may well be a better option to sort the waste into a Refuse Derived Fuel (RDF) – containing significant proportions of the available combustible materials such as mixed paper, plastics
- **Potential Outlets for RDF**
- 1. Industrial intensive users for power, heat or both (Combined Heat and Power, CHP).
- 2. Cement kilns.
- 3. Purpose built incinerators
- 4. Co-firing with coal at power stations.

Cement Kiln - RDF

Deliverability

- Data
- Mix of technologies
- Modularity
- Proven technology
- Affordability
- Bankability (surety of supply and markets)
- Market confidence
- National Strategy

Policy

- EU Proposal to restrict and ultimately ban Organic waste from landfill – 2025
- Objectives of both new WFD and Resource Efficient (RE) Road Map
- Key drivers are climate change and RE carbon benefits, particularly on food waste
- Currently Key EU waste Initiatives
- UK along with Many other EU member states have banned food waste from landfill

Composting - complying with the Quality Protocol

Quality compost from source-segregated biodegradable waste will normally be regarded as having ceased to be waste provided it:

- has been produced using only those source-segregated input materials
- meets the requirements of an approved standard for use in the market
- is destined for appropriate use
- requires no further processing including maturation or re-screening for use

Producers must demonstrate that these criteria have been met

They must do this in this by:

- obtaining certification from an approved certification body; and
- by producing and keeping copies of customer supply records of inputs
- complying with (BSI PAS 100). Standards and specifications which apply to this Quality Protocol applies

The compost must be destined for appropriate use within

- land restoration and soft landscape operations;
- horticulture
- agriculture and soil-grown horticulture; or
- forestry

The purpose of the Quality Protocol

- The Quality Protocol has four main purposes:
- clarifying the point at which waste management controls are no longer required;
- providing users with confidence that the quality compost from source-segregated biodegradable waste
- protecting human health and preventing pollution of the environment (including soil)

Complying with the Quality Protocol

- has been produced using only those source-segregated input materials
- meets the requirements of an approved standard (BSI PAS 110).;
- requires no further processing including maturation or re-screening for use
- Quality digestate must not be used in such a way as to adversely affect human health or the environment

Features of PAS 110

- input materials to the digestion system shall not include contaminated wastes, products or materials
- source segregated materials or biowastes are stored, collected and not subsequently combined with any non-biodegradable wastes, or any potentially polluting or toxic materials or products, during treatment or storage

Features of PAS 110

- supply agreement for the input materials
- controls on input materials and the management system for the process of anaerobic digestion
- Sets limits for Potentially Toxic Elements
- Sets a range of test parameters for digested materials made from specific input
- Processes for ensuring input material has no physical or chemical properties that would prevent the digested material made from it from being fit for purpose

Features of PAS 110

- depending on input sources pasteurization process included to ensure pathogenic bacteria, viruses and other harmful organisms in material undergoing anaerobic digestion are significantly reduced or eliminated
- stabilization of biological and chemical processes
- A quality management system (QMS) specific to a defined digestion process

Typical End Uses of PAS 100and 110 outputs

- Digestate is a nutrient-rich substance produced by anaerobic digestion that can be used as a fertiliser
- For compost – made from recycled green garden waste and food waste – the research shows it builds levels of soil organic matter more quickly than other organic materials, such as farmyard manure, which will help deliver stronger and more resilient crops.

Typical End Uses of PAS 100 and 110 outputs

- Crops grown with an integrated nutrient plan combining chemical fertilisers and digestate or compost resulted in higher yields[2] and better financial returns.
- By using digestate instead of chemical fertilisers derived from virgin materials, we can save energy, cut consumption of fossil fuels and reduce our carbon footprint.
- All the nitrogen, phosphorous and potassium present in the feedstock will remain in the digestate . However, the nutrients are considerably more available than in raw slurry, meaning it is easier for plants to make use of the nutrients.

Nutrient Management

- Northern Ireland is a Nitrates Vulnerable Zone therefore all fertilizer- chemical or PAS 110 output material / Digestate is applied to farm land only after nutrient analysis and assessment of nutrient need /maximum nutrient loading criteria

Other Uses of PAS 110 / 100 output materials: -

- Soil conditioner, Landscaping Horticulture or Agriculture

Use of Compost-Like Outputs (CLO)

- The processing of mechanically separated organics can produce partially/fully stabilised and sanitised CLO.
- The potential applications of these outputs are dependent upon their quality and legislative / market conditions.
- CLO and digestate has the potential to be used as a source of organic matter to improve certain low quality soils, e.g. in the restoration of brown field sites, or for landfill cap restoration.

Use of Compost-Like Outputs (CLO)

- CLO derived from MSW mixed waste will be of a lower quality largely due to higher contamination levels.
- Trials on mixed waste derived materials have reported large amounts of physical contaminants (e.g. glass) and levels of potentially toxic elements
- The quality of CLO produced will vary with different MBT technologies, the quality of raw waste inputs, and the method and intensity of waste preparation and separation prior to biological treatment

Use of Compost-Like Outputs (CLO)

- The use of CLO produced from mixed MSW on agricultural land is not permitted by the UK Environment Agency.
- Countries use composting and Anaerobic Digestion to generate electricity reduce volume, stabilise waste prior to landfilling / using as a fuel

Case Studies

- New Earth Solutions, Avonmouth MBT Facility
- The 200,000tpa capacity facility primarily treats residual household waste from the West of England
- The site, extracts metals and plastics, and produces a CLO from the organic waste fraction.
- The CLO is used in 21 remediation projects, such as the capping of former landfill sites.
- From the fraction of the waste which cannot be recycled, New Earth produces a refuse-derived fuel product.
- Will generate 13MW of electricity, enough to meet the needs of nearly 25,000 homes

Mechanical-Biological Treatment Plant in Hanover, Germany

- Treats 160k tons of MSW annually
- The waste is processed first mechanically and then biologically
- Refuse derived fuel is produced - RDF is usually a remaining fraction from waste treatment operations
- Anaerobic digestion process produces high-calorific biogas for energy production along with biological stabilization of organic matter
- Digestate is matured dried for use as a refuse derived or landfilling

Kahlenberg (ZAK) MBT Plant

- The plant is owned and operated by ZAK which is the regional municipally owned by a waste handling company
- The MBT Plant and landfill site accepts 100,000 tons per year of residual waste
- Mechanical Treatment The heavy and light fractions of the waste stream are separated for SRF production. The SRF can be made to a required standard in terms of content, quality and particle size
- AD - There are three identical anaerobic digesters, with a combined volume of approximately 5,000 m3 -producing electricity and digestate
- The digestate is further treated and dried to produce fuel

Useful Links to Protocols

- https://www.gov.uk/government/collections/quality-protocols-end-of-waste-frameworks-for-waste-derived-products
- https://www.gov.uk/government/publications/quality-protocol-anaerobic-digestate
- https://www.gov.uk/government/publications/quality-protocol-for-the-production-and-use-of-compost-from-waste
- https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/292473/426765_EA_QP_Anaerobic_Digestate_web.pdf

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- https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/292473/426765_EA_QP_Anaerobic_Digestate_web.pdf
- http://www.wrap.org.uk/content/digestate-and-compost-agriculture-dc-agri-reports