Topic: **Biomass**
Title: **ANAEROBIC DIGESTION**

INTRODUCTION

Anaerobic digestion (AD) is a process through which animal slurries, silage, food processing and other organic wastes can be converted to biogas. An aerobic digester is a large sealed vessel from which air is excluded. When organic waste is added, warmed and mixed the conditions are perfect for anaerobic bacteria. In the absence of oxygen the bacteria break down the organic matter, which ferments to produce biogas (a mixture of methane and carbon dioxide) and a liquid/fibre digestate. The liquid component of the digestate can be used as liquid fertiliser and the fibre as a nutrient-rich soil conditioner.

TYPES OF DIGESTER

There are two types of digestion process that can operate in an anaerobic plant. The most common is *mesophilic digestion*. During this process decomposition of the organic matter takes 15 to 40 days and as a result requires a large tank. The tank is heated to a relatively low temperature of between 30 to 40°C. Mesophilic digestion is an established and relatively simple technology.

Thermophilic digestion is an emerging technology with a lower retention time (12 to 14 days) and with a faster and higher rate of biogas production. It also has the benefit that a smaller tank can be used. However, the tank needs to be heated to a higher temperature (55°C) therefore using more energy. The thermophilic digestion process is currently more expensive and is technically more complex.

WASTE MANAGEMENT

Increasing concerns about, and awareness of, air and water pollution have led to tighter controls on waste management. The requirement to invest in better waste management solutions is likely to increase in order to take into account the ongoing need to reduce environmental impacts. An on-farm anaerobic digestion facility offers a number of waste management benefits:

- It is an alternative to landfilling of organic wastes.
- The products of AD produce around 80% less odour than farm slurry.
- Methane (a greenhouse gas) emissions to the atmosphere are reduced.
- A range of organic waste materials can be processed through AD, with the highest gas yields being achieved through the co-digestion of a mix of fatty (food processing wastes) and liquid wastes (animal slurries) and green wastes.
- The processing of farm slurry reduces the amount that is sprayed onto farmland and hence reduces the risk of run-off and pollution of waterways.
- The AD process destroys harmful bacteria and viruses, reducing the spread of harmful disease causing pathogens.
- AD effectively recycles organic wastes. The biogas can be burnt as a fuel and the digestate products used to return nutrients to the land.
- A reduced dependence on inorganic fertilisers.
- It is a waste management option providing environmental and economic benefits.

ENERGY GENERATION

The biogas produced in AD is a mixture of methane (65%) and carbon dioxide (35%) which can be used to generate heat through a boiler, or heat and power through a combined heat and power (CHP) system. In addition, following further processing, biogas is also a suitable fuel source for vehicles.

The energy generating potential of an AD facility is determined by the size of the digester and waste feedstock composition. A range of AD scales exists, from single on-farm digesters through to large centralised anaerobic digesters (CAD) collecting waste from a larger surrounding area.

A small farm facility using farm waste can produce enough heat to warm the digester and meet domestic heating requirements. If electricity is generated through CHP of 10kWe capacity, enough electrical energy could be generated to supply up to 13 homes.

A large centralised (CAD) facility with a CHP system, collecting slurry from local farms, food waste from caterers and domestic green wastes, can produce enough electricity for a whole community (3000+ homes) as well as heat for local buildings such as leisure centres, health centres etc.

The key benefits of AD from an energy point of view are:

- A reduction in the use of fossil fuels, offsetting carbon dioxide emissions.
- Biogas offers a form of renewable energy that enables local communities to become more self-sufficient and promotes socio-economic opportunities.
- Fuel is used locally, reducing pollution aspects of long distance transport required to supply fossil fuels.
- Government and EU policies are driving for increases in the proportion of energy derived from renewable sources.
- Increasing competition in the energy market and rising fossil fuel costs has led to new energy markets supported by renewable energy sources.

ECONOMIC CONSIDERATIONS

AD facilities are by no means cheap, with high initial outlay costs. However, the economic case for AD has been strengthened as a result of increasing fossil fuel costs. In addition the tightening legislation governing waste management and the growth in financial incentives for renewable energy schemes make it an option that is certainly well worth considering, particularly if well managed and income opportunities are maximised:

- Electricity generated may be eligible for Renewable Obligation certificates (ROC's)
- Gate fees can be charged for waste taken in. Biogas, fertiliser and soil conditioner can be sold.
- Investments in renewable energy are often eligible for some form of grant assistance and can be accessed via your local energy agency.
- Savings can be made as reliance of mineral fertilisers, soil conditions and fossil fuels is reduced.
- Local economies can be enhanced through job creation and increased disposal incomes, and through stimulation of new locally owned and managed developments

CONCLUSIONS

Anaerobic digestion is a valuable integrated waste management solution that is becoming increasingly economically viable. In addition to helping compliance with legislation on the safe handling of waste, it also provides opportunities for developing renewable energy enterprises.