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MICRO DIGESTER PROPOSAL

Background

James Murcott of Methanogen UK Ltd has built over 30 micro digesters in the past 30 years. These have been supplied to private customers, water authorities, small farms, smallholdings and for food digestion research at Greenfinch, the findings from which were used to help build the current Ludlow plant.

Our Range of Digesters

The Methanogen UK Ltd range of medium and micro digesters:

Medium: 20 m³ vol, 2.8m dia x 3.6m high
60 m³, 3.8m dia x 5.4 m high

Micro: 6.0 m m³ vol, 2.5 m dia x 1.2 m wide
2.0 m³ vol, 1.8m dia x .9 m wide
0.6 m³ vol, 1.2m dia x 0.6m wide
0.2 m³ vol, 0.8 m dia x .4m wide

Design Concept

Micro – the principle of operation is very similar to the German 'Blacksmiths' digester design which has been in operation for more than 30 years. This design consists of a horizontal circular tank with a slow speed rotating paddle mixing system. This design has demonstrated its suitability for small systems, but has proved difficult to scale up above about 200 m³.

The Methanogen design is slightly different in that it incorporates fixed heat exchangers which interact with the rotating paddle to create a degree of physical shredding within the digester, so that unprocessed material can be fed directly into the digester, e.g. bags of food waste, garden weeds or plant toppings, etc. Due to the vertical rotation of the paddle, floating solid matter is brought down from the top and grit is prevented from building up on the bottom. For very gritty applications, eg garden green waste, the grit is scraped into a de-gritting chamber from where it can be removed independently from the normal outlet.

The rotating paddle mixing system is integral to the design, as are the heat exchangers. The design concept allows for up to six individual heat exchangers which can be heated from independent heat sources running at different temperatures, eg from solar panels, a gas boiler or a low grade heat recovery system.

Animal By-Product (ABP) Regs Compliant Micro Digester System

This consists of two micro digesters and a much smaller micro pasteuriser. For example, a system designed to handle about 100 kg per day of food waste would operate as follows:

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The input is fed into a 2 m³ micro operated at 35 degrees centigrade. The output from this feeds by gravity via an inline low-speed macerator to a micro pasteuriser of 0.2 m³. From the pasteuriser, a pump, typically a 50mm dia progressive cavity pump feeds into the second 2 m³ micro digester sited alongside the primary digester, both driven together by a common mixing shaft. Output from the digester is by a small low speed auger directly into a holding tank or over a small belt press separator.

Bags of food waste or similar can be fed directly into the primary digester without pre-treatment if it is a suitable waste (without shredding) because of the shredding action within the digester. A hopper with straight sides about the size of a wheelie bin can be filled with the day's input whereby a flat plate on a lead screw (rather like a press) gradually (over the course of many hours) forces the input into the digester. At intervals of about every 2 hours, the macerator runs, allowing digested macerated material to flow into the pasteuriser. After the minimum dwell times of 1 hour at 70ºC, a portion of the pasteurised material is pumped into digester 2. The distribution of the heat exchangers within the micro digester is potentially 4 in the bottom half and two in the top half. When the hot pasteurised material is pumped into digester 2 at 70ºC: obviously this will raise the temperature of digester 2. For this reason, digester 2 is fed many times per day to allow the temperature to stabilise at about 40ºC. The bottom heat exchangers in digester 2 are connected to the top heat exchanger in digester 1 to allow the heat to thermo-siphon into digester 1.

If we look at the heat balance, assume the feedstock temp is 5ºC, so a temperature rise of 30ºC is required to heat digester 1. With no heat losses from the system, digester 2 would run at 40ºC if *all* the heat could be transferred from digester 2 into digester 1. This would suggest that nearly all the heat requirement is in order to heat the pasteuriser. If the loading rate is about 100 kg per day, the total heat requirement is only a fraction of a kilowatt.

Estimated daily gas yield will be about 10m³ - enough to run a Rayburn or an Aga. Potential heat output is about 2kW constant (24 hrs a day).

Depending upon the time of year, this heat could be used to heat a greenhouse, but a gas holder would be needed.

Digester Mechanical Power Requirements

The micro digesters are designed to run on a very low mechanical input and can operate off-grid using a solar panel and/or a small wind generator, eg Rutland type, connected to a 12 volt battery.