TECHNICAL SHEET: ANAEROBIC DIGESTION

Anaerobic Digestion is a series of processes in which microorganisms break down biodegradable material in the absence of oxygen. It is used for industrial or domestic purposes to reduce waste and/or to release energy. Sludge production is lower from this process than from aerobic treatment (normally earlier in the treatment chain).

It is often used to treat biodegradable waste and sewage sludge, in an integrated waste management system. The digesters can also be fed with purpose-grown energy crops, such as maize. The nutrient-rich digestate produced can be used as fertiliser. In addition to the digestate, anaerobic digestion produces biogas (methane and CO2) which can be used to generate heat and/or power.

The key challenge for pulp mill waste is the potential inhibitory effect of extractives and lignin in the case of mechanical mills. These compounds can be reduced by removal prior to anaerobic treatment either by aerobic treatment; flocculation or selective removal for other uses.

Materials Accepted	• Garden/green wastes • Food wastes • Farm wastes • Sludge • High organic strength wastewaters
Examples in Current Use	*NZ* Municipal biosolids and high strength industrial wastes such as dairy and meat processing. *Overseas* Multiple municipal and agricultural sites but limited pulp mill sites; e.g. Tembec pulp mill, Canada

Infrastructure and Space Requirements	Many configurations from simple, static, below ground pits (low rate) to completely mixed, heated, egg-shaped digesters constructed above ground. System components may include scrubbers, blowers, IC engines, generators etc. depending on gas quality and energy generation options. Smaller footprint for high rate digesters. 1 - 5 kg VS/m^3/d are used for digester sizing, based on the type of waste and digester design.
Capital Cost	Retrofitting existing anaerobic ponds with covers for gas capture (low cost) to tank based systems (high cost). Capital cost estimates vary depending on the plant sizing and sophistication and energy production options. Cited values for digesters vary from $600 – $1500 / m^3. As an example, the new Tembec pulp mill anaerobic plant, in Matane Quebec, cost US$26 million in 2012. This plant treats wastewater from the 230,000t/yr mechanical pulp mill.
Operating Cost	Operating costs include labour, material transport/pumping, digestate carting, external nutrient and electricity costs. Energy plant maintenance costs and biogas cleaning costs need to be considered for larger operations. Simple pay back for biogas driven electricity generation plants are reported to be 2 – 5 years. Co-digestion with other regional waste materials could enhance digestion efficiency and gas generation and boost revenue from gate fees. Integrated use in dealing with biological sludge that is difficult to dewater is known to produce a net gain in energy from biogas.
End Product	Biogas (methane and carbon dioxide) quality and yield is dependent on inputs. Calorific value of 21 – 25 MJ/m^3 of biogas. Digestate - the remaining solids (digestate) can have an additional nutritional value. The end use for this digestate depends on the nutritional value and contaminant level of the inputs.
Operating capacity e.g. viable at low tonnage	Viable at nearly any tonnage. Large scale digesters are in operation for municipal wastewater treatment plants that treat very large volumes of wastewater per day.
Potential consenting issues	• Odour and environmental effects (waste management, pollution prevention) may need consenting. • Waste storage and digestate discharge are also of interest to consenting authorities. • Process safety
Technology Risk	A qualitative assessment of the likelihood of failure of the option or scenario due to issues related to the technological solution e.g. equipment failure, unable to achieve output standards 1 = high risk, limited examples of pulp sludge digestion in Canada. Technology not proven for pulp mill solids in NZ
Commercial Risk	No of suppliers Range of input materials A qualitative assessment of the likelihood of failure of the option or scenario due to issues related to the commercial arrangements e.g. supplier unable to maintain operations, increase in cost of process, transport or ongoing site management exceed those able to be reasonable recovered or those for comparable options. 1 = high risk, not proven technology and would need a new supplier or investment by pulp mill
Market Risk	A qualitative assessment of the likelihood of failure of the option or scenario due to issues related to the 'market' for the product e.g. a use for the product cannot be found due to concerns about trace contaminants. 3 = low risk, multiple secure markets for product; easy market for heat and power but risky market for digestate.

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