Anaerobic Digestion: Save Cost and Lower Carbon Footprint

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Anaerobic Digestion: Applying Geomembranes in A Wastewater Treatment Technology That Saves Cost and Lowers Carbon Footprints

Anaerobic digestion has become an increasingly popular technology for treating wastewater. Not a new technology, it has been practiced in various industries in the United States for several decades. In the earlier days of its use, companies chose anaerobic digestion as a means for controlling odor as well as to meet industry regulations for waste management.

The recent gain in its appeal, however, has more to do with dollars. Anaerobic digestion uses considerably less energy than the conventional method of treating wastewater. At a time when energy prices are relatively high, saving energy means saving money. And to some, it means much more.

Anaerobic technology is considered a "green" technology – but not only because it draws less energy from the grid than alternatives. Anaerobic digestion also yields a prized byproduct: biogas. As organic waste degrades in an anaerobic digester, it gives off methane, which can be harvested and used as energy in place of nonrenewable fossil fuels.

Anaerobic Digestion: A Brief Overview

In anaerobic digestion, microorganisms break down organic matter in the absence of oxygen. The process has occurred in the natural world in uncontrolled settings for as long as life has existed. For the wastewater treatment industry, digesters are designed and engineered to handle specific types of waste streams with high organic content. Operating costs are relatively low, compared to alternative methods.

The process of degrading waste streams through anaerobic digestion generates off gases, including methane. Methane can be reused on site to power the boilers and generators used for the digesters; or, sold to a local power company looking to expand its portfolio to include sources of alternative energy.

Depending on the quality of the feedstock, another valuable byproduct of anaerobic digestion is a nutrient rich fertilizer, which can be used in agriculture as a supplement to chemical alternatives.

Aerobic Digestion: The Conventional Method in Wastewater Treatment

The more conventional wastewater treatment technology is aerobic digestion, which relies on oxygen to fuel the breakdown process. In wastewater treatment, large blowers are required to power air into the system to stimulate the degradation process, drawing heavily on the electric grid and contributing significantly to the cost of this technology.

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Types of Anaerobic Technology

Numerous types of anaerobic digestion systems have been developed since the early use of the technology in the 1970's. Location, climate and the type of organic waste factor heavily into the design considerations, as well as a host of additional technical details. Most can be categorized as low rate or high rate systems.

Low Rate Systems are utilized where waste volumes are hydraulically large and a less sophisticated operation is desired. Typically, these are installed at impoundment-based facilities. Gas and rainwater control are accomplished with floating geomembrane covers.

High Rate Systems have a smaller footprint and are operated to treat concentrated, smaller volume, more concentrated, waste streams. Because the process is operated at a higher rate, the facilities employed are usually tank-based and more sophisticated in operation. Both fixed and flexible roofs are used.

The Role of Geomembranes in Anaerobic Wastewater Treatment Solutions

Geomembranes offer a cost effective, durable and flexible design solution for anaerobic digesters used in wastewater treatment. For wastewater lagoons and tanks, geomembranes can be used as floating covers to contain the biogases generated within the digester. They also function as a barrier to oxygen entry and protect the fermentation process from environmental interference. In lagoon applications, geomembranes also function as liners, protecting the groundwater and subgrade from the wastewater contained within.

The use of a geomemembrane in the floating cover design is highly beneficial for low rate digesters because they offer cost, installation and maintenance advantages over alternatives. Geomembranes are one of the best options for high rate systems designed as tanks. They act as a membrane roof or as part of a fixed roof and are also advantageous based on price, ease of installation and maintenance.

Not all geomembrane products perform the same. At the close of this article we will discuss the specific requirements of a high-performing membrane for this application.

Industries Best Suited for Anaerobic Technology

Anaerobic digestion is suitable as a wastewater treatment solution for various industries, but some benefit more than others. Because municipal wastewater generates large volumes of sludges, anaerobic technology has long been used. Municipalities with certain circumstances benefit most, for example: those that process waste streams with high organic content, such as food processing; and, those with high industrial organic content components and sludge digestion at municipal wastewater treatment plants.

Anaerobic technology is a great fit for treating wastewater within the food processing industry. Some types of food processing will reap greater benefits than others because of the high amounts of methane gas given off in the treatment process. Potato, corn, beer and alcohol manufacturing facilities and distilleries are examples. For these companies, harvesting and reusing the biogas can offer very tangible long-term cost savings.

The Power of Anaerobic Digestion to Reduce Your Carbon Footprint

Most of us know this: the burning of fossil fuels, through traditional energy usage, contributes to increased levels of carbon dioxide in the atmosphere. If we decrease our reliance on these energy sources, we can, by definition, decrease our carbon footprint.

Anaerobic digestion is a process that oxidizes organics naturally without relying on adding oxygen into the system. Choosing anaerobic digestion to treat wastewater, over aerobic digestion offers tremendous savings of power generated by a traditional energy source by cutting out the need for fans to blow oxygen into the waste stream. Choosing to harvest the biogases with an anaerobic digester creates additional environmental benefit by reusing the biogases as an energy source in place of fossil fuels. Further, the vitamin rich digestate can supplement chemical fertilizers, which, from an energy standpoint, are costly both to produce and transport.

Market History and Horizon for Anaerobic Digestion

According to Dennis E. Totske, P.E., of Applied Technologies, in an annual review of the industry, titled, "2009 Anaerobic Technology Overview," Europe has historically been the leading proponent of anaerobic technology for wastewater treatment. According to this report, the trend continues. He estimates that today there are approximately 1,026 anaerobic installations (including all types of systems) in Europe, 961 in Southeast Asia, 634 in the United States, 311 in South America and 64 throughout the Middle East and Africa.

The Kyoto Protocol has likely impacted the number of installations in Europe and some parts of the developing world. A cap and trade system that resulted from the International Framework Convention on Climate Change held in Kyoto, Japan in 1997, the Kyoto Protocol requires 36 developed countries and the European Union to reduce greenhouse gas emissions by amounts specified in the treaty. The treaty came into force in 2005. As a result of the Kyoto Protocol, carbon credit compliance markets have been developing for several years. Voluntary markets also exist for businesses or individuals to lower their carbon footprint by purchasing carbon credits from an investment fund or company that has aggregated credits from individual projects that reduce emissions. Voluntary markets exist in countries like the U.S., where the treaty has not yet been ratified, and also in many other major developing countries, including China and India.

Germany has a renewable energy law in effect today, which is likely why it, according to additional numbers in Totske's report, is the leading country in Europe in terms of anaerobic installations. The German government gives companies subsidies to afford the capital investments required to transition to this technology. Other European countries and parts of the developing world are following suit.

The United Nations Development Program has recognized anaerobic digestion facilities as among the most useful decentralized sources of energy supply. Funding assistance is available to development projects that prove to reduce carbon emissions.

In the United States today, anaerobic technology offers immediate energy and cost savings benefits to companies considering it as a wastewater treatment solution. Totske's report shows that currently there are approximately 460 such installations in the country. The report also estimates there are an average of 20 to 40 new installations per year. The decision to take full advantage of the economic and environmental benefits this technology offers (i.e. harvesting, upgrading and reusing the biogas as energy onsite) may be far easier for large companies. Inspiring this kind of action from the broader industrial and municipal markets, however, will require support from the U.S. Government.

References

Totske, Dennis E., P. E., "2009 Anaerobic Treatment Technology Overview" (2009).

Factors to Consider When Selecting A Geomembrane Product for an Anaerobic Digester

Consider these important performance requirements of a geomembrane product in anaerobic digestion installations:

1. Resistance to methane gas
2. Proven long term resistance to UV rays
3. Proven resistance to puncture and tear (the product must be able to support the weight of people walking on top of the cover to conduct system maintenance)
4. Low thermal expansion, contraction
5. Low temperature flexibility
6. Overall proven weather resistance
7. Lastly, consider the manufacturer's ability to offer the product in prefabricated panels, which makes for a more reliable and less labor intense installation.

For more information about XR® Geomembrane Systems please contact **Bill Shehane** by phone at **330-262-1111** extension **3003** or email at **bshehane@seamancorp.com**