MBT News

2010 MSU Agricultural Expo

The MBT displayed at the 2010 MSU Agricultural Expo on July 20-22, 2010, at the Ag Expo grounds on the MSU Campus. Thanks to everyone who helped out with this event! We signed up about three dozen new farmers this year, gave out lots of popcorn and water, and handed out lots of information. Biosolids were provided by Delhi Township WWTP.

Ag Expo Tent and Display

MBT 2010 Biosolids Fall Seminar

The MWEA Biosolids Committee has scheduled a one day seminar for October 14, 2010, at the Charlevoix Public Library in Charlevoix, Michigan. The draft title for the seminar is “Septage to Biosolids”. The seminar will focus on septage receiving, treatment, POTW impacts and concerns, and tours of the Big Fish Septage Treatment Station and a site being reclaimed with biosolids at St. Mary’s Cement in Charlevoix. For more information go to: www.mi-wea.org or call the MWEA office at 517-641-7377

2011 Joint Conference

The MWEA Biosolids Committee has teamed up with the MWEA Industrial Pretreatment Committee to have a two-day joint conference in September 2011. The proposed location is the Radisson Hotel in Kalamazoo, with possible tours of the Coca-Cola Bottling Plant and St. Julian Winery in Paw Paw, as well as the Plainwell WWTP, and dinner at the Air Zoo. Topics covered will be relevant to both committees, as well as breakout to cover Biosolids or IPP specific areas.

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The Michigan Biosolids Team has a Facebook Page!

Become a fan and “Like” our page to get timely and relevant updates to local and national biosolids news, meeting dates, locations and schedules and to view pictures and videos of Michigan Biosolids Team events!

Vision: To make Michigan a national leader in environmentally sound Biosolids processes and products.

Mission: To provide leadership and promote beneficial uses of Biosolids.

To learn more, search Facebook for Michigan Biosolids Team and click the “Like” button.
Unique Ishpeming facility produces high-quality compost

By JOHN PEPIN Journal Staff Writer
Posted: August 17, 2010

ISHPEMING - A new municipal waste biosolids treatment facility, the first of its kind in the state, is now producing high-grade, safe composting material for home gardeners in the Ishpeming area.

Work on constructing the $1.5 million facility at the Ishpeming Area Joint Wastewater Treatment Facility in Ishpeming began last September and was completed earlier this year.

Michigan's first in-vessel composting system for treating municipal biosolids is now producing an "exceptional quality" soil amendment that meets U.S. Environmental Protection Agency regulations of being 99 percent pathogen-free.

"It's ready and it's safe to use," said Facility Director Deborah Pellow. "We do extensive testing. Because it's Class A exceptional quality, you can use it in home gardens, landscaping, anywhere you want."

A 5,775-square-foot building houses five 14x12 foot composting vessels, where the biosolids are heated to kill pathogens. It takes 80 days for the vessels to produce the composting material, including three consecutive days at 131 degrees and 14 days at 113 degrees to meet required time and temperature regulations.

From the in-vessel composting units, the material is moved to a curing barn to mature and stabilize, and then it is screened. The soil amendment is sifted out, with the material not fitting through the screen put into a new batch to be composted.

Pellow said a California soil control laboratory tests the compost material and it is far below EPA limits for a range of metals. The material also passes tests guarding against salmonella.

In-vessel composting is done in enclosed vessels where time and temperature along with the right amount of wood chips and air destroy any pathogens.

At its peak capacity, the new facility is expected to produce up to 8,500 yards of organic soil amendment each year. This compost material can be mixed with sandier soil to produce high quality top soil.

The process uses renewable natural resources, including wood chips instead of natural gas as its energy source.

"The whole idea behind this is instead of throwing it (biosolids) away, re-use it," Pellow said. "Instead of spending money to landfill it, we're making something that can be sold."

The compost material costs $15 per 1-ton pickup truck load and is available at the facility on certain days. Pellow said the facility is working on a contract with a local landscaper, which would make the material available in larger quantities.

For more information on the composting process or the soil amendment, contact the facility at 906-486-4391.

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From Biomass to Energy

Reducing carbon footprint with two-phased digestion

Sudhakar Viswanathan

Numerous wastewater treatment and recovery plants are adopting novel technologies to help reduce dependence on fossil fuel and provide an off-the-grid option to power their waste treatment facilities. This has resulted in demand for alternative sources of energy from sustainable, localized sources that are considered renewable in nature. Increasingly, the use of biogas to generate process heat and electricity using cogeneration mechanisms has made anaerobic digestion an attractive treatment choice for many small to medium-size facilities.

Delhi Charter Township Wastewater Treatment Plant (WWTP) is located just south of the city of Lansing in Ingham County, Mich. The WWTP was built in 1962; upgrades were made in 1980 and in 2007. The plant is capable of treating a wastewater flow of 2.5 million gal per day on average and 4 mgd during peak flow.

Preliminary treatment is accomplished through shredding and grit removal. Primary treatment takes place in circular settling clarifiers. Secondary treatment consists of an activated sludge process followed by secondary settling.

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The plant also has tertiary treatment that includes a nitrification tower and polishing lagoons. Disinfection is achieved by chlorination of the nitrification tower effluent prior to passing through the polishing lagoon. Prior to the 2007 upgrades, the solids handling system consisted of two trains of anaerobic digesters followed by gravity thickening, with a combined capacity to treat 12,000 gal per day (gpd) of sludge. It was estimated that the capacity prior to upgrade would be overloaded severely within five years.

Addressing Capacity Needs
In 2005, with the aid of two local engineering companies, WWTP staff started investigating alternatives to increase the solids handling capacity to 30,000 gpd. Delhi Charter Township staff chose to upgrade the treatment system using an advanced, high-rate, two-phase anaerobic digestion process. The facility upgrade included the implementation of two parallel treatment trains of two-phased anaerobic digestion (2PAD) system by Degremont Technologies – Infilco, a Suez Environment Co. The 2PAD system has been awarded a conditional “National Process To Further Reduce Pathogens Equivalency” by the U.S. Environmental Protection Agency (EPA). As a result, the 2PAD system can produce Class A biosolids. The system requires the design meet guidelines set by the EPA Pathogen Equivalency Committee. The conditional approval requires the monitoring of two parameters, enteric virus and helminth ova, in addition to the parameters required for Class A biosolids certification.

Because there are fewer restrictions as to where Class A biosolids can be land-applied, the solids generated from this plant can be trucked wet and delivered as an alternative to fertilizers, offering the WWTP an alternative source of income.

Offsetting Carbon Footprint
Additionally, a state-of-the-art microturbine system capable of cogenerating process heat and electricity was integrated with the two-phase anaerobic digestion system. The microturbine system consisted of two 30-kWh turbines, with room for two similarly sized turbines to be added as the capacity of the plant increases. In doing so, Delhi’s WWTP has established the state’s first integrated biomass-to-energy system. The multiple-turbine system offers numerous benefits over a single-turbine system, most notably the flexibility in operation, strategic gas utilization and future expansion.

High volatile solids reduction across the 2PAD system results in high biogas yield. The biogas is captured and stored in the floating gas-holder covers on the mesophilic digesters. When heat or electricity demand is sensed, the stored biogas is treated through a biogas conditioning skid prior to usage in the microturbines. The biogas conditioning skid consisted of a series of heat exchangers to remove condensation and media filters to address impurities such as siloxane and corrosive agents such as hydrogen sulfide.

The integrated biomass-to-energy system includes microturbines designed to operate with a turndown of up to 50%, which allows the two turbines to operate in the range of 25% to 100% of the combined operable capacity, producing 15 to 60 kWh of electricity on demand.

Because the electrical efficiency of these microturbines is around 30%, the majority of the energy generated is in the form of heat. The microturbine exhaust gas exiting the system is at around 500°F and is captured using a tube-in-shell, gas-to-liquid heat exchanger. The hot water from the heat exchanger is cycled through a biogas boiler. The hot water, in turn, blends with return water from heat-addition heat exchangers for the thermophilic digester sludge heating and heat-addition heating jackets on the internal mixing system within the mesophilic digesters.

At current capacity, the facility is able to reduce electricity consumption by more than 40% and eliminate almost all of the process heat; this sustains the operation of the solids handing system. The treatment facility demonstrates that waste treatment plants can reduce consumption of traditional fuels significantly and offset carbon footprint while producing numerous usable byproducts (e.g., Class A biosolids, process heat and electricity) in a sustainable fashion. The result is an average annual cost savings of $75,000 for the WWTP using the 2PAD-IBES system. The solids facility upgrade was recognized with a States’ Clean Water Revolving Fund PISCES Performance & Innovation Award in 2008 by the EPA.

Sudhakar Viswanathan is product manager, biosolids, for Infilco Degremont Inc. He can be reached at 804-756-7645 or by email at sudhakar.viswanathan@infilcodegremont.com.

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Missouri Biosolids Compost Facility Ready to Roll

Sedalia, MO Democrat, 7-31-10

The construction of a new biosolids compost facility in Sedalia was completed earlier this month, and the center is set to begin composting organic material from the city's wastewater treatment plants along with wood from the yard waste drop-off site to produce fertilizer in the coming weeks. The city contracted Septagon Construction last November to construct the compost facility at 27882 state Route U for $1.57 million.

Public Works Director Bill Beck said the idea to construct the composting site arose about four years ago, when Sedalia's Water Pollution Control Department started experiencing difficulties in maintaining a Class B biosolids rating at two of the city's three wastewater treatment plants. Environmental Protection Agency regulations categorize biosolids as Class A or B, depending on the level of bacteria remaining in the material after being treated at a wastewater plant. Class A biosolids can be applied as a fertilizer without any pathogen-related restrictions, but there are buffer requirements, public access and crop harvesting restrictions for most Class B biosolids. Correcting the issues with biosolids coming from the treatment plants would have required digester improvements for at least two of the facilities, Beck said, and would have cost the city upward of $4 million to ensure it was meeting the Class B rating. "If we don't hit that Class B number, our choices are to find another process to do that or put it in the landfill," Beck said. "It's not economical to (send it to the landfill), and it's just wrong anyway."

City officials devised an alternative strategy that entailed the development of a $1.5 million facility that would compost the wastewater biosolids along with the materials collected at the yard waste drop-off site to produce a Class A biosolids that the city could market as a fertilizer. "It's a less expensive deal, and we're attacking two things at the same time," Beck said. The recently constructed facility includes a covered sorting area, where the biosolids and wood will be separated before composting. The materials are then blended and treated, while computers monitor the temperature and blow more air into the hoses when it drops below a certain level. "After a while, the temperature will stay pretty static, and that's when the compost time is completed," Beck said.

The pile of material is then run through a screen, separating fine particles from larger wood pieces that have not been degraded, and those larger chunks are replaced in the sorting area to go through the process again. The compost is then subjected to a series of tests to ensure its levels of nutrients, metals and organic materials comply with the Class A categorization standards. Once it checks out with the testing, the material can be bagged and marketed for application to fields, lawns and gardens.

Beck said officials expect to have enough of the product to put a marketing plan in place by the start of 2011. "We've got all sorts of ideas on how to market it," Beck said. "It's a great soil amendment, and it has a good fertilizer value to it. If you've got clay soil it really loosens it up, and if you're in a sandy area it helps bind it." The Water Pollution Control Department will oversee the operation of the facility. But with a computer monitoring the process and sending updates wirelessly, Beck said officials anticipate the site will only need to be staffed about once a week, when the materials are mixed, put in a row, separated and bagged.

Beck said the material sorting areas are covered to prevent the site from causing a stink with surrounding property owners. Its location is at a fair distance from any densely residential areas, while remaining a short trip from the city's wood disposal site and nearby water treatment facility. "It shouldn't be too odorous. We really wanted to be a good neighbor, and we don't want any complaints," he said. "It's still located pretty close to our wood drop-site and it's not very far from the southeast wastewater plant, ... they're one of our biggest biosolids producers."

Research Short Story

Fate of Chemical and Biological Emerging Contaminants in Biosolids and After Land Application

By Ian Pepper, Syreeta L. Miles, David M. Quanrud, and Charles P. Gerba, University of Arizona

Emerging contaminants currently cause great concern nationally and include both chemical and biological entities. Chemical emerging contaminants include pharmaceuticals and personal care products that function as endocrine disruptors. Biological emerging contaminants include not only newly discovered pathogens, but also infectious proteins known as prions.

A) ENDOCRINE DISRUPTORS

Endocrine disrupting compounds (EDCs) are chemicals that interfere with endocrine glands or their hormones. Among the EDCs present in wastewater, estrogenic compounds have received the most attention due to their well documented detrimental effects in exposed fish. Estrogenic activity in wastewater effluent and in biosolids is due to presence of residual amounts of steroidal hormones, nonionic surfactant

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metabolites (including nonylphenol), and other types of compounds. During anaerobic sludge digestion, alkylphenols are broken down to nonylphenol and other lower chain alkylphenol polyethoxylates that have greater estrogenic potency than the parent nonionic surfactants. Nonylphenol concentration in biosolids can reach levels of parts per thousand and thus contribute a significant component of the total estrogenicity in biosolids. Polybrominated diphenyl ethers (PBDEs) are additive flame retardants used in everyday household items including carpets and cushions. PBDEs are a known class of EDCs that are typically present at ppm levels in municipal biosolids produced in the USA, but data on the fate of PBDEs following land application are limited. PBDEs consist of two benzene rings with an ether linkage. Substitution with up to 10 bromine atoms yields 209 congeners with physical characteristics that differ primarily based on degree of bromination. In general, hydrophobicity increases and bioaccumulation/toxicity decrease with bromine addition. The magnitude of PBDE manufacture and use of these compounds in clothing and home furnishings guarantees their presence in municipal wastewater and sludges produced from wastewater treatment. Environmental exposure to PBDEs related to wastewater reuse, and use of biosolids as a soil amendment remains a concern.

**METHODS**

To evaluate the fate of endocrine disruptors following land application of biosolids, we sampled soil that had received annual applications of Class B biosolids for 20 years at The University of Arizona Marana Agricultural Center. Soils were sampled to a depth of 5 feet in one foot intervals and analyzed for specific endocrine disruptors and estrogenic activity. Specific methods of analysis are described in Quanrud et al. 2010.

RESULTS AND DISCUSSION

Estrogenic activity was not detected in either of the control or biosolid amended plots. The lower level of detection for estrogenic activity was 150 ng EE2 equivalents per kg soil. Nonylphenol and PBDEs were detected in all soils from all depths of the control, low and high rate biosolid amended plots. For both NP and PBDEs, higher concentrations were found near the surface and decreased rapidly below the 2 foot depth. The highest average (n=4) total PBDE concentration was 120 mg/kg in the upper foot of the high rate biosolid amended plot. Relatively little PBDE mass was encountered below the two-foot depth horizon (all profiles), suggesting that vertical transport of PBDEs with infiltrating rainfall or irrigation water is limited.

Due to sorption, biodegradation of the PBDEs would be unlikely. It is important to note that although the consequences of PBDE accumulation in soil are unknown, PBDE concentrations in household dust are higher than concentrations found in biosolids. In addition, a risk assessment based on these data showed that risks to human health from PBDEs in biosolids are negligible. Based on these results, land application of biosolids is likely to be sustainable with respect to EDCs.

**Figure 1. Prions with helix structure (left) and β sheet structure**

**B) PRIONS**

Cellular prions (PrP C) are proteins that are normally found in the human body, but particularly neuronal cells. The PrP C function is not completely understood but it contains 209 amino acids that form alpha-helices in the majority of prion structure, and is anchored into the cell surface by a glycosyphosphatidyl inositol (GPI) moiety (Figure 1). Infectious prions (PrPSc) are also composed of the same 209 amino acids; however it is largely composed of beta-sheets in the prion structure (Figure 1). This difference in structure is thought to result in the prion associated diseases that can be fatal. If a PrPSc is in the vicinity of a PrP C, it can induce a conversion of the structure to form a PrPSc. An accumulation of PrPSc can cause the transmissible spongiform encephalopathy (TSE) disease that can be transmitted from host to host in a single species or across species. There are many types of TSE diseases affecting both animals and humans such as scrapie commonly affecting sheep and goats, Chronic Wasting Disease (CWD) affecting deer and elk in the United States, or the most infamous form of TSE called bovine spongiform encephalopathy (BSE) also known as “mad cow disease.”

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disease” which caused an epidemic in the U.K. during the 1990's. The BSE epidemic has increased the public health concerns not only because it infected over 180,000 cows, but because it is also the portable cause of the human version of TSE called variant Creutzfeldt-Jacob disease (vCJD).

The potential route of exposure of prions to humans is shown in Figure 2.

This study examined the survival of infectious prions in biosolids. To accomplish this, a method was developed for extracting prions from biosolids that was compatible with the assay of the samples using cell culture. Heating biosolids samples with 4 M urea and reducing the urea concentration by membrane centrifugation resulted in a method capable of recovering prions with an efficiency of 17.2% following detection via an enzyme-linked immunosorbent spot (ELISPOT) assay (Figure 3).

This method was then used to study the persistence of prion infectivity in Class B biosolids incubated at mesophilic (37°C) and thermophilic (60°C) anaerobic digester temperatures. A 2.43-log₁₀ reduction in prion infectivity was observed under a mesophilic (37°C) temperature after 15 days and 3.41-log₁₀ reduction was observed after 10 days at a thermophilic temperature (60°C). This loss of infectivity was greater than in PBS, suggesting factors other than temperature are responsible for the loss of infectivity of the prions.

In summary, a method has been developed that allows for studies on the survival of prions in biosolids. The determination that prions are inactivated at mesophilic or thermophilic temperatures is significant since it implies that infectious prions will not survive wastewater treatment and therefore will not be present in biosolids that is subsequently land applied.

**LITERATURE CITED**


**Nitrogen fertilizer replacement value of biosolids for winter wheat in the Willamette Valley**

*By Dan Sullivan, Oregon State University*

*OSU collaborators: Mike Flowers, Eddie Simons, Daniel Jepson, Richard Mattix*

*Research support provided by Northwest Biosolids Management Association and Oregon Association of Clean Water Agencies*

**Background**

Increased fertilizer costs have increased grower interest in biosolids. Improved estimates of plant-available N release from biosolids under Willamette Valley conditions are needed in order to determine profitable biosolids application rates. Winter wheat acreage has increased dramatically in the Willamette Valley in recent years.

**Objectives**

- Evaluate biosolids as a N source for winter wheat
- Determine grain yield response to biosolids application timing (fall vs. spring application)

**Experimental Design**

4 replications
Randomized complete block design, each field treatment plot 7 x 20 ft.
Site: OSU Hyslop Agronomy Farm, Corvallis, OR
Woodburn silt loam soil, 2.3% organic matter (0-12 in.)

**Experimental treatments**

N application rates: 0, 40, 80, 120, 160, or 200 lb total N/acre
N sources
Soundgro heat-dried biosolids (5-4-0)
Urea (46-0-0)
Timing of biosolids application
Preplant (Oct 12), or spring (March 1)

Additional spring-only N source:
City of Myrtle Creek (OR) biosolids dried via Fenton process.
Applied at 80 lb total N/acre, March 1.

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Results
Grain yield (2008-9 growing season; graph to right) demonstrated that N fertilizer equivalence of Soundgro heat-dried biosolids was ≥ 50% of total N when applied in fall (preplant), or in spring.

Soil testing for mineralizable N (Feb 18, 2010; 0-12 inch depth) demonstrated an increase in soil N mineralization potential associated with a fall biosolids application. A fall biosolids application of 200 lb total N per acre increased the spring mineralizable N soil test by approx 30 to 40 lb N/acre (table below).

Wheat flag leaf chlorophyll (measured by SPAD meter) and flag leaf area (cm² per 10 leaves) measured on May 27, 2010 at flowering growth stage demonstrated showed relative N fertilizer effectiveness: spring urea > spring biosolids > fall biosolids (graphs next column). The flag leaf is the uppermost leaf on the plant, just below the wheat head. The size, color and nutrient content of the flag leaf are important indicators of grain yield potential.

Stripe rust (leaf disease) was severe in spring 2010 because of prolonged cool, wet weather. We observed that bigger, greener flag leaves had earlier leaf death due to stripe rust on June 8, 2010 (photo below). We expect stripe rust to reduce grain yield of spring urea and spring biosolids treatments, while having less impact on grain yields for the fall biosolids treatments.

Conclusion
Spring or fall applied Class A heat-dried biosolids (Soundgro) application increased grain yield in 2009, and indicators of grain yield in 2010 (plant growth and chlorophyll). Grain yields for the 2009-10 trial will be determined in a few months (August). N fertilizer equivalency for the SoundGro heat dried biosolids in 2009 was ≥50% (relative to spring applied urea).

Calendar of Events

MBT Meetings

Thursday, November 18, 2010
Location TBD
10:00 a.m. to 12:00 p.m.
Holiday Party

Other Events

MBT Fall Biosolids Seminar
October 14, 2010
Charlevoix Public Library
Charlevoix, Michigan