BOCC

Bio-Organic Catalyst Canada

Cleaner, Safer, Waste Remediation

Town of St. Marys Wastewater Treatment Facility, Ontario, Canada

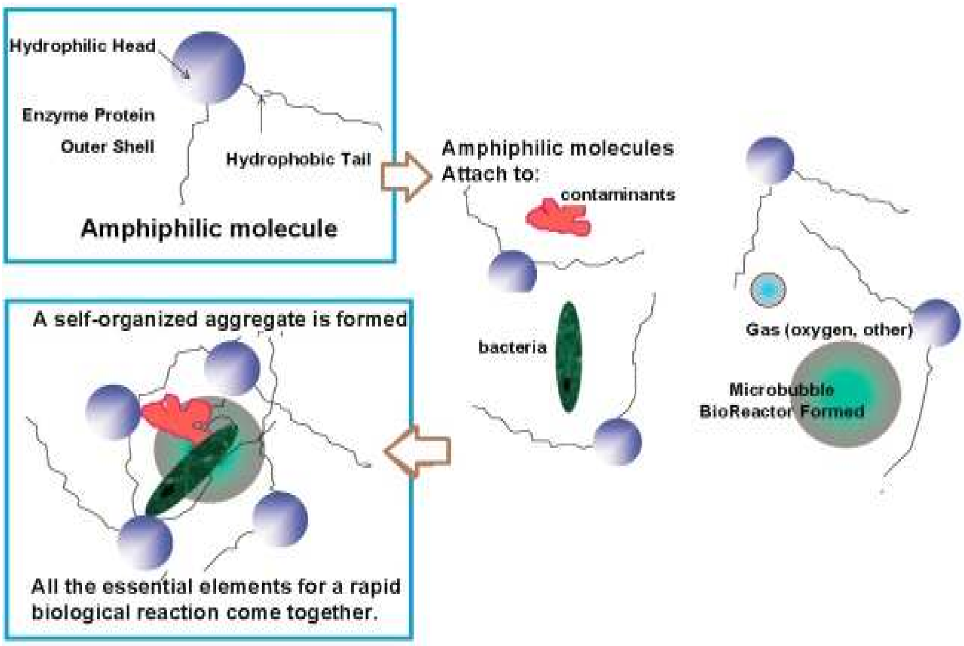
Summary of Field Trials for Bio Organic Catalyst

Oct 21, 2013

1. BIO-ORGANIC CATALYST

Technology Description

Bio-Organic Catalyst [BOC] is a concentrated liquid that contains patented amphiphilic molecules or surfactant. The organic catalyst contains no bacteria and is a nontoxic and biodegradable product. The functional mechanism is attributed to the amphiples molecules, these molecules consist of both a hydrophobic and a hydrophilic element. BOC's patented amphiphilic molecules attach to components such as bacteria, organics, oxygen, foul gases and also bi-products of decaying organic matter including sulfides, amines, mercaptans, skatole, and other contaminants in the aeration basin. Once they attach the components it then self-organizes into a loose aggregate, creating an ideal situation for biological and chemical reaction to rapidly occur. When molecules are physically close together they form a common aggregate; countless such aggregates are formed across the bin thus rapidly enhancing the speed of biological degradation of the organic contaminants and chemical oxidizing the inorganic pollutants. There are three aspects of the mechanisms of action in BOCs that work synergistically together: oxygenation, solubilisation, and catalysis.



2. ST. MARY'S WASTEWATER TREATMENT FACILITY

The plant is located on Thomas Street in the Town of St Mary's. The plant sees a wide flow rate fluctuation as well as significant variability in the organic concentrations in the incoming wastewater. BOCC was dosed in the anoxic tanks. The anoxic tanks also receive activated sludge, secondary digester overflow, internal recirculation from the aeration tanks and other process effluent. The overflow from the anoxic tanks is fed into the aeration tank. The treated effluent from the aeration tanks overflows into the gravity clarifiers and thereon into UV disinfection before it is measured and discharged to the river.

The waste sludge is thickened and stabilized using primary and secondary digester. A second dose of BOCC was introduced in the feed to the Anaerobic Digester; the digested (anaerobic) solids are dewatered and thermally treated to meet Bio-solid Class A requirements. The treated bio-solids are stored in concrete tanks and then pumped out in two times per year for land application.

3. TEST PLAN

1.1. Test – Expected Outcome

The outcome was to validate that the process meets the following requirements:

- Financial objectives
  - Lower sludge generation resulting in
    - Lower steam and KOH consumption in biological cell breakdown process
    - Lower transportation cost
    - Lower land application cost
    - Lower polymer and chemical consumption.
  - Reduced power and chemical consumption in aeration tank
- Process Objectives
  - Robust and resilient process
  - Higher quality of biogas that can be easily used in a Combined Heat and Power unit in future.
- Environmental Objectives
  - Higher VS destruction (stabilized Bio-solids)and
  - Higher biogas Generation (renewable energy) quantity
  - Wastewater treatment at lower sludge yield rate and consistently producing treated effluent meeting all applicable Ontario regulations, guidelines, procedures and site specific effluent quality criteria.
  - Substantial odour elimination

1.2. Key Milestone Dates

Start date to the anoxic tanks	-	December 3, 2012.
Start date to the digester	-	February 11, 2013.
End date for the project	-	April 26, 2013.

1.3. Test – Data

Biogas Yield

Biogas generation is a function of

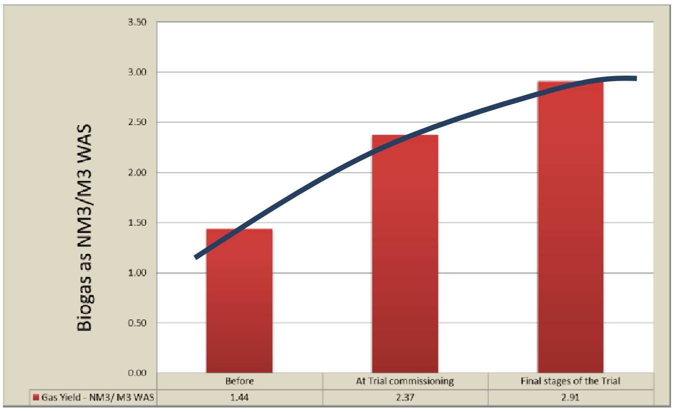
1. **WAS generated** and rejected from the Process
2. VS capture rate in the RDT and **feed to the primary digester**
3. Biodegradability of VS and the **health of the digesters**(optimized biological and chemical control parameters).

All process control parameters were stable and operated at constant levels,

- Sludge wastage reduced to half
- Approximately 45% higher biogas was generated in the anaerobic digesters with lower VS feed.
- Quality of Biogas Improved - CH_4 Concentration in Biogas increased from 56% to 63%.

Biogas yield based on WAS generation - The trial started on December 3, 2012 and was concluded in April of 2013; three data samples were chosen to evaluate the effectiveness of the BOCC.

The three data-points biogas generation trend is as below



The data indicates that BOCC dosing at the anoxic tank improved the biogas conversion by 65% and an additional dosing at the primary digester inlet further improved the conversion by 18% for an overall doubling of biogas conversion from sludge.

- **Improved CH4 % in the Biogas**

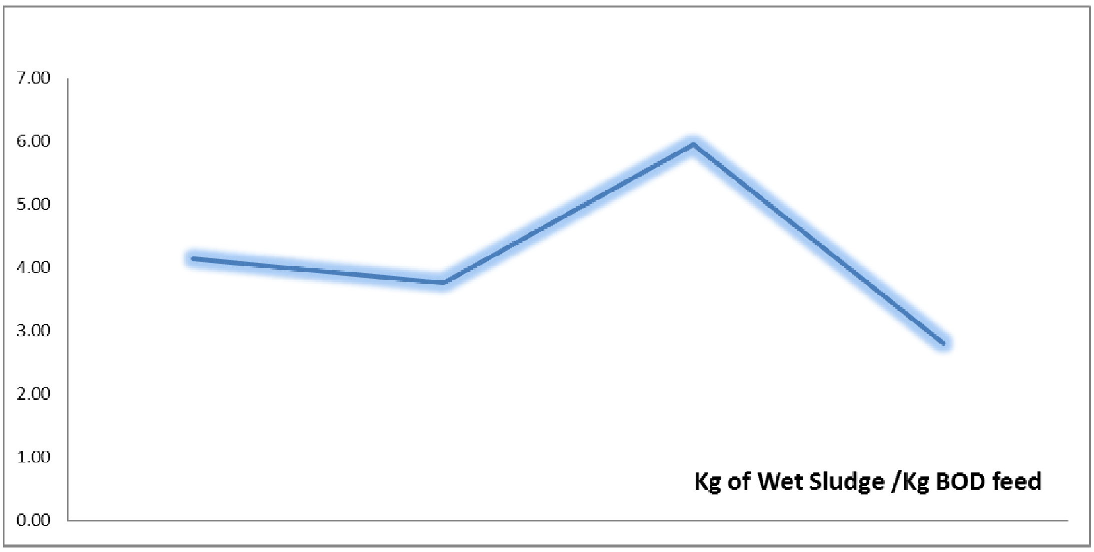
  Typically the methane concentrations in the digester gas samples of fall within the typical range of 55 to 65 percent for digester gas;then it is considered as an indication of a well-functioning digestion process. Biogas samples were analyzed before BOCC dosing was initiated and after the BOCC dosing. The tabulated information is as below

Date	CH_4 (Methane as %)
26/02/2013	56%
18/03/2013	63%
26/03/2013	66%
02/04/2013	66%
08/04/2013	63%

  The Table shows a stabilized CH_4% in Biogas, and also reflects an net increase of CH_4% in Biogas from 56% to 63% (an increase of ~ 12.5%)

The system is performing at **69% lower generation of WAS** that needs processing, haulage and disposal.

Another method of looking at the sludge generation is the amount of sludge generation from this facility and developing a co-relation with the input organic load over the period of the trail.



Based on the Influent Volume the sludge yield also shows a constant decline

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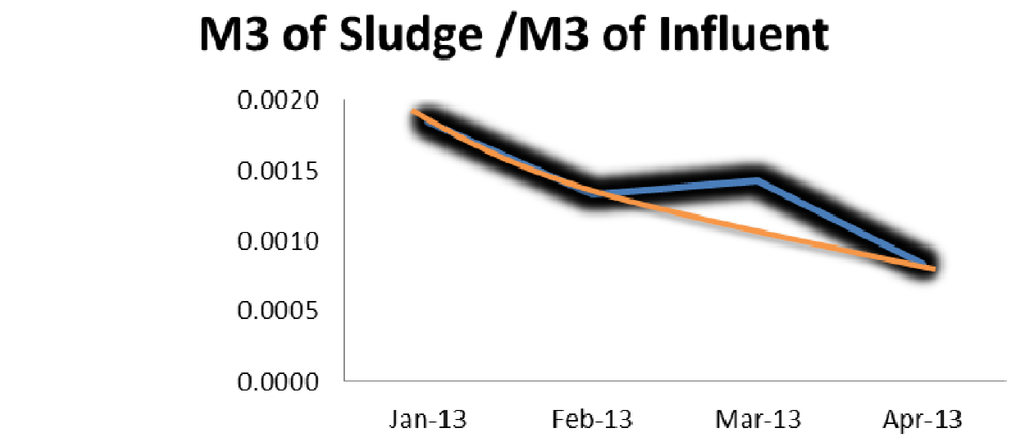

	Jan-13	Feb-13	Mar-13	Apr-13
M3 of Sludge /M3 of Influent	0.0019	0.0013	0.0014	0.0008

Conclusion

The Field Trial included a review of St Mary's WWTP documentation review, including their daily report and review of the sample analysis. The samples were collected and analysed under the guidance of Fleming College. Based on the above it can be easily concluded that there was a steady decline in the sludge generation from the system.

Any indication of significant inorganic accumulation in the system was not observed.

The sludge reduction is approximately

- 55% - when compared wrt hydraulic flow of influent into the Facility.
- 32% - when compared wrt BOD_5 coming along with the influent into the facility.
- 69% - when compared wrt desktop modelling of the influent understand standard operating conditions

Process Robustness

The key process parameters that indicate the health of the treatment Facility or WWTP were all in the desired range.

- Sludge age (mean cell residence time) , Dissolved oxygen , Nutrient requirements
- Cone settle-ability, Sludge volume index (SVI), Microscopic examination of sludge

The plant successfully managed the day to day fluctuations of Organic loading rate as well as the hydraulic flow rate.

Power Consumption

The piping layout on site is such that the aeration headers or the air distribution manifold is also connected to the WAS equalization tanks and the same blowers are used to keep the TSS in the WAS equalization tank in suspension.

The review of the plant data also indicates that although all the aeration tanks are designed to receive the same flow and organics and are designed with the same dimensions and configuration, the DO in the outside tank falls faster than the other two tanks. Also, the flow regulation is purely based on overflow and gate valve opening and it is difficult to conclude that the flow in these tanks can be regulated. Therefore, in situations where one of the three tanks receive higher organics the DO will fall and this may trigger the second blower to turn on, while keeping much higher DO's in the other two aeration tanks. The orientation of the blowers, air distribution manifolds and the use of the same blowers for keeping the equalization tank in mix, make it hard to capture the positive impacts of the BOCC electricity reduction in the process.

> **Reduction of Aeration Power**
>
> - Although similar concepts have been proven at other operating plants, but could not be established at St Mary's trial due to complex air distribution and no direct power measuring abilities.

1.4. Test – Data Analysis

The data collected during the field trials clearly indicates that the use of BOCC

1. Improved uptime and process resilience
2. Reduced risks from storm or snow melt inflow. As the site is mixed feed, dosing of BOCC proved that the system can handle higher rain water without the risk of sludge washout and without any delay in the recovery of process.
3. Improved the quality of biogas that can be easily used in a Combined Heat and Power unit in future.
4. Increased VS destruction (stabilized Bio-solids)and
5. Generated higher biogas (renewable energy) quantity
6. Enabled wastewater treatment at lower sludge yield rate
7. Achieved consistent results for treated effluent Ontario regulations, guidelines, procedures and site specific effluent quality criteria.
8. Substantially reducedodour withno foaming observed during the trial period.

4. CONCLUSION

Based on the study conducted and the data analysis, it can be concluded that the sludge generation rate reduced drastically with the BOCC dosing in the system and also not only did the Biogas generation rate increase but also a significant increase in quality of biogas was observed.

Reduced CapEx on Expansion

The sludge yield reduced by an average of 55%. This technically re-rates the plant capacity on the back end of the process to double then that of the existing rating. This would occur without any major infrastructure capital expenses for downstream processes including WAS Storage, WAS thickening, Anaerobic Digesters, sludge storage as all these process required no upgrading. This is a significant capital cost that can be avoided. This can be roughly estimated as avoidance of around $5 million USD capEx.

Reduced Solid Processing Cost

- Lower disposal cost – based on the data collected, for 4000 M3/d of Influent, this will reduce around (7.6-3.2) = 4.4 M3/d,or 1606 M3/year or $12,500/year (@ $8/M3 sludge disposal).
- Lower polymer and chemical consumption – assuming 4000 M3 of Influent and 0.8 MT of dry solid yield and a dry polymer consumption norm of 8 Kg dry/Tonne of TS (on dry basis) , polymer consumption/d = 6.4 Kg/d @ $4/Kg dry = $25.6/d Or $9,344/Year, BOCC dosing can save 55% of this, saving potential - $5,150.