Update May 2017

2015-02 - The Development and Commercialization of Aerobic Digestion of Poultry Manure to Produce Bio-Active Fertilizers

- The project focuses on the aerobic digestion of poultry manure to produce plant fertilizer solutions to be used in greenhouses and field crops. Their fermentation process utilizes oxygen enhancement and pH control to minimize nutrient losses due to precipitates and ammonia off-gassing. The use of oxygen greatly reduces odours and accelerates the process.

Technology and Project Developments

I. **Supplementing Soluble Carbon to Increase Microbial Biomass** [1st Attachment]
All 13 fermentation runs to date are characterized by having a (rapid) exponential decay of soluble carbon given by BOD, Biological Oxygen Demand, graphs. The addition of methanol to the culture served to yield 1000 X more bacteria. We're up to 10^{11} bacteria per mL - that's 100 million bacteria per drop

The 1st attachment highlights pathogen kill due to competition from other bacteria. It would be ideal to co-ferment a waste stream rich in soluble carbon with poultry manure.

II. **Iron Supplements** We're experimenting with adding iron sulfate to the culture in order to increase the iron concentration. The goal is to *pressure* the bacteria to uptake iron; if so, once they die the iron would likely be available to plants. Chemical analysis does indicate increased iron concentrations.

Peculiarities have been observed. [2nd Attachment]; divalent cation oscillations have been observed for the first time. Iron had these oscillations for both types of analysis – dissolved iron varied between 15 and 185 / 125 ppm – the final solution assayed for 100 ppm iron – easily 5 to 10 times more iron than prior runs. *But, is it available to plants?*

Are these oscillations due to chemistry – phosphate is quite consistent it fluctuated between 750 and 1,000 ppm - (*Maybe more conjecture than hypothesis) Can these divalent cation oscillations be due to microbial biomass i.e. uptake during growth and release during death phase?* It's difficult to conclusively correlate runtime heat cycles to these cation concentration cycles.

One of many questions: at the valley of these oscillations where did the cations go?

III. **pH Control Agent Development** The acid control agent is now an acid blend of sulphuric (the cheapest) and phosphoric (the most expensive) acid; doing so serves to modestly increase the phosphate levels. The caution is not to increase the phosphate concentration so much as to lose nutrients by inducing irreversible phosphate-divalent cation precipitates. Similarly, the base control agent is a blend of ammonium and caustic (potash) hydroxides; the addition of ammonium hydroxide may serve to stimulate bacteria growth especially at the beginning.

Most runs tend to go to higher pH's (near 9); at these times there's considerably more acid added to the culture than base. However, at times (possibly due to low oxygen levels and other factors) there are "*runs that go acidic*" – in the presence of a catalyst it may be able to produce hydrogen during these conditions [3rd Attachment].

IV. **Vinegar as an Antifoam Agent** Commercial cleaners use vinegar as an antifoam agent; the project also tried using vinegar as an antifoam agent: It appears adding vinegar to the culture at the beginning does delay the need for antifoam addition – this allows the culture to easily attain temperatures near 70°C since antifoam addition is known to negatively impact broth temperatures. However, there appears to be a negative impact (unknown at this time) in using vinegar since the last two runs stalled and vinegar may have induced a "major Foam-Out".

For comic relief: please note the [4th Attachment];

V. **CARA Soil Health Study** A producer research group will be investigating the solution's impact on soil health; soils were trialed Fall of 2016 and Spring of 2017. The group will likely be assessing the impact on a Tree Farm's three year trial of the solutions.

For greater process / technology detail a webinar was archived at this link: [https://gov-ab.webex.com/gov-ab/onstage/g.php?PRID=af09e48e11e118d1f4c659631e98c4df] select, 14 February, 2017

Presented at the "Cultivating Connections Forum" Edmonton Northlands, the display booth was well received; the project also had a display booth at Edmonton's Green Industry Show & Conference.