Sodium alginate composition and molecular weight

Sodium alginate is a naturally abundant polymer found in seaweed. The polymer has potential use as a eco-friendly, industrial fiber that can biodegrade when composted or in seawater. To successfully engineer sodium alginate into an industrial fiber, we must be able to understand the affect of its acid groups and molecular weight on fiber spinning. Typically when sodium alginate is sold, its viscosity is given as an indication of its molecular weight. The research goals of the proposed study are two-fold: 1) specify an analytical technique can calculate the actual molecular weight of sodium alginate polymers and 2) give a protocol for determining the acid value of sodium alginate raw materials. Once the molecular weight is determine, we can calculate the number of acid groups per molecule.

ASTM D 974 and DIN 51558 (for mineral oils, biodiesel), or specifically for biodiesel using the European Standard EN 14104 and ASTM D664 are both widely used worldwide

Parameters:
MDSC experiments were conducted as follows: equilibration at -20 °C, modulation of ± 0.796 °C of the average temperature every 60 seconds, and a temperature ramp up to 300 °C. The average rate of heating was 5 °C/min in nitrogen.

References
http://www.tainstruments.com/pdf/literature/TP_006_MDSC_num_1_MDSC.pdf

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Reading, M., D. Elliott, and V.L. Hill, A New Approach to the Calorimetric Investigation of Physical and Chemical Transitions. Journal of Thermal Analysis, 1993. 40(3): p. 949-955.

Projects-Spring 2019-CHEM 452

1. **Assessing Swine Sludge Bioactivity and Mineral Composition by strata**
    1. **Summary**

Swine manure is stored in open earthen lagoons where the top liquid is used frequently for crop irrigation. Solids accumulated at the bottom of the lagoon, referred to as sludge, are only removed once every 20 years. While these solids have been analyzed as a mixture before, no studies attempted to track changes in composition with depth. Furthermore, no attempts were made to assess the change in biological activity in the accumulated sludge by depth.
In this study we use multiple (4) solids core sampler to ensure the recovery of an intact sludge profile (2" diameter, 1 ~ 2' depth). Subsequently, the sludge core is frozen then sliced into discrete samples (3" height each) before freeze drying to facilitate analyses.

2. Analyses:

- FTIR Analysis→ To quantify changes, if any, in organic matter structures with depth in the lagoon.
- ICP-AES Analysis → To quantify changes, if any, in elements such as phosphorus, calcium, copper, and zinc.

3. Rationale

Findings from this study will help provide insights into changes in swine rations and feeding efficiency over a 10 to 20 year time-horizon. It will also provide producers with a more accurate estimate of the value of these recovered solids as soil amendment/crop fertilizer. This is

particularly critical since heavy metals, such as copper and zinc, can cause soil toxicity when applied in excess of crop needs.

2. Assessing influence of enzymatic and bacteria consortia on anaerobic digestion of swine manure

1. Summary

Swine manure is stored in open earthen lagoons that can be a source of malodorous emissions. There is interest in covering swine lagoons to mitigate odors and/or use anaerobic digesters to recover gaseous fuels (biogas) from the manure organic matter. The use of selected enzymes and bacteria can be beneficial to improve yield of gaseous fuel and/or reduce emissions of malodorous gases. In this project, two commercial products currently in R&D stages will be tested separately and as a blend to improve biogas productivity from swine manure. Anaerobic digestion tests will be conducted in closed reactors with pressure sensors to measure gas production yield.

2. Analyses

- Gas composition → to assess the impact of treatments, i.e., (1) enzyme blend additive, (2) bacterial blend additive, and (3) mixture of enzyme-bacterial additive, compared to control digestion unit.
- Digestate composition (CHNOS, ICP-AES) → to assess the impact of treatments on digestion process residue, i.e., nutrient and energy contents.