

## **Effect of ammonia inhibition on anaerobic conversion process of pig manure**

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Anaerobic digestion process inhibits due to the presence of ammonia, sulfide, light metal ions (Na, K, Mg, Ca, and Al), heavy metals, and some organics (chlorophenols halogenated aliphatic, N-substituted aromatic, long chain fatty acid). Ammonia is the main inhibitory factor in pig manure as it contains nitrogen. Although it is an important buffer in the process and an essential nutrient for microorganisms, if not controlled, high concentrations causes to operational failures. It is also leading to a low methane yield.

Since ammonia has free cell membrane-permeability, it is the active component causing ammonia inhibition. As ammonia is hydrophobic, the molecule diffuses passively into the cell which causes proton imbalance and potassium deficiency. Free ammonia concentration depends on the total ammonia ( $\text{NH}_3 + \text{NH}_4^+$ ), pH and temperature. Total ammonia concentrations level of around 1700–1800 mg/l, completely inhibitory to the inoculum which has not adapted. Literature shows that, with adaptation, inhibitory total ammonia nitrogen levels could increase up to 5000 mg/l. By using a semi continues anaerobic digestion process with an anaerobic inoculum and pig manure, can achieve that adapted inoculum. Adapted inoculum can give more than 250ml of bio gas volume per 50ml of pig manure which has 7% w/w solid content.

Because of above phenomena methonogen bacteria can be completely inhibited while Acetogen bacteria still can produce acids in a toxic environment. Therefore, acids are formed leading to lower methane yield. Due to that reason, when pig manure is anaerobically digested with adapted inoculum, pH drops from 6.5 to 6.3 during first 3days.

There are several methods mentioned in literature to reduce the ammonia inhibition directly in the anaerobic processes such as adaptation of microorganisms, co-digestion, increasing the COD:TKN (Chemical Oxygen Demand: Total Kjeldahl Nitrogen), dilution of the reactor content and adding trace elements. In this research Co digestion strategy was used to minimize ammonia accumulation in pig manure anaerobic digestion process. Pig manure was digested with food waste in different ratios. Adapted inoculum was used for this process.

**Keywords:** Anaerobic digestion, pig manure, inhibition, total ammonia