Questions During Ammonia Recovery Webinar on August 25, 2014

Question: What is the service life of these membranes?

Answer: We had an experiment running with livestock wastewater for one year without problem. Potential life not determined yet. However, it is known that PTFE (Teflon) is a long lasting material.

Question: Is this a batch or continuous process?

Answer: Our testing with liquid manure was mostly done in batches, but it can be easily configured for continuous process.

Question: What is the cost of this technology for farm use?

Answer: For pilot testing in a swine operation, we calculated that it is cost effective. For example, chemical and equipment (annualized) costs for a membrane module that treats effluent from 1000 finishing pigs after solids separation (20 kg N/day) were $16,388/year. On the other hand, at current prices of fertilizer ($522/ton of ammonium sulfate), the value of the recovered N was $20,002/year.

Question: In the low rate aeration, how low a rate are we talking about?

Answer: Very low compared to requirement for biological N removal. For example, effluent from 4000 pigs will require only 14 ft3 air/min (power consumption of 21.3 kWh/day).

Question: Is this cost effective for middle level dairy farms?

Answer: Some preliminary cost calculations for swine are provided above. It is more effective with higher strength manure (1000-3000 ppm N).

Question: Can this system be retrofitted into an existing operation?

Answer: Yes, it can retrofitted in manure storage tanks, pits, and lagoons.

Question: What is the effect of the membrane on sulphur (H2S)?

Answer: Gaseous sulfur could pass through, provided proper stripping solution is used. We have plans in our research project to develop modules for H2S removal from liquid manure (ARS Project 6657-13630-005-00D Objective 1d).

Question: Any concerns about clogging of the membrane?

Answer: There are concerns about membrane fouling, and cleaning protocols will be developed along. But the chance of clogging is lower than traditional membrane filtration (ultrafiltration, RO, etc. In this technology, the liquid does not pass the membrane, only gaseous forms. We experienced that after three months of submersion of membranes in liquid manure a slime film started to develop which was detached easily from the PTFE surface by slight shaking.

Question: What about volatile organic compounds (ethanol, etc) in terms of whether they pass through the membrane?

Answer: Volatile fatty acids (odour compounds) passed through. We have plans in our research project to refine technology for odor removal (ARS Project 6657-13630-005-00D Objective 1d).

Question: I am assuming that these membranes are suspended from the roof of the poultry house. Any concerns with the weight of the membrane?

Answer: We are currently carrying a demonstration of the membrane technology using tubular membrane manifolds hanging from the roof of the poultry house at the poultry research facility of the University of Maryland Eastern Shore (UMES). This allows adjust the height of the manifolds to the size of the birds or raise the system during cleaning of the house (Slide 61 of the Webinar).

Question: So, these membranes are modular units that can be changed when their service life is used up?

Answer: Yes, membrane modules are easy to scale up, replace or serviced.

Question: What is the chemical reaction using lime to increase ammonia recovery?

Answer: Lime addition to the poultry litter increases its pH and the conversion of ammonium (NH4) to ammonia (NH3), and ammonia volatilization rates. Therefore, the speed of ammonia volatilization and recovery by the membranes can be enhanced by increasing the pH of the litter.

Question: It sounds like there is a lot more work that needs to be done on a pilot scale before it can be applied universally?

Answer: Yes. Indeed, we are carrying out two pilot demonstrations. One demonstration is to remove ammonia from air being carried out at UMES poultry facility now (Slide 61). A second demonstration is to remove ammonia liquid manure and is being carried out through a NRCS-CIG grant in North Carolina (Slide 37).

Question: Is this economically feasible today? When do we think this technology will be available?

Answer: For pilot testing the annualized cost of ammonia recovery for a typical poultry house size growing 20,000 broilers (42 days per flock, 6 flocks per year) the chemical and equipment (annualized) costs for a flat membrane system was $6,028. The recovery of N as ammonium sulfate was $3,339. Considering the value of recovered N, the net cost was $2,689 per year without assuming any savings from reducing energy use in the poultry house during the winter.

There is a U.S. Patent issued on this technology and currently available for commercial use though licensing with USDA-ARS, Office of Technology Transfer.