

Abstract: Removal of Dissolved P and N from Livestock Manure by Air Stripping

AirPrex® is a proven technology to recover phosphorus (P) and nitrogen(N) in the form of struvite from sewage sludge. Formation of struvite is dictated by pH of the solution. Unlike other struvite recovery technologies which elevate pH by adding alkali solutions, AirPrex® uses stripping of CO₂. Due to its simplicity of operation, AirPrex® could be a viable option for recovery of nutrients from livestock manure.

Until recently, the relevance of AirPrex® technology was limited to municipal wastewater treatment plants, where sewage sludge is often digested anaerobically for volume reduction and renewable energy production. However, as more livestock producers are moving towards adding anaerobic digesters to their operations, AirPrex® could be applied to recover nutrients from livestock manure in a concentrated form.

This concept paper is prepared to illustrate the potential application of AirPrex® to manure digesters. In the proposed system, anaerobically digested manure is screened to remove coarse fibers and thickened to 4% solids. Thickened manure is then fed to AirPrex® reactor. Treated manure is, then, dewatered with decanter centrifuge to maximize the nutrient and moisture removal from manure solids. The whole system is expected to reduce by 71 – 85%, the total P and by 5.7-35%, the total Kjeldhal N of anaerobically digested swine manure. Air stripping and removal of CO₂ could enhance volatilization of ammonia, providing opportunity for further N removal and recovery.

With this process the removed nutrients would be concentrated within the produced struvite and manure solids. The whole process is expected to cost \$26 per animal. Yet some of this cost could be recouped by the sales of struvite (\$10-20 per head) and other benefits specific to each farm such as avoided long distance hauling of manure, improved dewaterability of manure and avoided dredging of lagoons.

Although AirPrex® itself is already an established technology; it has not been applied to manure treatment. So the technology development would start from bench scale AirPrex® testing to identify the facilities with desirable feed characteristics (e.g. high dissolved reactive phosphorus and ammonia, relatively low in ions which compete with Mg, such as Ca). Once several facilities are identified, a mobile pilot scale AirPrex® unit with a screen and decanter centrifuge will be sent to the farm to conduct pilot tests. From there, the AirPrex® in tandem with an advanced dewatering system could be commercially available for livestock producers.

Besides bringing AirPrex® technology to the field of manure management, two research opportunities are identified to further optimize the nutrient recovery from livestock operation. First, the fertilizer equivalencies of three products harvested from the proposed systems (struvite, manure solids, and the reject liquid) are to be evaluated to ensure the efficient use of nutrients and minimize the loss to the surrounding environment. Secondly, a modification of AirPrex® system will be explored to capture the ammonia which is stripped out along with CO₂ to maximize the recovery of N fertilizer and prevent N pollution to the environment.