Optimization of Phosphorus Partitioning in Dairy Manure Using Chemical Amendments with a Mechanical Solids Separator

Inhwan Oh1, R.T. Burns2, L.J. Moody2, I. Celen2, J. Lee2

1Department of Agricultural & Biosystems Engineering, Konkuk University, Chungju, Korea
2Biosystems Engineering and Environmental Science Department, The University of Tennessee, Knoxville

Introduction

- Long term and over application of manure results in accumulation of phosphorus in soil causing nutrient enrichment of surface waters during rain events and leading to eutrophication of streams and lakes
- Reduction of soluble phosphorus from animal manure prior to land application would:
  - Reduce P runoff
  - Prevent eutrophication
- Mechanical separation is an effective way to remove solids from manure slurries
- Research has shown that soluble P is preferentially partitioned in the liquid fraction following separation
- Proposed system consists of a screw press to remove solids from slurries using chemical additives to bind the soluble P and partition it into the solids fraction

Objectives

- Using metal ion and cationic polymer additive, assess potential of screw press separator to partition soluble P into the solid fraction of dairy manure
  - Determine optimal metal ion to soluble P ratio for phosphorus precipitation and solids reduction using Imhoff cones
  - Determine effect of metal ion and polymer addition on nutrient partitioning in the screw press separator

Material & Methods

- Metal ion : SP ratios tested were 0.1, 4.1, 8.1 & 12.1
  1) To perform a replication, slurry was continuously mixed in a 17 L bucket while 1 L quantities were obtained
  2) Chemical was added to the non-control slurries and stirred 5 min.
  3) Slurry was then poured into the 1L Imhoff cones
  4) Settled volume was monitored at 2, 5, 10, 20, 40, 60, 120, 240 minutes
  5) All experiments were replicated in triplicate
  6) Supernatant was analyzed as listed above

Screw Press Test Conclusions

- Addition of metal ion in combination with polymer to manure slurry before the screw press enhances soluble phosphorus and total phosphorus reduction in the press liquor
- Al2(SO4)3 : SP ratio is 7.5:1 and yields 96% SP reduction
- FeCl3 : SP ratio is 8:1 and yields 99% SP reduction
- Addition of 30 mg/L of polymer was sufficient to bind TSS particles
  - With polymer there was a ~79% reduction in TSS

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