

The Summer Undergraduate Research Fellowship (SURF) Symposium
6 August 2015
Purdue University, West Lafayette, Indiana, USA

Recovery of Nutrients from Animal and Human Wastes

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ABSTRACT

Removal of nitrogen- and phosphorus-containing molecules from wastewater is necessary to prevent excessive growth of algae and resulting chemical changes to bodies of water. Of wastewater components, urine contains relatively high concentrations of nitrogen and phosphorus, the majority of which is ultimately present as ammonia and phosphate. Separation and stabilization of these nutrients may also allow for their reuse as fertilizer. Before the nutrients may be stored, they must be stabilized. At least a portion of ammonia-N must be converted to nonvolatile nitrogen. This may be achieved by using ammonia- and nitrite-oxidizing bacteria (AOB and NOB, respectively) to convert ammonia to nitrate. Three fluidized bed reactors were developed to accomplish partial nitrification of human urine, swine urine, and supernatant from an anaerobic digester. AOB and NOB communities were established by incubation on Kaldnes K1 media in an ammonium chloride solution in a separate vessel. Ammonia concentration, pH, dissolved oxygen concentration, nitrate concentration, and nitrite concentration were measured to characterize the performance of each reactor. After replacing the ammonium chloride incubation solution with the three waste streams, detectable nitrification activity ceased. After diluting the feeds and shifting reactor pH to 7.5, no evidence of nitrification was found. Lack of nitrification after adjustments suggests decreases of AOB/NOB populations after application of the more concentrated waste streams. Development of a strategy to more gradually increase feed concentrations may be required for future work with similar reactors. Improvements to pH control will also be needed to accomplish effective startup of these reactors.

KEYWORDS

Ammonia oxidizing bacteria, nitrite oxidizing bacteria, urine, nutrient recovery.