Water Science & Technology

Volume 78, Issue 4
25 September 2018

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RESEARCH ARTICLE | AUGUST 16 2018

Recovery of ammonia in anaerobic digestate using vacuum thermal stripping – acid absorption process: scale-up considerations

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Water Sci Technol (2018) 78 (4): 878–885.
https://doi.org/10.2166/wst.2018.360 Article history

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Abstract

A vacuum thermal stripping process coupled with acid absorption has been developed at laboratory scale to recover ammonia in anaerobic digestate. To make this ammonia recovery process scalable, this study investigated the effects of feed depth on vacuum thermal stripping in a pilot system, developed sodium hydroxide dosages required to raise feed pH for stripping, and simulated the dynamics of ammonia reduction in batch stripping tests. As feed depth was increased from 8.5 to 34.0 cm, the ammonia mass transfer coefficient and ammonia stripping efficiency decreased while the mass of stripped ammonia increased. Digested municipal sludge had a greater ammonia mass transfer coefficient than digested dairy manure at each feed depth, which could be attributed to the difference in suspended and dissolved solids concentrations. The optimum feed depth was 18 cm of the digested sludge and 14 cm of the digested manure. Sodium hydroxide dosage for the digested manure was higher than that for the digested sludge and co-digested foodwaste. The dosages were correlated to concentrations of total dissolved solids and ammonia. Total ammonia concentration decreased exponentially in batch stripping of the digested sludge at 25.5 cm deep, with a first-order stripping rate coefficient of 0.087–0.144 h^{-1}.

Keywords: ammonia recovery, dairy manure, digestate, dosing curve, sludge, vacuum stripping