RP2008

WASTEWATER BIOSOLIDS

Research Question

1. ***Greenhouse gas emissions:***

The current greenhouse gas (GHG) accounting model used by water utilities in Australia to estimate emissions from biosolids stockpiles only considers the emissions of methane (CH_4), with nitrous oxide (N_2O) levels assumed negligible. Recent research has shown that N_2O emissions are underestimated while CH_4 is probably overestimated. With GHG emissions being a significant environmental and potential future economic liability to water utilities, more accurate emissions estimates are needed. This project aims to interrogate the accuracy of the current emissions model by comparing calculated emissions with direct GHG measurements and identify any needed corrections to the current model.

2. ***Soil carbon sequestration:***

The application of biosolids to farmland as a soil conditioner and fertiliser substitute is an important element in the overarching goal of beneficially reusing biosolids. Biosolids application has been shown to rehabilitate degraded soils via the restoration of organic matter and is known to increase crop yield. However, it is not known whether there is significant and prolonged carbon build-up in the soil from the current rates of industry application. This project aims to answer this question and investigate the feasibility of agricultural application of biosolids as a form of carbon sequestration in soil for the purposes of carbon crediting.

Methodology

For the study of GHG emissions, the static chamber method (widely utilised in soil science) will be employed to directly measure emissions of CH_4 and N_2O from biosolids stockpiled at a South Australian wastewater treatment plant.

For the study of biosolids soil carbon sequestration, soil cores will be taken from broadacre sites with and without biosolids application across the Yorke Peninsula in South Australia for analysis.

Full-scale sampling and analysis is currently in progress.

Results

1. ***Greenhouse gas emissions:***

Analysis so far suggests comparable N_2O and CH_4 emissions from biosolids.

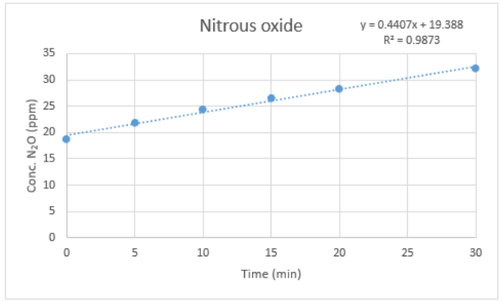

Figure 1: Preliminary GHG results.

While Figure 1 shows overall N_2O emissions several fold greater than that of CH_4, these results remain preliminary.

It is predicted that results from full-scale sampling campaigns will show similar trends, with CH_4 emissions lower than the current emissions model prediction and N_2O emissions more important than currently estimated by the model.

2. ***Soil carbon sequestration:***

Preliminary analysis of aged (stockpiled) biosolids samples has shown organic carbon levels to be relatively low (6±1%) compared to freshly dewatered material (20–30%).

Using statistical and mathematical calculations, it is predicted that the theoretical maximum of sequestered carbon in soil via the physical deposition of biosolids carbon will be minor (1.1 tons CO_2-equivalents) at current industry standard biosolids application rates (5 dry tons/ha). However, the effect of carbon build-up from increased microbial activity and plant (root) carbon fixation, as well as the physical aggregation (stabilisation) of soil carbon as a result of biosolids application, may bolster biosolids carbon sequestration potential.

Conclusions

There are significant levels of N_2O emissions from biosolids stockpiles and this needs to be addressed in future revisions to emissions guidelines. At the same time, CH_4 emissions are likely to be overestimated by current guidelines.

At current rates of biosolids application practiced by industry, the value from soil carbon sequestration may only be marginal; however, there is significant scope for increased biosolids application rates is soil carbon sequestration is to become a major future objective.

Anticipated impacts

The results of the GHG study will affect the emissions accounting of all water utilities stockpiling biosolids. It will help to increase the accuracy of the current model for more accurately quantifying GHG emissions. Additionally, the carbon sequestration study could potentially open up the possibility of generating carbon credits from the application of biosolids to land. This would benefit landholders, utilities as well as contribute to the national target of offsetting carbon emissions.

Biosolids – we're all saving the world one flush at a time.

Further information

http://www.lowcarbonlivingcrc.com.au/research/program-2-low-carbon-precincts/rp2008-wastewater-biosolids

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