CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)

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Project Number

S0803

Project Title

Methane Emissions Control and Energy Capture on Dairy Waste Lagoons

Abstract

Objectives/Goals

Current dairy waste lagoon design often consists of flushing manure through solids settling ponds and then partial bacterial digestion in large, open-air lagoons. The high amount of dissolved oxyen present in the upper regions of these lagoons allows aerobic bacteria cultures to thrive in the warm, nutrient-rich portion of the lagoon, while anaerobic bacteria cultures migrate to lower regions of the lagoon because of the low dissolved oxygen present there. My project attempts to create a model for dairy waste lagoon design that can create an anaerobic environment in the lagoon that allows for higher methane yields, which can then be captured and combusted for electricity. Controling the methane emissions through capture would also help prevent methane pollution on dairies.

Methods/Materials

Liquid dairy waste, to be used for testing, was collected on a dairy at a location where it was exiting the solids settling pond and prior to entering the waste lagoon. A method for testing the methane yields from the dairy waste under different conditions was designed and constructed. The testing apparatus consisted of 1-gallon jars, filled with dairy waste, controlled at differeent temperatures that simulated the relative position of the anaerobic bacteria in the lagoon; in this instance those conditions included:cold (43-45F); ambient (70-75F); hot (90-95F)--which would depend on the dissolved oxygen. An anaerobic condition was created at the various temperatures and methane yields were collected and measured with digestion times ranging from 3-6 days, to simulate differences in influent and affluent movement in the lagoon. The methane was collected over a vacuum, where it was measured three times a day.

Results

The dairy waste undergoing anaerboic digestion at the hot conditions showed methane yields of 15 cm, while the ambient and cold digesters yieled closer to 2 cm. Length of digestion time maintained a steady slope of increase methane yield.

Conclusions/Discussion

The test results suggested that allowing for an anaerobic environment in the dairy waste lagoon--which would allow for anaerobic bacteria cultures to undergo anaerobic digestion in warm conditions--would have a methane yield several folds that of current conditions. Methane could then be captured and combusted providing a clean burning alternate energy source which would limit harmful methane emissions into the atmosphere.

Summary Statement

My project attempts to provide a practical way of increasing anaerobic digestion on dairy waste lagoons, capturing that methane, and combusting it for electricity, inhibiting methane escape/pollution into the atmosphere

Help Received

Father helped edit written documentation; Professor Charles Krauter of California State University , Fresno (Plant Science Department) engaged in dialogue with me conerning the project; Mr. Wayne Garabedian gave suggestions on display and presentation