CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY

Name(s)
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Project Number
S0826

Project Title
The Effect of Denitrification on Methanogenesis in Constructed Wetlands

Abstract

Objectives/Goals
The objective is to determine if the presence of nitrate can cause denitrifying bacteria to grow in wetland environments and thereby inhibit methanogenic bacteria, thereby reducing methane emissions.

Methods/Materials
Six free water surface wetland model ecosystems (Models A through F) were created using 30 gallon plastic containers and adding equivalent quantities of pea gravel, sphagnum peat moss, mud from San Diego Creek, dechlorinated water and Scirpus americanus (commonly known as bulrush) to each container. A seventh model ecosystem (Model G) was created as a control with the same quantities of sediment and water as the other models but without wetland plants. After three months, equal amounts of glucose were added to all the models while potassium nitrate (a nitrate source) was added only to Models A, B and C. About one week after chemical addition, the models were sampled for biochemical oxygen demand (BOD) and nitrate concentrations (via aqueous sampling), and nitrous oxide and methane emissions (via gas sampling).

Results
The addition of nitrate to Models A, B and C with added nitrate source resulted in lower average BOD concentrations as compared to Models, D, E and F which were not dosed with nitrate. Also, Models A, B and C had higher nitrous oxide emissions as compared to methane emission, while models D, E and F had higher methane emissions as compared to nitrous oxide emissions. The nitrate concentrations in Models A, B and C were also lower as compared to Models D, E and F.

Conclusions/Discussion
The data clearly suggested that denitrification inhibited methanogenesis in the model wetlands and reduced methane emissions to the atmosphere.If this major global warming problem can be solved, wetlands can be ready for widespread implementation and can be used as a cost effective medium for treating pollutants in wastewaters.

Summary Statement
My project is about determining if methane emissions from constructed wetlands can be reduced through addition of nitrogen

Help Received
Dr. Brian Davis of Stantec acted as my mentor/advisor; Used lab equipment at UCI under supervision of Dr. Tyler, Zachary Scott ; Dr. Stephen Lyon of CH2MHill provided the mature seedlings of bulrush; Mr. Charles McGee of OCSD and his staff helped with BOD testing; Parents helped with the supplies and