USGS

WATER RESOURCES RESEARCH GRANT PROPOSAL

Project ID: 2003IA39B

Title: Sequestration of phosphorus with iron mine tailings

Project Type: Research

Focus Categories: Agriculture, Nutrients, Water Quality

Keywords: water quality, lakes, eutrophication, nutrients

Start Date: 03/01/2003

End Date: 02/29/2004

Federal Funds: $18300.00

Matching Funds: $36780.00

Congressional District: IA 4

Principal Investigators: Brown, Ed

Abstract: Surface water quality is currently one of the most important environmental issues facing the state of Iowa since the ecological and recreational health of water bodies are threatened by non-point source (NPS) pollution. Many lakes are polluted because of their high concentration of nutrients, often phosphorus (P), which leads to excessive algal growth (eutrophication). To prevent eutrophication, it is necessary to prevent P from entering surface waters or to sequester (make unavailable to algae) the P that is already in the water body. Ferric (Fe3+) and ferrous (Fe2+) iron are known to react with phosphate, leading to precipitates that tie up P. The ferric iron primarily present in hematite can react with P directly, or the iron can be reduced to ferrous iron in anaerobic waters through anaerobic respiration by certain microorganisms present in soils and sediments. This ferrous iron can react with P or can be re-oxidized chemically or biologically back to ferric iron which forms P-sequestering particulate hydrous ferric oxides (HFO). Anaerobic re-oxidation of iron is facilitated by oxidants with a more positive redox potential than the ferric/ferrous couple such as the nitrate/N2 couple. When this occurs, iron oxidation also helps resolve nitrate stimulated eutrophication. An ongoing study of Iowa lakes and wetlands presents an opportunity to investigate the finding that phosphorus found in sediments can be sequestered with iron mine tailings. Specifically, the microbial chemistry involved in the sequestration of P by mixtures of P-laden soils and sediments and iron mine tailings, particularly under anaerobic conditions,

will be investigated. The results will assist in formulation of pollution reduction and remediation plans for eutrophic lakes in Iowa and other locations where P is the major pollutant.

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Last Modified: Wed May 28, 2003 4:26 PM