Tugba Onal Okyay's Ph.D. Defense Announcement

CARBON DIOXIDE SEQUESTRATION THROUGH MICROBIALLY-INDUCED CALCIUM CARBONATE PRECIPITATION USING UREOLYTIC ENVIRONMENTAL MICROORGANISMS

Date: 04/13/2015

Time: 10:00 a.m.- 12:00 p.m.

Location: Civil and Environmental Engineering department conference room

Committee chair: Dr. Debora F. Rodrigues

Committee members: Dr. Yandi Hu, Dr. William G. Rixey, Dr. Timothy Cooper, and Dr. Richard Willson.

Abstract

The development of affordable and eco-friendly strategies for CO_2 sequestration has become a matter of paramount importance to reduce or mitigate the effects of global climate changes. Today, the most used solution to sequester CO_2 is its immobilization in geological reservoirs, commonly referred to as carbon capture and storage; however this technique is not completely reliable because of leakage risks, when storing vast quantities of CO_2 in geological strata. Alternatively, precipitation of CO_2 as solid carbonates may constitute an alternative strategy for carbon immobilization. The reaction to form calcium carbonates is generally not chemically favorable in the environment, unless at pH values higher than 9. On the other hand, microorganisms, through metabolic activities, have been shown to induce calcium carbonate precipitation, provided that certain environmental conditions are met. In this dissertation, the diversity and physiology of diverse ureolytic consortia and isolates able to induce calcium carbonate precipitation were investigated to better understand their roles in CO_2 sequestration. These microorganisms were obtained from karstic environments that are rich in calcium and present natural input of urea, which are considered to be the key factors in calcium carbonate precipitation. These urease-positive microorganisms were classified phylogenetically and their physiology was investigated. The relationship amongst urease activity, microbially-induced calcium carbonate precipitation, and CO_2 sequestration by the different consortia and isolates were shown to be dependent on the species and directly influenced by their growth conditions.