Using Lanthanum Bentonite, a Phosphorus Treatment, to Immobilize Arsenic in Lake Sediments

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Arsenic is difficult to remove from contaminated lake sediments, as it requires removing the bottom sediments through dredging, which is expensive. A proposed, cost-effective solution utilizes lanthanum-modified bentonite (LMB) to sequester arsenic in lake sediments, preventing its remobilization into the water column and entry into the lake's food chain. LMB is a certified phosphorus treatment, but in laboratory experiments, it successfully sequestered arsenic, since arsenate and phosphate are chemically similar. Our study aimed to test the efficacy of LMB for arsenic sequestration in the field, as LMB had previously been tested only in the laboratory. We set up six cylindrical mesocosms extending from the lake surface to the sediments in Lake Killarney, WA, with duplicates of high (1.0 kg/m^2) and medium (0.25 kg/m^2) concentrations of LMB. Two mesocosms were left untreated as controls. Throughout the summer, we measured temperature, dissolved oxygen, pH, and conductivity using a multi-parameter water quality probe near the surface and bottom of each mesocosm. We also collected water samples from the surface and the bottom of each mesocosm to analyze phosphorus and arsenic concentrations. We found that the treatment did not work in the same way in the field as it did in the lab, with arsenic and phosphorus concentrations spiking in the middle of the season. We attributed this result to the porous nature of the mesocosm and the involuntary mixing with lake water outside of the mesocosms. Further testing in the field is necessary to properly test LMB as an arsenic treatment.