Goldschmidt 2022 Abstract
https://doi.org/10.46427/gold2022.9510

Reaction mechanisms for the simultaneous removal of nitrate and phosphate in groundwater

JIYOUNG KANG AND SUNG-WOOK JEEN

Jeonbuk National University

Presenting Author: kjh51199@naver.com

Nitrate and phosphate are contaminants in groundwater and can also be transported to surface water, which can cause eutrophication. While these nutrients are required for treatment, a previous study proposed Ca-citrate as a reagent to simultaneously remove both nutrients [1]. This study investigated the reaction mechanisms of nitrate and phosphate removal using the Ca-citrate reagent before it can be applied to an actual field site. Column experiments were conducted using a column filled with sand, in which microorganisms were inoculated from natural soil. The input solution was composed of 0.6 mM nitrate, 0.6 mM phosphate, and 0.5 mM Ca-citrate. As the input solution was continuously injected into the column, the changes in chemical compositions were monitored through sampling from the column effluent with regular time intervals. The experimental results showed that nitrate was removed at 0.9 pore volume (PV), indicating that citrate was used as a carbon source during denitrification. Nitrite, an intermediate product of denitrification, was formed at 1.0 PV, supporting denitrification process. In the soil used for the experiment, a total of 68.6% of all bacteria were denitrifying bacteria in terms of order. The phosphate concentration was decreased at 0.8 PV, indicating that calcium released from Ca-citrate combined with phosphate, resulting in precipitation of phosphate minerals. The calculated phosphate adsorption capacity ranged 0.0124 to 0.0153 mg PO_4/g sand. This low adsorption capacity suggests that the main removal mechanism of phosphate is precipitation rather than adsorption. The results from this column study can provide a basis for the application of the Ca-citrate reagent to the actual contaminated groundwater site. This work was supported by the National Research Foundation of Korea (NRF) grant funded by the Korea government (MSIT) (NRF-2019R1A2C1086667).

[1] Kang & Jeen (2021), *Environ. Sci. Pollut. Res.* 28, 35738-35750.