

Effect of wetland plant and water level on the denitrification in the wetland mesocosms

HEE SUN MOON¹, JI YEON HAN¹, SEOLRAN OH¹,
PILYONG JEON¹

¹Groundwater and Ecohydrology Research Center, Korea
Institute of Geoscience and Mineral Resources, Daejeon,
34132, South Korea

In wetland, nutrients (i.e., nitrogen and phosphorus) as well as trace metals can be transformed through various biogeochemical reactions. The sediment redox conditions and organic carbon from plant litter in wetland may influence the biotransformation of nitrate by heterotrophic bacteria through denitrification process. Recently, climate change is causing frequent floods and droughts, thereby fluctuating groundwater levels and consequent redox condition changes in the wetland sediment. Also, plant root exudates from wetland plant contribute to the release of organic carbon to wetland environments. In this work, we investigated the fate of wetland nitrate in response to water level changes and in the presence and absence of plants using laboratory-scale wetland mesocosms.

Four acrylic columns (20×30 cm) packed with wetland sediment from Goodang wetland in Korea. Five sampling ports were installed along the side-walls of the columns at different depths to monitor the depth profile of nitrate and organic carbon concentration. Mesocosms were operated in the condition of a high (H) or low (L) water level above sediment surface (H: 5 cm, L: 2.5 cm) and with or without wetland plant (*Phragmites communis Trin*) in the growth chamber. Artificial groundwater containing 20 mg NO₃-N/L was injected upward at a flow rate of 2.0 mL/min min⁻¹ to maintain the predetermined water levels through discharge ports on the upper side of the column for 3 months.

High water level mesocosm with plant is present has more reducing environments with depth and NO₃-N decreased in the vicinity of -20 cm where denitrification is expected to occur actively and TOC concentrations over time due to the TOC generated from the root exudate of the plant. In low water level mesocosms, the mesocosm which the plant is absent has more reducing environment as the depth decreases and NO₃-N concentrations decreased around -5 cm, the most reducing environment. Also, more active denitrification may occur in the high TOC condition in the sediment irrespective of water level.