Study on the methane emission characteristics for the artificial wetlands system at mine sites in South Korea

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This study investigated the characteristics of methane emissions from mine drainage treatment systems and determined the effect of the mine drainage's water quality on the mitigation of methane emissions in wetlands. In order to estimate the methane flux in the field, changes in methane concentrations over time were measured using a closed gas chamber. Batch experiments were also carried out to estimate the methane production potential of sampled wetlands' sediments and water. Methane gas fluxes have been measured by multiplying the numbers of sites, but it is difficult to define the flux value by a certain amount due to the nature of gas flux that changes easily with time and space. The methane production characteristics were also investigated by the methane production potential test under a controlled anaerobic condition. The removal rates of carbon from the sediments collected at the mine area are higher than those at constructed ecological wetlands. The substrates of the mine site produced twice as much methane. By measuring the presence of microorganisms, it was confirmed that the decreasing carbon in the substrates was degraded by the microorganisms, and the methane produced was due to the activity of methanogen. In other batch experiments, the effect of sulfate concentrations on the methane emissions using the collected substrate of a mine wetland was investigated, and the results showed up to 1.5 lower methane emissions from the batches with a high sulfate dose. As a result, it was confirmed that the reduced carbon and hydrogen components in the substrate were due to the decomposition of microorganisms. Through the qPCR analysis, it was confirmed that sulfate reducing bacteria reduced the sulfate using substrates. In summary, the potential of methane emissions in mine wetlands is higher than those of general wetlands. The reduction of methane from mine wetlands may be possible through controlling the reduction ability of sulfate or the activities of sulfate reducing bacteria. The results of this study may contribute in studies on methane mitigation through biogeochemical processes in passive treatment systems of mine drainage.

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