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Measurement of CO_2 fluxes, a greenhouse gas, in aquaculture

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Abstract

The paper describes results of experiments to determine CO_2 fluxes in fish ponds. The work has implications for pond management in developing and developed countries. Experiments were performed to develop and validate a Headspace Equilibrium Technique for measuring fluxes of greenhouse gases. Preliminary experiments measured gas fluxes under control conditions using water from fish ponds. Spiking the water with known concentrations of $NaHCO_3$ increased the rate of CO_2 efflux from the water (5.1×10^{-04} mol $m^{-2}s^{-1}$ for 2.1 g $NaHCO_3$). The recorded pH values, 8.0-9.0 implied that bicarbonate ion (HCO_3^-) was the most prevalent in this spiking experiment. Similarly spiking the headspace with CO_2 gas increased the rate of influx into the water (1.6×10^{-06} for 5000 ppm CO_2). Shaking and stirring water samples with known concentrations of $NaHCO_3$ demonstrated that the equilibration process of CO_2 fluxes between headspace and water was reached in 70-80 s rather than >90 m without shaking. In fish ponds with high fish biomass there was a higher CO_2 efflux ($2.4\text{-}3.0 \times 10^{-06}$ mol $m^{-2}s^{-1}$). The rate of CO_2 efflux was found to be lower in sun light (1.8×10^{-07} mol $m^{-2}s^{-1}$) and higher in the dark (2.4×10^{-06} mol $m^{-2}s^{-1}$). Results using a portable infrared gas analyser were crossed checked with FT-IR applications. Fertilization and other management techniques are being investigated. The experiments gave responses which validate the method for determining GHG fluxes in aquaculture. Experiments with fish farms are aiming at providing protocols for management practices which reduces GHG impacts.

Biography

Khan Muhammad Nurul Islam is going to complete his Ph.D. Research Degree from the University of Western Sydney Australia. He was the Environmental Advisor (2007-2010) for O'Pacific Pty Ltd., an Environment Friendly Construction Company in Australia. He had worked as Program Coordinator (1999-2006) for CARITAS/Winrock International in Bangladesh in Environment and Natural Resources Management. He also worked with several research and development donor agencies, e.g., USAID, AUSAID, UNDP, DFID-UK, WorldFish Center, IUCN, Ford Foundation, APHD, ACIAR, Caritas Australia and University of Western Sydney Australia. He has published papers (5) in reputed journals and more than 30 abstracts in several scientific abstract books.