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## RESEARCH REPORTS

Sustainable Aquaculture for a Secure Future

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**Title:** Carbon Dioxide Control

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**Abstract:** Carbon dioxide management should be one of many important considerations in intensive aquaculture systems. Unchecked, carbon dioxide may lower the pH to stressful levels, suffocate animals even in the presence of oxygen, and reduce the efficiency of biological filters. Carbon dioxide concentrations in culture waters may be controlled by pH management or through gas exchange. Carbon dioxide control by pH management is reviewed in general terms based on principles of carbonate chemistry. Carbon dioxide removal by gas transfer is easily attained, but its quantitative description requires a multi-step approach due to the influences of the relative ratios of gas and liquid flow rates, gas flow characteristics, and chemical reactions among the carbonate species. Carbon dioxide removal by gas transfer is often limited by the build up of carbon dioxide in the gas phase, requiring gas to liquid flow ratios that are substantially higher than those needed for other important gases such as oxygen and nitrogen. Carbon dioxide removal is described here in detail for a packed column aerator where the gas to liquid ratio can be controlled. Principles of carbon dioxide removal may be applied to other aeration devices, however, quantification of gas to liquid ratios and flow characteristics are not currently available.

This abstract is excerpted from the original paper, which was in: M. Timmons and T.M. Losordo (Editors), *Engineering Design and Management of Aquaculture Water Reuse Systems*. Developments in Aquaculture and Fisheries Science, 27:209-234. (1994)

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