

DISSOLVED OXYGEN IN AQUACULTURE SYSTEM

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Introduction:

Sources and important of dissolved oxygen in aquaculture system

Water quality parameter is the important factor that determined the production of fish and its quality in aquaculture system. For aquatic organism dissolved oxygen is most crucial as the water quality parameter. There were three main sources of oxygen in the aquatic environment which were direct diffusion from the atmosphere, wind and wave action, and photosynthesis. Photosynthesis process conducted by aquatic plants and phytoplankton is the most important. Oxygen that derived from photosynthesis, is produced during the day when there is sunlight captured by the plants in the water. Oxygen levels decrease at night via the respiration process by plants and animals, including fish (Francis-Floyd, 1992). When there is no light penetration plant and phytoplankton cannot produce oxygen through photosynthesis thus decrease in the production of dissolved oxygen. A research done by Amon P. Shoko, et al (2014) also show that concentration of dissolved oxygen during the past midnight and pre-dawn were significantly lower than the levels in the morning and afternoon hours. This situation will caused harmful to cultured species.

Although there is more oxygen produced during the day from the photosynthesis process, but the water movement will transport the oxygen to other location. The organisms will not capture all the produced oxygen. Most of benthic organisms need the dissolved oxygen for aerobic process to be continued. When the dissolved oxygen not enough the process will turn to the anaerobic condition without the use of oxygen. This is sufficient to some organisms but harmful to other organisms. These predictable changes in dissolved oxygen occur every 24 hours are called the diurnal oxygen cycle.

Aquatic organisms need dissolved oxygen to breath and prevent the mortality. Fish required oxygen for respiration. The amount of oxygen required by fish is depends on the metabolic rate of the fish, where small fish consumed more oxygen than the larger fish. In freshwater system, normally the level of dissolved oxygen is around 6 ppm at 25⁰C environment temperature (Najiah Musa,et al, 2008). Every single species of fish required different level of dissolved oxygen. For example, carps required 6 -7 ppm of dissolved oxygen in its medium culture (B.N.Yadav, 2006). To obtained good growth and production of fish culture, the optimum level of dissolved oxygen in culture syatem must be maintained at least at 5 ppm.

Factor and impact on depletion of dissolved oxygen to aquatic organism

Oxygen demand affected through its environment condition. A study have been conducted and shown that cage culture area give high biological oxygen demand level than the non culture area (Rawson *et al.*, 2002). When the oxygen demand is high, the level of dissolved oxygen will low. Dissolved oxygen is necessary to living organisms in water bodies. Microbes play a key role in the loss of oxygen from surface waters. Oxygen used by microorganisms as energy to break down long-chained organic molecules into simpler, more stable end-products such as carbon dioxide, water, phosphate and nitrate. After the organic molecules are broken down by the microbes, oxygen is removed from the system and must be replaced by exchange at the air water interface. According to United States Environment Protection Agency (USEPA) review report 2004; Pollutants of concern in Salt River Bay are biochemical oxygen demand and sediment oxygen demand.

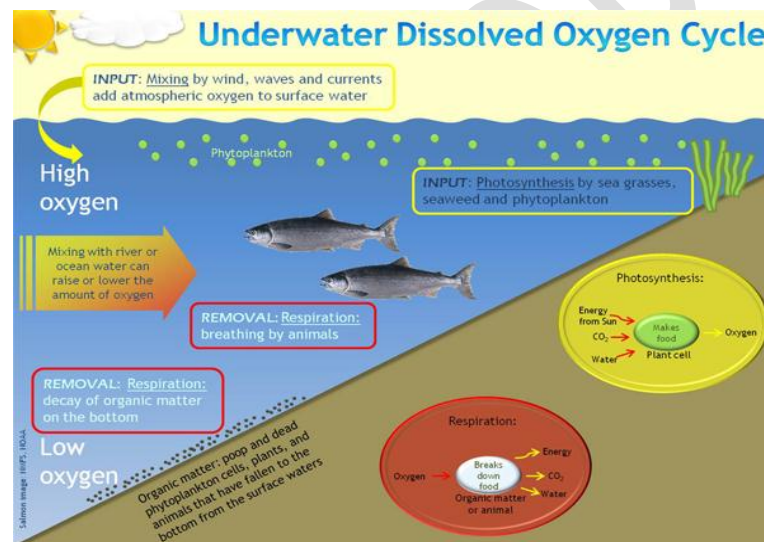


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Low dissolved oxygen in temperate waters is generally linked with high levels of nutrients, which caused algal blooms and eutrophication. In tropical areas, nutrient levels are generally low even in areas where low dissolved oxygen levels are observed. Low dissolved oxygen levels, in tropical areas, are generally associated with high levels of oxygen demanding substances such as biological oxygen demand and sediment oxygen demand. Biochemical oxidation of organic and inorganic matter increased the biological oxygen demand level when an amount of dissolved oxygen is consumed by microorganisms. The cumulative amount of dissolved oxygen consumed by all biological and chemical processes at the water-sediment interface referred as sediment oxygen demand. What minor impact nutrients and phytoplankton may have on the dissolved oxygen in these water bodies will be addressed by reducing biological oxygen demand and sediment oxygen demand loads. Photosynthesis process and oxygen production only occur near the surface water, then, water in the deep layer becomes devoid of oxygen and develops an oxygen demand. Dissolved oxygen present will rapidly be removed from the water column when the oxygen demand is sufficient thus causing in severe oxygen depletion and a fish mortality (Francis-Floyd, 1992).

Conclusion

In conclusion, dissolved oxygen is very important to support life in aquatic ecosystem especially in aquaculture system. Dissolved oxygen will vary throughout the day. To avoid low dissolved oxygen in the culture system, the parameter must be monitored regularly. Optimum level of dissolved oxygen affects fish growth causing high production, profit and product quality. Dissolved oxygen in culture system can be obtained from diffusion from air to water system, mechanical aeration by wind or aeration system, and through photosynthesis process by aquatic plants.

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