Thesis Title	Mathematical Modeling of Oxygen in Shrimp Pond
Thesis Credits	12
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Degree of Study	Master of Engineering
Department	Chemical Engineering
Academic Year	2001

Abstract

Oxygen, one of the essential growth factors, is necessary for all aquaculture, including shrimps. Insufficient oxygen increases shrimp stresses, decreases its appetite and immunity, and consequently, causes fatal impact on shrimp. Oxygen level increases during the daytime due to photosynthesis, but pond respiration and decomposition of organic matters lower oxygen level which sometime can drop below the critical concentration at dawn. Therefore, prediction of oxygen dynamics are necessary for proper aeration of the pond rather than depending alone on the experiences of the farmers.

Oxygen concentration in shrimp ponds is a function of photosynthesis, mass transfer between air and water, as well as, respiration and decomposition of organic matters by microorganism. Photosynthesis depends on light intensity, and planktons tend to move up to the water surface and obstruct the penetration of light to the deeper layer. Therefore, photosynthesis occurs mainly near the water surface. During the nighttime, on the other hand respiration of all living organism and biodegradation at the pond bottom requires more oxygen than that supplied by aerators, hence the oxygen level gradually drops until photosynthesis starts again in the next morning.

Mathematical model was developed considering these phenomena. The oxygen level was set to be the function of light intensity, temperature, mass transfer between air and water, respiration and biodegradation.

Simulation results showed that the photosynthesis rate depended on temperature greater than light intensity. The simulation results fit quite well with the measurement, especially the DO level at the surface and middle layer of the pond. There were two adjusted parameters used in this model, P_{max} and K. P_{max} , maximum photosynthesis rate depended upon chlorophyll-a, transparency and nutrients. Another parameter, K, was used to represent the aeration intensity of the pond which differed between day and nighttime and also varied with the cultivation period as well.

Keywords : Mathematical Model / Oxygen / Shrimp Ponds / Aeration