Sulphide and Dissolved Oxygen Concentrations in Batang Ai Hydroelectric Reservoir

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ABSTRACT

Anoxic condition of reservoir often results in the presence of sulphide in the water. Warm water column in Batang Ai Hydroelectric Dam is well-suited for the production of sulphide in the water column. Temperature, pH, dissolved oxygen (DO) and sulphide concentrations were measured at 5 locations at 3 different depths in the reservoir. Highest temperature recorded was 30.31 °C at ST1 while the lowest been recorded was 24.75 °C at ST4. The pH values were found to range from 6.63 to 7.37. The sulphide levels were lower at the 1 m depth compared to 14 m and 27 m. They ranged from 0.3 to 6.7µg/L. Most of the stations (ST2, ST3, ST4 and ST5) were found to have higher concentration of sulphide at the 14 m compared to 27 m except at ST1. Sulphide concentration was measured highest at 14 m of ST5 (14.7 µg/L) and lowest at 1 m of ST2. The surface water concentration of sulphide at ST2 differ significantly with ST4 ($p=0.024$) while at both 14 m and 27 m depth, the concentrations of sulphide at ST2 were significantly lower than ST5. One way ANOVA shows that there were significant differences among stations at every depth (1m, $p=0.028$; 14 m, $p=0.029$; 27 m, $p=0.028$). Hence, the concentrations of sulphide were found to be different at every locations as well as different water column depending on the sampling sites.

Keywords: sulphide; dissolved oxygen; reservoir; Batang Ai

INTRODUCTION

Batang Ai Hydroelectric Reservoir is considered as an oligotrophic reservoir due to low primary productivity associated with low concentrations of nutrients (N and P) with visibly clean water.[1] Water column of oligotrophic reservoir also tends to be saturated with oxygen at the surface water thermal stratification which exists in the reservoir contributes to low oxygen level in the hypolimnion.[2] Low water exchange rate contributes to low oxygen level in the hypolimnion where mixing of water between upper and bottom part of water column does not usually occur and the deeper part of the reservoir. Hydrogen sulphide (H_2S) will only be formed when the intensity of the anaerobic (low or no dissolved oxygen) water column is conducive for microbial reduction.[3] Hydrogen sulphide can be oxidised to elemental sulphur, thiosulphate or sulphate in anoxic water condition. In addition, H_2S also precipitates easily with metal ions to the corresponding metal sulphide. For instance, FeS, gives many anoxic sediments their black coloration.[4] The presence of H_2S is usually notable due to its unpleasant odor which smells like a "rotten egg".

Hydrogen sulphide is toxic to most organisms and can lead to fish kill.[5] Fish cannot live in low dissolved oxygen water and high hydrogen sulphide concentrations for any extended period of time.[5] The concentration of H_2S measured 0.34 mg/L when more than 2.5 million juvenile menhaden (*Brevoortia tyrannus*) were killed.[5] The lethal concentration of H_2S to fish varies with species. Previous research suggested that concentration of H_2S at 50 % fish mortality falls between 0.1 to 1.7 mg/L depending on the type of fish species being investigated.[6] Hydrogen sulphide inhibits the respiratory function of the fish, leading to symptoms of choking. A less severe effect is reduced growth rate and less resistance to diseases while sudden and heavy releases of H_2S can kill off a whole cage stock in a short time.[7] Critical condition arise when the concentration is higher than 0.002 mg/L