

Effectiveness of Oxidation Ponds in Pig Farm Wastewater Treatment in Sarawak

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Abstract

Pig farm wastewater contains high concentrations of solids and nutrients. Operators are required to build oxidation ponds for the treatment of wastewater. However, there is a lack of information on the performance of the ponds being implemented in Sarawak. Therefore, in this study, wastewater quality from inflow and outflow of farms with 2-pond with and without separator, and 3-pond systems was investigated. Comparing inflow and outflow concentrations, all the systems resulted in significant reduction of the parameters studied. The order from the most efficient to the least was: 3-pond > 2-pond > 2-pond (separator). Most of the reduction of TSS, BOD₅ and COD occurred in the first two ponds. The presence of the third pond resulted in large improvement in DO, AN, TN and TP. Comparing the final effluent with the discharge standards proposed by Natural Resource and Environment Board (NREB) for TSS, BOD₅ and COD, it was exceeded only by the 2-pond (separator) system. This indicates that even with solid-liquid separator, the size of the ponds and maintenance of the ponds are still essential to ensure good treatment and compliance to the proposed water quality standards.

Keywords - pig farming, oxidation pond, wastewater, biological treatment

1. Introduction

Like other parts of the world, in Malaysia, waste management including agricultural waste is a challenge to scientists, engineers and policy makers. In Sarawak, pig farming is an important industry. There are 154 commercial farms in Sarawak with an estimated standing pig population (SPP) of about 460,000 generating about RM 40 million revenue a year [1]. Plenty of water is used to cool the pigs and clean the pen [2]. The wastewater which is loaded with solids, organic matter, and nutrients is channelled to ponds [3]. According to the Control of Livestock Pollution Rules of the Natural Resources and Environmental Board (NREB), farms with more than 100 animals need to have oxidation ponds installed [4].

Wastewater treatment ponds have been widely used for the treatment of human, industrial and animal waste due to low capital costs and simple operation and maintenance requirements when compared with other treatment systems [5]. In Sabah, it was reported that

oxidation ponds did not treat the wastewater adequately thus polluting the receiving river [6]. However, little information is available on the efficiency of the ponds installed by the farm operators in Sarawak. Therefore, the objective of this study was to investigate the efficiency of installed ponds in treating pig farm wastewater in Sarawak.

2. Materials and Methods

2.1. Wastewater sampling

Wastewater was collected from three pig farms with 2-pond, 2-pond (separator), and three-pond systems in Kota Samarahan division from November 2004 to January 2005. The standing pig population and the size of the ponds of the three farms are shown in Table 1. The type of separator used in the 2-pond (separator) farm was in-channel flighted conveyor screen separator. Composite samples of 2 liters each were collected in polyethylene bottles at the inflow and outflow points of each pond. Wastewater collected was transported in an icebox to the laboratory for analysis.

Table 1: Standing pig population of the farms and size of oxidation ponds.

Farm	Standing Pig Population (SPP)	Pond Dimension (L (m)xW (m) xD (m))
2-pond	920	20x17x2.7 20x10x2.7
2-pond (separator)	1200	13.3x13.3x2.7 (x2)
3-pond	1920	20x13.3x3.3 (x2) 13.3x13.3x3

2.2. Water quality analysis

The *in-situ* parameters measured were temperature, pH and dissolved oxygen (DO) using DO meter (Cyberscan 100) and pH meter (Cyberscan pH100). Water quality parameters analyzed were total suspended solids (TSS), biological oxygen demand (BOD₅), chemical oxygen demand (COD), ammonia-nitrogen (AN), total nitrogen (TN) and total phosphorus (TP).