

# Dynamics of Nitrogen and Phosphorus Nutrient Concentrations in Egerton University Wastewater Stabilization Ponds

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## **Abstract**

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Studies were conducted to investigate changes in nitrogen and phosphorus concentrations in three Egerton University wastewater stabilization ponds (WSPs). Weekly samplings were done between March and May 2007 and 2008. Significant differences were observed in conductivity, dissolved oxygen and pH. Mean dissolved oxygen concentration ranged between 0.0 mg O<sub>2</sub> L<sup>-1</sup> and 11.0 mg O<sub>2</sub> L<sup>-1</sup> in 2007, and 0.38 mg O<sub>2</sub> L<sup>-1</sup> to 20.0 mg O<sub>2</sub> L<sup>-1</sup> in 2008. Conductivity ranged between 726 and 1810.5 μS/cm, and 931 to 1259 μS/cm in 2007 and 2008 respectively. Significant differences in soluble reactive phosphorous (SRP) nitrate - nitrogen (NO<sub>3</sub>-N) and ammonium-nitrogen (NH<sub>4</sub>-N) concentrations among the ponds were recorded with highest concentration recorded in Pond 3. This was attributed to the breakdown of organic matter into the dissolved phosphorus form as well as the dissolution of phosphorus from the sludge due to the low oxygen levels at the anaerobic bottom layer in Ponds 1, 3 and 5. The mean total phosphorous values recorded in pond 1 and 5 were 1576 and 1372 μg L<sup>-1</sup>, in 2007, and 2234.98 and 1358.87 μg L<sup>-1</sup> in 2008 respectively while NO<sub>3</sub>-N values were 39.25 mg L<sup>-1</sup> and 201.25 mg L<sup>-1</sup>, in 2007, 151.81 μg L<sup>-1</sup> and 392.88 μg L<sup>-1</sup> in 2008 respectively. The removal efficiency of phosphorous was 13.29% and 39.46% in 2007 and 2008 respectively. The lower concentration of nutrients in Pond 5 is attributed to their uptake by algae and other aquatic plants in the ponds. Though distinct conversion between nitrogen compounds and phosphorus occurred and the ponds appear to remove phosphorus and nitrogen from the wastewater, the amount of phosphorus in the outlet of pond 5 exceeded the WHO standards for wastewater effluent release into the streams (less than 1.0 mg L<sup>-1</sup>). To improve the removal efficiency, there is need to construct the artificial wetland.

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**Key words:** Wastewater, phosphorus, ponds, physico-chemical, nitrate, ammonium