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# Application of up-flow anaerobic sludge blanket reactor integrated with constructed wetland for treatment of banana winery effluent

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## Abstract

Agroprocessing constitutes sizeable industries in the Eastern Africa region discharging wastes into the environment. Proper management of industrial waste is perceived as expensive and enforcement of laws is weak. Generally, there is low awareness of environmental and socio-economic consequences of polluting the environment. The Banana Investment Limited (BIL) in Arusha Tanzania which produces banana wine from ripe bananas was discharging untreated wastewater into the environment. This project aimed at treating the BIL wastewater to meet environmental standards and recover nutrients, water and energy. The feeding wastewater to the up-flow anaerobic sludge blanket (UASB) with flow rate of 62.4 m<sup>3</sup>/d had concentrations (mg/L) of chemical oxygen demand (COD) ( $4,959.3 \pm 388.7$ ), BOD<sub>5</sub> ( $1,453.7 \pm 110.3$ ), total suspended solids (TSS) ( $2,431.0 \pm 190.5$ ), NH<sub>4</sub><sup>+</sup> ( $7.2 \pm 1.1$ ), NO<sub>3</sub><sup>-</sup> ( $23.4 \pm 3.2$ ), PO<sub>4</sub><sup>3-</sup> ( $5.12 \pm 0.73$ ), volatile fatty acid ( $0.60 \pm 0.09$ ), and Alkalinity ( $60.00 \pm 8.98$ ). After 17 months of operation the system achieved removal efficiencies (%) of COD (99.0), BOD<sub>5</sub> (98.6), TSS (96.0), NO<sub>3</sub><sup>-</sup> (88.7), PO<sub>4</sub><sup>3-</sup> (50.8). There was a net generation of NH<sub>4</sub><sup>+</sup> (387.8%) in the system. The biogas produced in the UASB is collected at a rate of 163 m<sup>3</sup>/d and is used in the boiler at BIL. The dried sludge and the treated water are used for irrigation. The study concluded that integrating the bio-digestion process with polishing stage for water, nutrient and energy recovery ensures compliance to environmental law and provides incentive to treat wastewater while also mitigating greenhouse gases.