Title : Reducing Energy Consumption in Wastewater Treatment through Optimized Aeration and Sludge Recirculation Rate

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ABSTRACT

The “Activated Sludge” process is a wastewater treatment method which requires high levels of energy consumption, particularly in the operation of aerators and the return sludge pumps. These requirements directly impact industrial operational costs. This research aims to reduce electricity consumption within the activated sludge system of Thai Beverage (1991) Public Company Limited. The study focused on the efficiency improvement of aerators and Return Activated Sludge (RAS) rates and compared with the 2025 operational performance as a baseline. The methodology involved the adjustment of the RAS ratio from the baseline of 150% down to the levels between 145% and 130% with the reduction of Dissolved Oxygen (DO) levels to a controlled range of 2.0–2.4 mg/L. The results indicated that both reduction of the RAS ratio and optimization of DO levels significantly caused a decrease in Specific Energy Consumption (SEC). Reducing the RAS ratio to 130% yielded the highest efficiency, with an average SEC of 0.0364 kWh/m^3, representing a 32.71% reduction from the baseline and an estimated annual cost saving of 33,714 Baht. Simultaneously, the optimized DO control resulted in an average SEC of 0.543 kWh/m^3, a 30.43% reduction from the baseline, contributing to an estimated annual saving of 426,182 Baht. Throughout the study, the quality of biological characteristics of the activated

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sludge in an aeration tank was improved. These results demonstrate that optimizing machinery performance at appropriate ratios can effectively reduce costs and achieve sustainable long-term energy savings.

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