

## **Convective sludge drying by rotary drum dryer using waste steam for palm oil mill effluent treatment**

### **ABSTRACT**

Achieving a more sustainable wastewater treatment plant has never been so important. Issues around energy consumption and pollutants removal efficiency are of growing importance in the context of production costs and pollution control. In the palm oil industry, more than 85% mills are managing their palm oil mill effluent (POME) via lagoons, yet the system considered less effective as the quality of the effluent hardly achieved the permissible limits. It is therefore in the best interest of the industry to employ a better practice. Convective sludge drying (CSD) has been shown to have exceptional efficiency in high-strength wastewater treatment. In this study, CSD epitomized the zero-emission of POME treatment due to the fact that; 1) It operates on low-grade steam discharged by the mill instead of electricity, leading to a huge cut on energy consumption, 2) Production of secondary micronutrients-enriched solids by-product (i.e., calcium and magnesium) that can be repurposed as fertilizer, and 3) The decoction produced can potentially be reused to irrigate the existing oil palm plantation for nutrient cycling. The treatment resulted in substantial removal of the chemical oxygen demand (COD), biological oxygen demand (BOD), suspended solids (SS), ammoniacal nitrogen (AN), and oil and grease (OG) down to 2 mg/L, 67.7 mg/L, 40.0 mg/L, <0.01 mg/L, and <1 mg/L, respectively, which meets the Standard-A of Malaysia Environmental Quality Regulation (2009), making it sourceable for domestic usage. Reported groundworks demonstrated that CSD was superior to other physicochemical methods in POME treatment, with >99% of BOD, COD, SS, OG, and AN removal efficiency. The operating cost was valued at USD 1.91 per m<sup>3</sup> POME. The pilot-scale operation proved CSD is a viable alternative to the lagoons.

**Keyword:** Palm oil mill effluent; Wastewater treatment; Convective sludge drier; Rotary drum dryer; Zero-emission