

Ecotoxicological assessment of palm oil mill effluent final discharge by zebrafish (*Danio rerio*) embryonic assay

ABSTRACT

Most palm oil mills adopted conventional ponding system, including anaerobic, aerobic, facultative and algae ponds, for the treatment of palm oil mill effluent (POME). Only a few mills installed a bio-polishing plant to treat POME further before its final discharge. The present study aims to determine the quality and toxicity levels of POME final discharge from three different mills by using conventional chemical analyses and fish (*Danio rerio*) embryo toxicity (FET) test. The effluent derived from mill A which installed with a bio-polishing plant had lower values of BOD, COD and TSS at 45 mg/L, 104 mg/L, and 27 mg/L, respectively. Only mill A nearly met the industrial effluent discharge standard for BOD. In FET test, effluent from mill A recorded low lethality and most of the embryos were malformed after hatching (half-maximal effective concentration (EC50) = 20%). The highest toxicity was observed from the effluent of mill B and all embryos were coagulated after 24 h in samples greater than 75% of effluent (38% of half-maximal lethal concentration (LC50) at 96 h). The embryos in the effluent from mill C recorded high mortality after hatching, and the survivors were malformed after 96 h exposure (LC50 = 26%). Elemental analysis of POME final discharge samples showed Cu, Zn, and Fe concentrations were in the range of 0.10–0.32 mg/L, 0.01–0.99 mg/L, and 0.94–4.54 mg/L, respectively and all values were below the effluent permissible discharge limits. However, the present study found these metals inhibited *D. rerio* embryonic development at 0.12 mg/L of Cu, and 4.9 mg/L of Fe for 96 h-EC50. The present study found that bio-polishing plant installed in mill A effectively removing pollutants especially BOD and the FET test was a useful method to monitor quality and toxicity of the POME final discharge samples.

Keyword: Fish embryo toxicity test; Palm oil mill effluent; Final discharge; *Danio rerio*; Heavy metals; Ecotoxicity