Modeling BOD and COD removal from Palm Oil Mill Secondary Effluent in floating wetland by Chrysopogon zizanioides (L.) using response surface methodology

ABSTRACT

While the oil palm industry has been recognized for its contribution towards economic growth and rapid development, it has also contributed to environmental pollution due to the production of huge quantities of by-products from the oil extraction process. A phytoremediation technique (floating Vetiver system) was used to treat Palm Oil Mill Secondary Effluent (POMSE). A batch study using 40 L treatment tanks was carried out under different conditions and Response Surface Methodology (RSM) was applied to optimize the treatment process. A three factor central composite design (CCD) was used to predict the experimental variables (POMSE concentration, Vetiver plant density and time). An extraordinary decrease in organic matter as measured by BOD and COD (96% and 94% respectively) was recorded during the experimental duration of 4 weeks using a density of 30 Vetiver plants. The best and lowest final BOD of 2 mg/L was obtained when using 15 Vetiver plants after 13 days for low concentration POMSE (initial BOD = 50 mg/L). The next best result of BOD at 32 mg/L was obtained when using 30 Vetiver plants after 24 days for medium concentration POMSE (initial BOD = 175 mg/L). These results confirmed the validity of the model, and the experimental value was determined to be quite close to the predicted value, implying that the empirical model derived from RSM experimental design can be used to adequately describe the relationship between the independent variables and response. The study showed that the Vetiver system is an effective method of treating POMSE.

Keyword: Biological oxygen demand (BOD); Chemical oxygen demand (COD); Vetiver; Palm Oil Mill Effluent (POME); Wastewater; Response surface methodology (RSM)