Title:
Multivariate models for the effect of two coagulants on palm oil mill effluent

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Abstract:
Two coagulants (Al2 (SO4)3 and FeSO4) were investigated for their performance in treating raw and anaerobic effluents from a palm oil mill. The treatment efficiencies for both palm oil mill effluents (POMEs) were assessed based on chemical oxygen demand (COD) removal. Different dosages of Al2 (SO4)3 and FeSO4 were investigated in terms of COD removal in raw and anaerobic effluents under different pH levels. The results show that FeSO4 performed better than Al2 (SO4)3 in removing COD from both effluents. The maximum COD removal efficiency (94%) was achieved when both effluents were treated with 0.4 g of FeSO4 at pH 3, while the maximum COD removal achieved by Al2 (SO4)3 was 70% using 0.4 g at pH 7. Using these optimal operational conditions, the removal of 11 parameters, namely COD, color, total suspended solids (TSS), electrical conductivity, biochemi-cal oxygen demand (BOD), pH, NH3 –N, Cu+2, Fe+2, Zn+2, and Pb were measured and assessed. The results were analyzed statistically using factor analysis (FA) and cluster analysis (CA) to identify the main factors responsible for the differences in the parameters and to display the similarity and dissimilarity between the selected parameters among the different POME sources. The FA method

produced four factors responsible for more than 99% of the differences in data. The first factor cov-ered COD, color, TSS, and BOD and was responsible for explaining 36% of the differences, whereas the second factor was responsible for explaining 34% of the differences, including NH3 –N, Cu+2, Fe+2, and Zn+2. The percentage variance explained by the third and fourth factors was 16% and 14%, respectively. The CA method produced three different groups (clusters). It was found that raw and anaerobic POMEs treated with Al+3 and raw POMEs treated with Fe+2 were close to each other, rep-resenting the second cluster, while the raw treatment represented the first cluster. The last cluster represents the anaerobic effluent before and after coagulation using Fe2 SO4. The results reveal that Fe2 SO4 is an efficient method for removing organic and heavy metal content from POME. The study provides essential data and knowledge that can be used to evaluate and manage POME treatment.