Optimization of decolorization of palm oil mill effluent (POME) by growing cultures of aspergillus fumigatus using response surface methodology

Abstract:

The conventional treatment process of palm oil mill effluent (POME) produces a highly colored effluent. Colored compounds in POME cause reduction in photosynthetic activities, produce carcinogenic by-products in drinking water, chelate with metal ions, and are toxic to aquatic biota. Thus, failure of conventional treatment methods to decolorize POME has become an important problem to be addressed as color has emerged as a critical water quality parameter for many countries such as Malaysia. Aspergillus fumigatus isolated from POME sludge was successfully grown in POME supplemented with glucose. Statistical optimization studies were conducted to evaluate the effects of the types and concentrations of carbon and nitrogen sources, pH, temperature, and size of the inoculum. Characterization of the fungus was performed using scanning electron microscopy, Fourier transform infrared (FTIR) spectroscopy, and Brunauer, Emmet, and Teller surface area analysis. Optimum conditions using response surface methods at pH 5.7, 35 A degrees C, and 0.57 % w/v glucose with 2.5 % v/v inoculum size resulted in a successful removal of 71 % of the color (initial ADMI of 3,260); chemical oxygen demand, 71 %; ammoniacal nitrogen, 35 %; total polyphenolic compounds, 50 %; and lignin, 54 % after 5 days of treatment. The decolorization process was contributed mainly by biosorption involving pseudo-first-order kinetics. FTIR analysis revealed that the presence of hydroxyl, C-H alkane, amide carbonyl, nitro, and amine groups could combine intensively with the colored compounds in POME. This is the first reported work on the application of A. fumigatus for the decolorization of POME. The present investigation suggested that growing cultures of A. fumigatus has potential applications for the decolorization of POME through the biosorption and biodegradation processes.