Abstract:
Drinking water quality and its treatment are negatively impacted by the presence of coloured natural organic matter (NOM). Ligninolytic fungi (i.e., white rot fungi - WRF) secrete non-specific oxidative enzymes that can oxidise a wide range of recalcitrant organic compounds. The potential for these organisms to degrade fresh NOM and concentrated aquatic NOM was investigated. Preliminary work involved the screening of twenty-one isolates from diverse fungal genera using NOM plate assays. Four WRF strains: *Trametes* sp., *Polyporus* sp., *Trametes versicolor* ATCC 7731 and *Bjerkandera adusta*, which displayed good NOM decolourisation on solid medium were further investigated in shake-flask culture using concentrated NOM and fresh water NOM as the only source of nutrients. Of these, *B. adusta* demonstrated the greatest decolourisation. NOM decolourisation coincided with the expression of the oxidative enzymes (manganese peroxidase (MnP), lignin peroxidase and laccase (Lac)), which varied with fungal strain. The enzyme activities of *Polyporus* sp. and the two *Trametes* strains were significantly greater than those of *B. adusta*, although their decolourisation was less. For the *Trametes* and *Polyporus* sp. strains, Lac activity was greatest, whereas for *B. adusta* MnP activity was the greatest, suggesting its predominant role in the decolourisation process. The high decolourisation of NOM by *B. adusta* was likely due to versatile peroxidase (VP). To further elucidate the mechanisms of enzyme degradation, purified extracellular enzymes were purchase and essayed on NOM. The decolourisation of NOM was also accompanied by a decrease in the average molecular weight, along with the formation of lower molecular weight species for the four white-rot fungi. Fluorescence spectroscopy was used as a fingerprinting tool to further characterize changes in the NOM following fungal treatment. This research demonstrates the significant potential for WRF in NOM removal so long as the enzyme activity can be controlled.