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Comparative evaluation of enzyme production efficiency of monocultures and paired interactions of fungi on different agricultural substrates

There is a renewed interest in finding sustainable energy sources with particular focus on agricultural waste residues. The justification for this perspective is that this eliminates the need to cultivate already scarce land mass and has the added advantage of utilizing agricultural residues that otherwise would have presented problems of waste management. However, the use of agricultural waste residue is significantly hindered by the difficulty in degradation of lignocellulose components of its structure. Ligninolytic fungi have the ability to degrade these agricultural waste residues but enzymes employed in the degradation process are produced in limited quantities and more often during the secondary metabolism by these organisms. Methodology & Theoretical Orientation: The objective of this study was to investigate a strategy that could improve the production of these enzymes and likely accelerate the organisms into secondary phase enzyme production mode. Dual culture combinations of 10 fungi that had previously demonstrated the ability to produce ligninolytic enzymes were cultivated on PDA to ascertain their interspecific interaction and also on three agricultural residues, corn cob, sugarcane bagasse and wheat straw. Spectrophotometric analysis of the enzyme activities of laccase (Lacc), manganese peroxidase (MnP) and lignin peroxidase (LiP) demonstrated that observed antagonistic invasions yielded an increased enzyme activity in dual cultures on all the substrates. Findings: The highest ligninolytic enzyme production was observed in invasion/replacement interactions that involved Trichoderma sp. KN10 with average mean value in MnP production was approximately 1.46 U/ml compared to all monocultures of 0.055 U/ml. Similarly, Lacc mean value was 0.10 U/ml compared to monocultures value of 0.05 U/ml. This study demonstrated and proved that antagonistic invasion by some fungi in co-culture, although dependent on substrate affinity, can increase production of one or more of the three enzymes laccase, lignin peroxidase and manganese peroxidase.

Recent Publications

1. Ijoma GN, Selvarajan R, Tekere, M (2018) The potential of fungal co-cultures as biological inducers for increased ligninolytic enzymes on agricultural residues. International Journal of Environmental Science and Technology 1-20.
2. Ijoma GN, Tekere, M (2017) Potential microbial applications of co-cultures involving ligninolytic fungi in the bioremediation of recalcitrant xenobiotic compounds. International Journal of Environmental Science and Technology 14(8): 1787-1806.
3. Ijoma GN, Selvarajan R, Oyourou JN, Sibanda T, Matambo T, Monanga A, Mkansi K (2018) Exploring the application of biostimulation strategy for bacteria in the bioremediation of industrial effluent. Annals of Microbiology (In review).

4. Ijoma GN, Tekere, M (2016) Increased Enzyme activity during antagonistic invasion interaction of Fungi grown on Corn Cob – 8th International Conference on Environmental Science and Technology, Houston, Texas, June 6 -10, 2016.
5. Ijoma GN, Tekere, M (2016) 'Increased Production of Ligninolytic Enzymes using dual cultures of Fungi on Corn Cob and Sugarcane Bagasse Media' (Oral Presentation) – 6th International Symposium on Energy from Biomass and Waste. Venice, Italy. November.

Biography

Dr. Grace N Ijoma is a senior lecturer of Biotechnology at the Pearson Institute of Higher Education and a postdoctoral fellow at the University of South Africa. Her PhD focused on antagonistic interspecific interactions amongst fungi. Previous paper presentation of portions of this work was presented at 8th International Conference on Environmental Science and Technology. Houston Texas, USA in 2016 and was judged first place paper. She is eclectic in her research interests and has a keen interest in several areas including Bioprospecting of niche environments, Food Microbiology, Environmental and Industrial Microbiology and Biotechnology (particularly Fermentation technology and process optimization), Microbial enzymes and biodegradation of xenobiotic compounds including polyaromatic hydrocarbons, pesticides and synthetic dyes, Ground water quality research and Microbial treatment of industrial waste water, Solid waste management. She is currently supervising undergraduate and post graduate research projects designed towards industrially relevant applications.

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