Solid waste management employing bio-inoculants

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Rapid increase in population and urbanization has led to a drastic increase in the rate of waste generation. A report by World Bank has estimated that the amount of municipal solid waste generated globally is 1.3 billion tons per year and by 2025 this will likely increase to 2.2 billion tons. As per the information received from State Pollution Control Board, India (2009-12), 127,486 TPD (Tons per day) municipal solid-wastes is generated in the country. Big cities collect about 70-90% of MSW generated, whereas smaller cities and towns collect less than 50%. More than 91% of the MSW collected formally is land filled. It has also been reported that about 12% of the wastes is burnt openly on the streets. All these waste disposal practices create various environmental problems and health hazards. Moreover there is a lot of demand of organic food all over the world and to produce the same huge quantity of organic manures is required. To solve these problems, environment friendly waste management practices have to be identified and employed to manage the solid waste. One such process of converting organic waste into plant nutrient rich humus, is composting. As traditional aerobic composting process takes a time period of 3-6 months, it is important to search the ways to fasten the decomposition process and produce quality compost in short period. The composting process can be fastened through the use of bio-inoculants or mechanization or both. At CRDT, IIT Delhi a tremendous amount of work has been done on solid waste management. This includes development of microbial formulations employing Paecilomyces variotii, Pseudomonas fluorescens, Azotobacter chroococcum, Lactobacillus Casei and Trichoderma harzianum for rapid decomposition of waste and quality compost production during summer and winter seasons. Enzyme activity of lignocellulolytic microorganisms, T. harzianum and P. variotii during the composting process has also been studied. A complete package of rapid composting technology has been transferred to village Mubarakpur and handed over to Gram Panchayat. The combined role of microbial formulations developed and earthworms in rapid composting, plant nutrient management and bioremediation (removing heavy metals namely Pb and Cd) has been evaluated. The efficacy of efficient microorganisms employed in rapid decomposition has also been studied against plant pathogens namely Fusarium oxysporum and Verticillium dahliae. T. harzianum and P. variotii recorded a percentage inhibition of 66% and 44% against V. dahlia and 72% and 64.7% against F. oxysporum respectively. The vermi-compost produced by the local (L. mauritii) and exotic (E. foetida) earthworms was used for cultivating button mushrooms (Agaricus bisporus). Very interesting results were obtained pertaining to all these studies mentioned and all the data regarding various experiments will be presented in the conference.

Lignocellulose attacking oxidoreductases and biofuel production from wood wastes by comparative genomics on phlebioid fungi

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Species of the Basidiomycota, class Agaricomycetes, order Polyporales, belonging to the diverse phlebioid clade, are among the most efficient saprotrophic fungal degraders of compact wood and wood lignocelluloses. The phlebioid clade includes species like Phanerochaete chrysosporium and Phlebia radiata, which are white rot fungi being able to attack and degrade even the recalcitrant lignin components in plant biomasses, and convert lignin-like xenobiotic molecules. With genomes of the phlebioid species available (P. chrysosporium, P. carnosa, Phlebia brevispora, P. radiata, Phlebiopsis gigantea, Bjerkandera adusta), we performed a comparative phylogenomic study on this clade with special emphasis on CAZy (Carbohydrate Active Enzymes), oxidoreductases (laccases, heme-including peroxidases, lytic polysaccharide monooxygenases) and hydrogen peroxide producing enzymes (GMC oxidoreductases, Cu radical oxidases). Transcriptomes and proteomic evidence of the species on lignocellulose substrates are compared, taking into account enzyme activity profiles and evolutionary diversification of the species to three distinct subclades within the phlebioid clade. Our aim is to find the enzymatic, genetic and genomic elucidation of the species diversification in this important fungal clade to different life-styles and growth patterns on wood and plant biomass, and find novel candidate genes for oxidative attack on lignocelluloses.