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Nutritional Evaluation of Fungal Treated Rice Straw

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Abstract

Microbial improvement of nutritive value for rice straw is not only aids in the prevention of Egyptian environmental pollution but also solve the problem of shortage in animal feeds ingredients. The current study was designed to investigate the microbial improvement of rice straw via solid state fermentation using five strains of fungi namely *Trichoderma viride*, *Trichoderma reesei*, *Pleurotus ostreatus*, *Aspergillus oryzae* and *Aspergillus fetidus*. This fermentation results in improving of nutritive value of rice straw by increasing its dry matter, protein, fat, ash and energy content with decreasing of fiber and organic matter content. These effects were variable according the type of fungi, which were very high for rice straw treated with *Trichoderma viride* and *Trichoderma reesei* followed by that treated by *Pleurotus ostreatus* then those treated by *Aspergillus oryzae* and *Aspergillus fetidus*.

Keywords: Rice straw, Solid state fermentation, Fungi, Biotechnology

Practical Application

In Egypt the annual agriculture by-products estimated to be around 30 million tons of dry material. Approximately, two thirds of the crop residues are burned or wasted, and hence lead to environmental pollution and consequently health hazards. Burning of agricultural wastes specially rice straw form 42% of Egyptian environmental pollution. Utilization of such by-products cannot only be used in solving for problem of animal feed shortage but also as a method to control environmental pollution. To increase the nutritive value of rice straw, many efforts have been carried out. Several reports have been documented on the use of chemical, physical, mechanical and biological treatments. Biotechnological approaches as the use of suitable microorganism have been employed. This approach is believed to be more safe and environment friendly than using of chemicals. Recently, biological degradation of agricultural residues by solid state fermentation (SSF) using selected microorganisms should have the ability to produce sufficient amount of appropriate enzymes that are able to degrade the cellulose and hemicelluloses in the substrate. By this method, lignin is preferentially decreased. Fungal organisms have the ability to utilize starch of the substrate to produce single cell protein. However, the reduction of lignin and lingo-cellulosic complex depend on the strain of fungi and the cultural conditions. Among different fungal strains, treatments with *Asprigillus* spp. increase crude protein content of different substrates such as rice bran, sugar cane and corn-cob. Furthermore, several reports revealed the ability of certain species of fungi such as white rot fungi *Pleurotus sajor* to enhance the nutrients in both stem and leaves of rice straw within 30 days incubation period. Moreover, treatment of agricultural wastes with *Pleurotus* species resulted in increased its ether extract, crude protein and minerals contents, while decreasing crude fiber and cell wall constituents. The ability of white-rot fungi is in degrading lignin due to secreting ligninases enzymes. Furthermore, Studies found that rice straw treated with three different edible mushrooms: *Pleurotus ostreatus (POR), Pleurotus pulmonarius (PPR) and Pleurotus tuber-regium (PTR)* resulted in increase in crude protein and reduction of crude fiber fractions of the treated rice straw. *Trichoderma* is another strain of fungi known by its capacity in degrading indigestible fiber of rice straw by secreting lytic enzymes, which commonly found in all climatic zones. Cellulases, hemicellulases and pectinases produced by *Trichoderma* fungi used in the partial hydrolysis of plant cell walls in animal feeds, enhancing its digestibility and nutritive value. The aim of the current study was to differentiate nutritionally among the effects of certain strains of fungi and their ability to enhance the quality of rice straw and improving its nutritional value for animal feeding.

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