CHAPTER 1

INTRODUCTION

The word fungus has been taken from Latin, which means mushroom. Their plant body consist of thallus, made up of hyphae, which together constitute mycelium. At present, about 5,100 genera and more than 50,000 species of fungus are known. These are cosmopolitan in distribution and can occur in any habitat where life is possible. Some fungi occur in fresh and marine water, others are terrestrial and still others are airborne. Many species are parasitic, infecting plants, animals and human beings (Blanchette, 1995). Fungi have a worldwide distribution and grow in a wide range of habitats, including extreme environments such as deserts or areas with high salt concentrations or ionizing radiation as well as in deep sea sediments. Some can survive the intense UV and cosmic radiation encountered during space travel (Dadachova et al., 2007). Wood decay in hardwood forests, tropical forest and coniferous forests plays a prominent role in ecosystem (Eriksson et al., 1990). Fungi is the second most diverse of all groups and is considered as a prime member of the other “mega-diverse” groups like insects, bacteria, arachnids and nematodes (Gaston, 2000; Hawksworth and Kalin-Arroyo, 1995).

A mushroom is a fleshy, spore bearing fruiting body of fungus, typically produced above ground on soil or on its food source, large enough to be seen with naked eye and picked by hand (Chang and Miles, 1992). Mushrooms have long been used as a valuable food source and as traditional medicines around the world, especially in Japan and China. Mushrooms include 14,000 to 22,000 species while the real number may be much high. There are over 2000 species of mushroom which are edible, some of them are cultivated commercially while few are poisonous if consumed (Dix and Webster, 1995). Mushrooms are recognised as important food item since ancient time. This usage is increased day by day their significant role in human health, nutrition and disease. Fungi are ideal food because they have more content of protein (typically 20-30% dry matter as crude protein) which contains all of essential amino acid (Moore and Chiu, 2001). Fungal biomass is a source of dietary fibre and virtually free of cholesterol. Mushrooms are good source of vitamin and mineral. Most of mushrooms contain biologically active polysaccharide. Mushrooms contain substances of various kinds that are highly valued as medicine, flavouring and perfumes (Chang and Buswell, 1996; Fan et al., 2008). Fruiting bodies, mycelia
and submerged broth are the source of bioactive compounds. Mushrooms represent an important biological resource of social, economic and ecological significance. They have been found effective against cancer, cholesterol reduction, stress, insomnia, asthma, allergies and diabetes (Bahl, 1983). Due to high amount of proteins, they can be used to bridge the protein malnutrition gap. Mushrooms as functional foods are used as nutrient supplements to enhance immunity in the form of tablets. Due to low starch content and low cholesterol, they suit diabetic and heart patients. One third of the iron in the mushrooms is in available form. Their polysaccharide content is used as anticancer drug. Even, they have been used to combat HIV effectively (Nanba, 1993; King, 1993). Biologically active compounds from the mushrooms possess antifungal, antibacterial, antioxidant and antiviral properties have been used as insecticides and nematicides.

Brown rot fungi (BRF) comprise a relatively small group of basidiomycetes that decay cellulose in wood preferentially. They do not degrade the lignin extensively, although they modify it by demethylating it. BRF make a large contribution to wood decay, especially in coniferous forests (Dix and Webster, 1995).

White rot fungus (WRF) breakdown lignin and commonly cause rotted wood to form moist soft, spongy and appear white or yellow colour residues. It breakdown lignin in wood, leaving the lighter colour residue behind (Hatakka, 1994).

Lignin plays a crucial role in conducting water in plant stems. The polysaccharide components of plant cell wall are highly hydrophillic and thus permeable to water, whereas lignin is more hydrophobic. The crosslinking of polysaccharides by lignin is an obstacle for water absorption to the cell wall. Thus, lignin makes it possible for the plant's vascular tissue to conduct water efficiently. Lignin is present in all vascular plant, but not in bryophyte, supporting the idea that the original function of lignin was restricted to water transport (Arora et al., 2002). Lignin is the second most abundant biopolymer after cellulose, employing 30% of non-fossil organic carbon and constituting from a quarter to a third of dry mass of wood (Boerjan et al., 2003). Ecological factors such as climate condition, duration of sun light exposure, soil composition affect the chemical composition of lignocellulosic materials. The hydrolysis of lignocellulosic materials in natural condition is slow. Several enzymes plays a role in degradation of lignin by WRF: laccase (polyphenol oxidase), Mn-peroxidase, H_{2}O_{2} producing enzyme and ligninase (Kirk and Farrell, 1987). Lignin degrading fungi are also known as
ligninolytic fungi are classified into three major categories based on the type of wood decay caused by these organisms: white-rot, brown-rot and soft-rot fungi (Eriksson et al., 1990). Among these three groups of fungi, white-rot fungi are the most effective lignin degraders and have been the most extensively studied group (Mester and Field, 1998).

Ligninolytic enzymes are enzymes involved in the degradation of the complex and recalcitrant polymer lignin. The demand of these enzymes has increased in the recent years due to their potential applications in diverse biotechnology area (Zumdahl, 2009). Due to the irregular structure of lignin the degradative enzymes must have lower substrate specificity than typical biological catalysts (Hammel, 1997). Some of the enzymes secreted by fungi generate hydrogen peroxide as an oxidant and others transfer the electrons. The most important lignin-modifying biocatalysts are lignin peroxidases (LiPs), manganese peroxidases (MnPs) and laccase.

Laccases are copper containing oxidase enzymes that are found in many plants, fungi, and microorganism. Laccase belongs to the oxidase enzyme family it require oxygen as a second substrate for enzymatic action. Laccases are also used as catalysts for the manufacture of anti-cancer drugs and even as ingredients in cosmetics. Recently, the utility of laccases has also been applied to nanobiotechnology (Edward et al., 1996).

Aryl alcohol oxidase (AAO) these enzymes belong to family oxidoreductase. It is enzyme catalyzes a chemical reaction. An aromatic primary alcohol + O₂ → Anaromatic aldehyde + H₂O₂. AAO activity was described for the first time in the fungus Polystictus versicolor in 1960. Some of them breakdown lignin and cellulose and because this fungi able to produce enzyme laccase (Farmer et al., 1960).

Lignin peroxidases (LiP) are highly resistant to biodegradation and only higher fungi are capable of degrading the polymers via an oxidative process. Lignin is found to be degraded by an enzyme lignin peroxidase (Erikson et al., 1990).

Manganese peroxidises (MnP) belongs to family of oxidoreductase to be specific those acting on a peroxide as acceptor. These enzymes need Ca²⁺ for activites. White rot fungi secrete this enzyme to add lignin degradation (Zumdahl, 2009). The product of Mn²⁺ oxidation, Mn³⁺ must be chelated by organic acids such as oxalate or malonate, which are produced by the
fungus. MnP is also regulated at the level of gene transcription by heat shock and H₂O₂. MnP have been found in most WRF (Alic et al., 1997).

*Auricularia polytricha* is known as the Jew's ear, jelly ear or by a number of other common names, is a species of edible Auriculariales fungus found worldwide. The fruiting bodies are distinguished by its noticeably ear-like shape and brown colouration; it grows upon wood. Its edible fruitbodies could be easily identified by pilose upper surface which is strongly capitate with dark brown smooth hymenium (Jonathan, 2002).

*Morchella* spp. are commonly known as “Guchhi” and true morels. It is one of the most readily recognized of all the edible mushrooms. Each fruiting body begins as a tightly compressed, grayish sponge with lighter ridges and expands to form a large yellowish sponge with large pits and ridges raised on a large white stem (Pegler, 2003).

*Helvella* spp. is creamy white in colour. It is striking due to its irregularly-shaped lobes on the cap. It grows in grass as well as in humid hardwoods, such as beech, (not so well in resinous ones) along the side of pathways, in hedges and on the talus of meadows. They can be spotted from the end of summer until the end of autumn (Maheshwari and Balasubramanyam, 1988).