Chitin uses

Thesis Abstract or Dissertation Abstract (Summary):

Chitin is an abundant renewable natural resource obtained from marine invertebrate, insects, fungi and algae. Almost 10% of the gobal landings of aquatic products consist of organisms rich in chitinous material (10-50% on dry weight basis). More than 80,000 metric tons of chitin is obtained from marine waste (Patil et al, 2000). Chitin comprises with 22-44% of cell wall materials of fungi.

Chitinases are glycosyle hydrolases, which are chitin hydrolyser, present in a wide range of organisms that do not contain chitin but play an important physiological and biochemical role. Chitinases have many applications. It can be used as biopesticide, mosquito control agent, anti-inflammatory and anti-tumor drug. Chitinase also can be used as waste utilization in form biomanagement.

A serious problem faced by the antibiotic producing fermentation industry is the disposal of large amounts of myceial biomass, which emerge as refuge, and creates pollution. It is estimated that per cycle of fermentation about 30% of mycelial mat develops. The major amount of mycelial biomass is the cell wall material, which is largely chitin. This problem could be overcome if the fungal biomass were used as substrate for further industrial production of useful compounds. In view of this, a suitable strain was isolated which degrades and utilizes the mycelial biomass that also produces useful metabolite such as antibiotic and chitinase enzyme. One of the major goals of my research project (funded by Department of Biotechnology, Government of India) is to develop a model for cyclic fermentation for the biomanagement of mycelial waste (of penicillin industry) to produce value added chemicals.

Chitin is one of many naturally occurring polymers. Its breakdown may be catalyzed by enzymes called chitinases, secreted by microorganisms such as bacteria and fungi, and produced by some plants. Some of these microorganisms have receptors to simple sugars from the decomposition of chitin. If chitin is detected, they then produce enzymes to digest it by cleaving the glycosidic bonds in order to convert it to simple sugars and ammonia.

Shellfish Waste. On average, the processing of shellfish generates from 50 to 60 percent solid waste. This waste consists primarily of exoskeleton and ranges from 25 to 40 percent protein, 15 to 25 percent chitin, and 40 to 50 percent calcium carbonate. Shellfish waste has a much lower protein value than fish waste and is therefore not a desirable source of animal feedstuff. It is a more likely candidate for use as a fertilizer source and shows relative fertilizer values of approximately six percent N, two percent P and one percent K. In California, fertilizer is manufactured from shellfish waste by a few small, locally based companies. The availability of this product is still quite limited relative to other more popular fertilizer sources.

Chitin. Chitin is a by-product of the shellfish industry and consists of the shells of crabs and lobsters, usually in a pulverized form. While it usually contains about three percent nitrogen, it is really too expensive to be used as a source of nitrogen. However, chitin may be the first organic soil amendment to be used as a specific biological control agent. Recent studies have shown that chitin additions suppress pathogenic nematodes and fungi. This research is still in the field trial stage, however the preliminary results look very promising.

Actinobacteria or **actinomycetes** are a group of Gram-positive bacteria with high G+C ratio. They include some of the most common soil life, playing an important role in decomposition of organic materials, such as cellulose and chitin and thereby playing a vital part in organic matter turnover and carbon cycle. This replenishes the supply of nutrients in the soil and is an important part of humus formation. Other Actinobacteria inhabit plants and animals, including a few pathogens, such as *Mycobacterium*, *Corynebacterium*, *Nocardia*, *Rhodococcus* and a few species of *Streptomyces*.

Actinobacteria are well known as secondary metabolite producers and hence of high pharmacological and commercial interest. In 1940 Selman Waksman discovered that the soil bacteria he was studying made actinomycin, a discovery which granted him a Nobel Prize. Since then hundreds of naturally occurring antibiotics have been discovered in these terrestrial microorganisms, especially from the genus *Streptomyces*.

Genomes of 44 different strains of Actinobacteria from different genera are either already sequenced or underway right now.

Some Actinobacteria form branching filaments, which somewhat resemble the mycelia of the unrelated fungi, among which they were originally classified under the older name Actinomycetes. Most members are aerobic, but a few, such as *Actinomyces israelii*, can grow under anaerobic conditions. Unlike the Firmicutes, the other main group of Gram-positive bacteria, they have DNA with a high GC-content and some Actinomycetes species produce external spores.