

## Degradation of Lignin & cellulose by microbe:

Ligninocellulose are made up of composition of Lignin & cellulose.

Structure of cellulose: → Cellulose fibres — composed of microfibrils containing glucose molecules.

## Lignin: →

- A highly insoluble complex branched polymer of substituted phenyl propane units joined by carbon-carbon and ether linkages.
- It provides an extensive cross-linked network within the cell wall, and increase the strength and recalcitrance of the plant cell wall.
- A phenolic compd which binds the cellulose microfibrils providing rigidity to the cell wall but also making it recalcitrant to ~~degradation~~ degradation.
- Some fungi and bacteria produce ligninases that can biodegrade the polymer, thereby releasing the carbohydrates.
- Lignin is a copolymer of 3 diff phenyl propane monomer units.

## X why depolymerization of biomass needed?

To decrease the harmful effects of global climate change, as well as to satisfy the future energy demands.

Biofuels are emerging as a new source of energy derived from biomass. e.g. bioethanol or cellulosic ethanol.



- Biomass are major sustainable energy source, hence, to obtain clean fuel using cellulose and hemicellulose, lignocellulosic residues offers a cheap feedstock raw material than the food crops.

### Lignocellulosic Biomass — 2<sup>nd</sup> generation.

- The prod<sup>n</sup> of biofuels could decrease effectively the impact of pollutants in the atmosphere, in addition to assisting in the management for tons of biomass waste generated.
- Biomass produced in a sustainable way can be used for electricity generation, heat production and transportation of liquid fuels...

### ✓ How lignocellulosic components are degraded?

- In nature, lignocellulose and lignin are major sources of plant biomass, therefore their recycling is indispensable for the carbon cycle.
- Naturally lignocellulosic components are degraded by bacteria & fungi.

These polymers are degraded by a variety of microorganisms which produce a battery of enzymes that work synergistically.

eg - some fungi & bacteria produce ligninase that can biodegrade the polymer, thereby releasing the fermentable sugars.

It can also be degraded by dilute acid or base and as well as by many exogenously supplied hemicellulose degrading enzymes.

In the near future, processes that use lignocellulolytic enzymes or are based on MOs could lead to new, environmentally friendly technologies.

Pre-treatment methods of digestion:

- (i) Mechanical      (iii) Chemical      (v) combination
- (ii) Physical        (iv) Biological

Lignin is extremely recalcitrant to degradation.