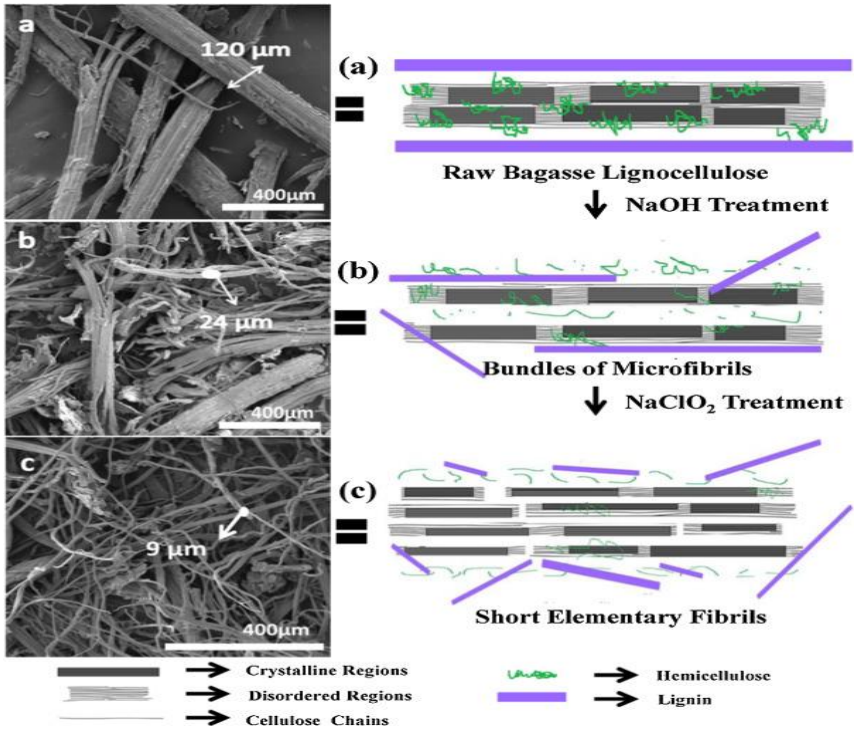
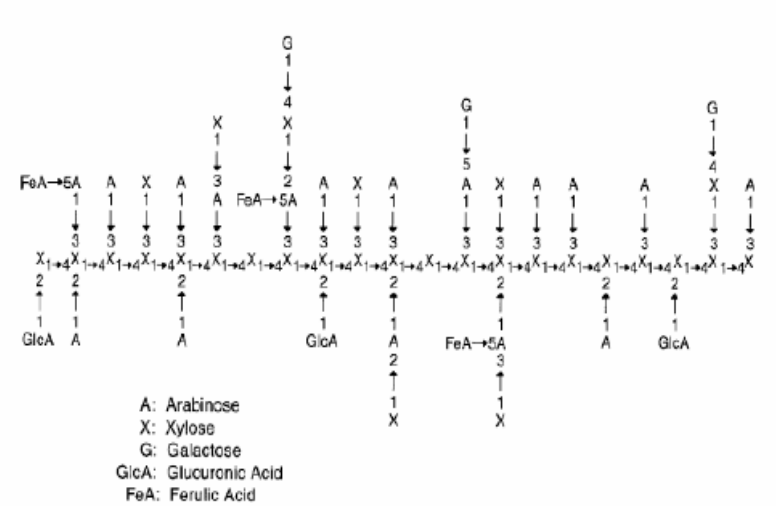
Cellulose fibers under Scanning Electron Microscopy (SEM)



(Yiying Yue, Jingquan Han, Guangping Han, Giovanna M. Aita, Qinglin Wu,"Cellulose fibers isolated from energycane bagasse using alkaline and sodium chlorite treatments: Structural, chemical and thermal properties", Industrial Crops and Products, Volume 76, 2015, Pages 355-363)

Hemicellulose is identical to cellulose with respect to being a sugar based polymer but it is made up of shorter and branched chains of various subunits compared to the long strands of glucose subunits forming the organized structure of cellulose. Another significant structural difference between cellulose and hemicellulose is that hemicellulose is entirely an amorphous polymer. While possessing six-carbon sugars including, glucose, mannose, galactose and it also consists five-carbon sugars, including xylose and arabinose ($C_5H_{10}O_5$).

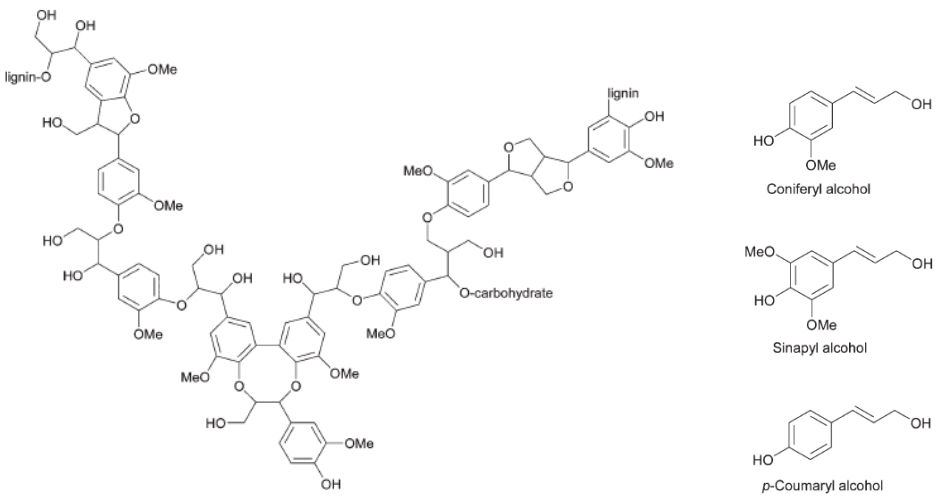
In addition to ethanol production, biotechnological applications of hemicellulose mainly include production of the value-added products such as xylitol, 2, 3-butanediol, films and coatings.



Lignin

Lignin adds strength and rigidity to structure. Its chemical structure consists of **phenylpropane** units, originating from three aromatic alcohol precursors (monolignols), p-coumaryl, coniferyl and sinapyl alcohols.

Among the fundamental uses of lignin are being an additive in carbon fibers and precursor for platform chemicals production.



Lignin is the most abundant polymer possessing aromatic functionality on earth. It is a three-dimensional and water-insoluble macromolecule, which is originated from polymerization of three monolignols (phenylpropane units), p-coumaryl, coniferyl, and sinapyl, incorporated into the structure through several linkages. β-O-4 ether linkage is the most common linkage, which constitutes almost 50% of the intersubunit bonds in lignin.