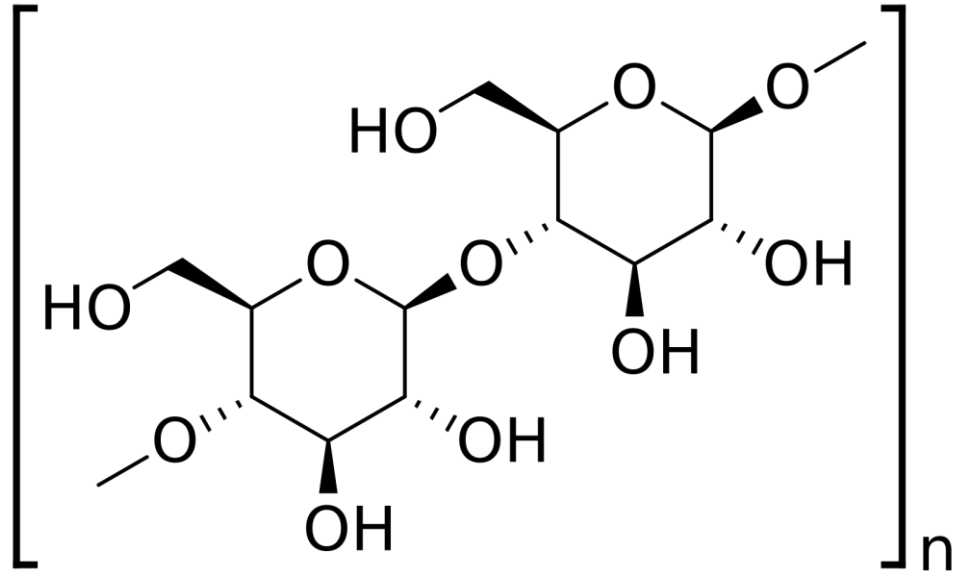


Enzymatic Degradation

Borbala Koseczki (Hungary) and Katharina Posch (Austria)

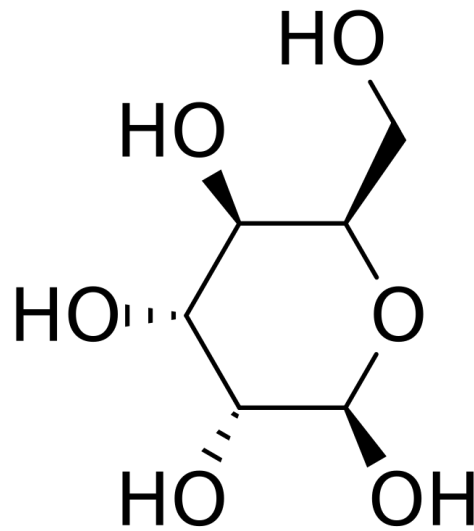
Overview

enzymatic splitting by
cellulase



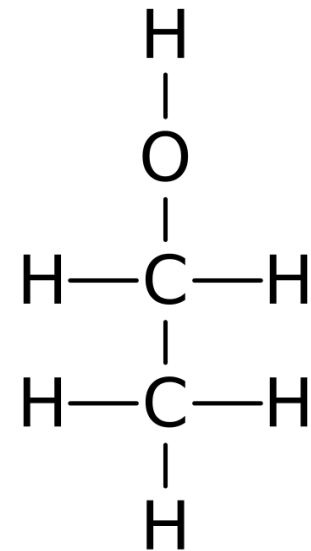
cellulose

alcoholic
fermentation

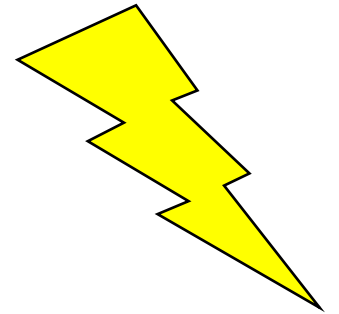


glucose

ethanol fuel
cell



ethanol

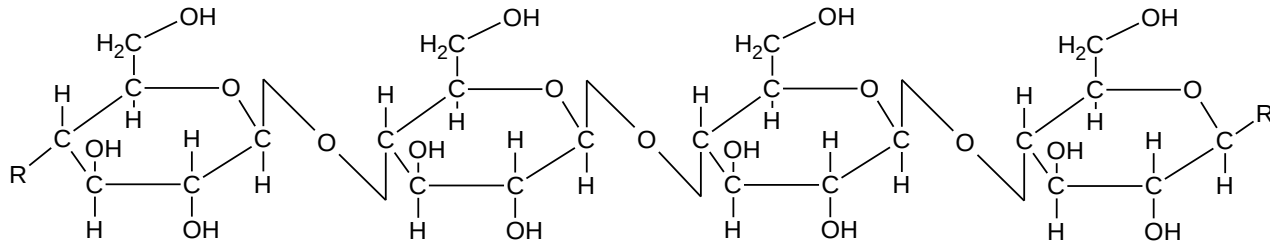


power

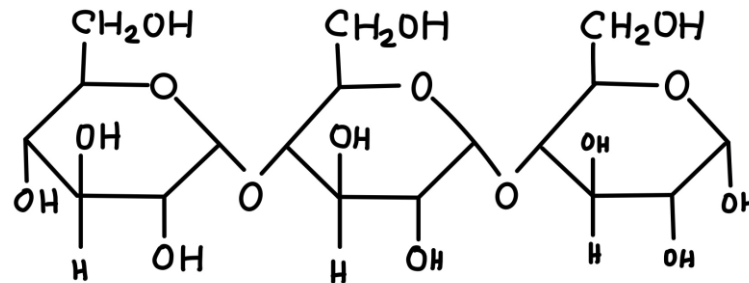
Hydrolysis of Amylose

- **amylose** – main component of starch (second component: amylopectin)
- **amylase** – enzyme used to degrade amylose to glucose (saliva carries amylases to make the energy in starchy food accessible to the human body)
- degradation of **amyloses** with **α -1,4 –glycosidic bonds**

Hydrolysis of Amylose – Structural Formula



Cellulose



Amylose

Hydrolysis of Cellulose

- production of glucose (monosaccharide); needed for further fermentation to ethanol

enzymatic catalyst

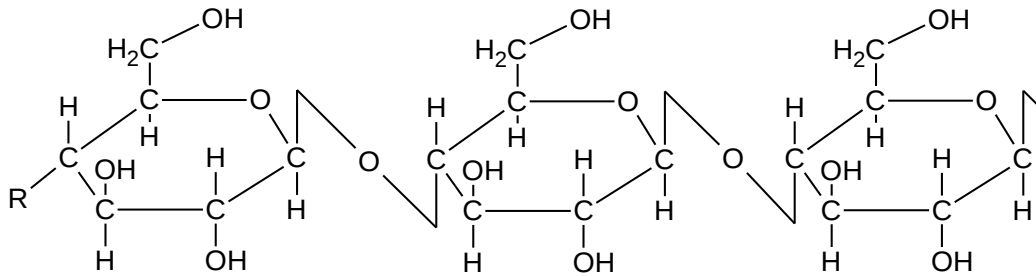
- used method in our project
- industry standard

acidic catalyst

- unprofitable
- more dangerous

Enzymatic Hydrolysis of Cellulose

- glucose molecules bound by β -1,4-glycosidic bonds

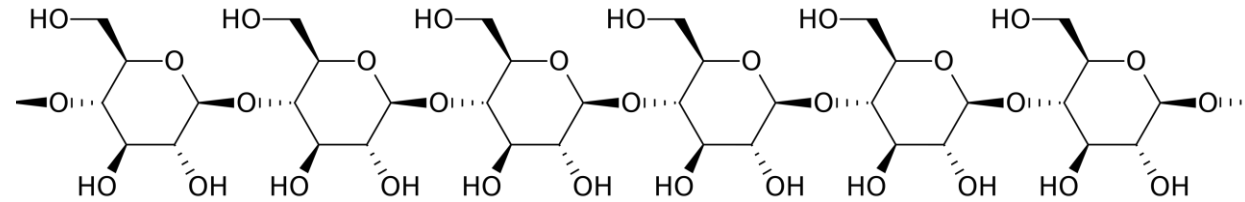


Cellulose

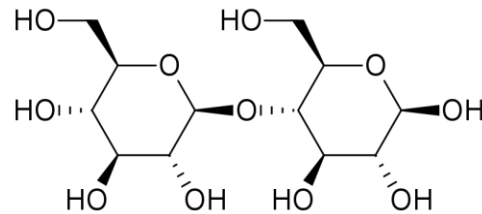
- Enzymatic hydrolysis of cellulose is achieved via the enzyme cellulase, which breaks down β -1,4-glycosidic bonds.

Enzymatic Hydrolysis of Cellulose

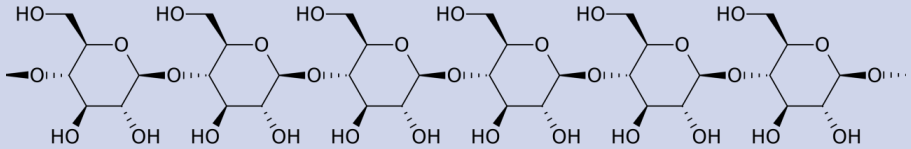
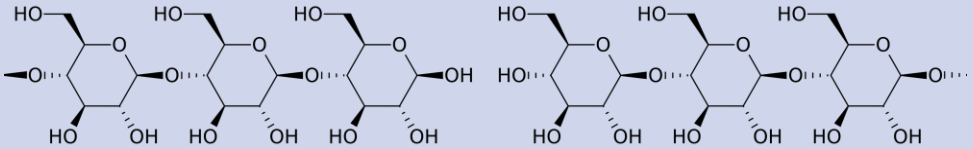
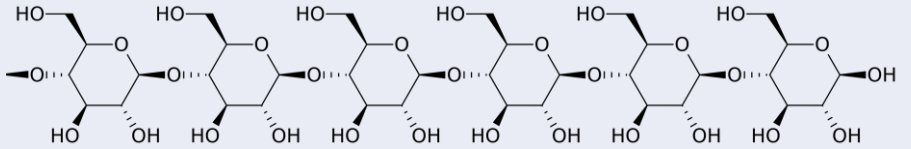
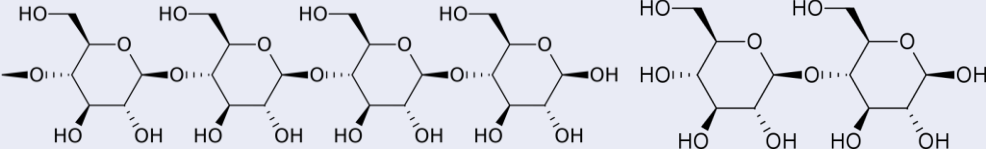
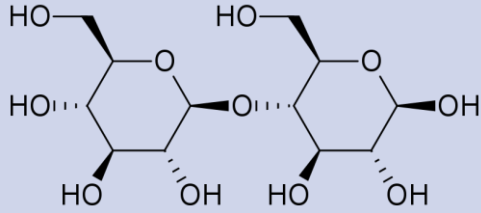
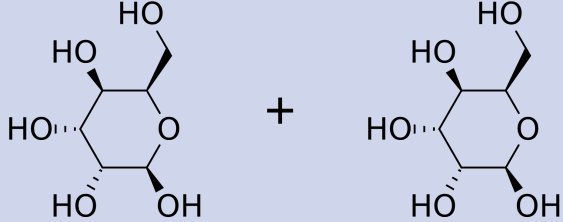
- enzymes are added to break down the cellulose
- cellulose – cellulase



- cellobiose – cellobiase



Splitting of Cellulose - Cellulases

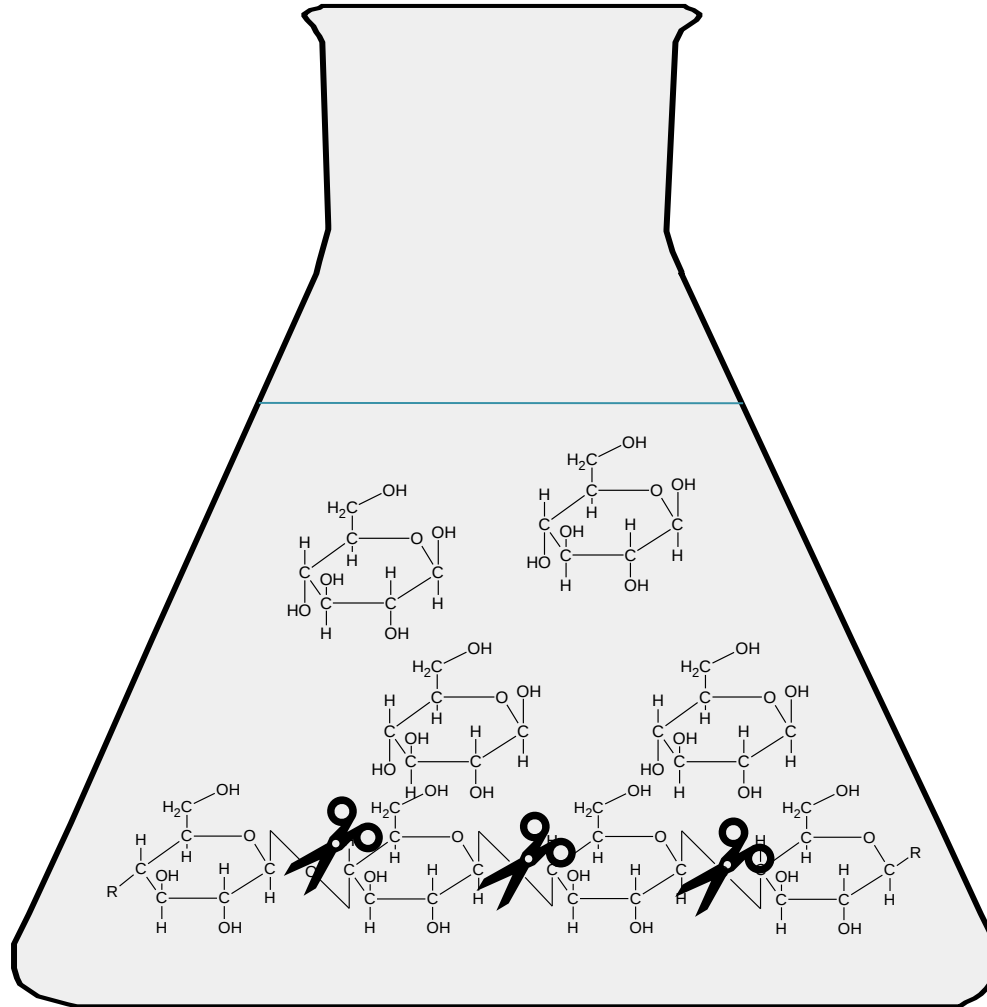
enzyme	substrate	product
endocellulase		
exocellulase		
cellobiase		

Enzymatic Hydrolysis of Cellulose

- formation of cellobiose inhibits the effect of cellulase
- cellobiase breaks cellobiose down into glucose
- cellulase can work correctly again

Enzymatic Hydrolysis of Cellulose - Example

- cellulase added to scrap paper (contains cellulose)
- glucose develops and can be measured by the photometer



Sources

- Golan, Adam E.: Cellulase. Types and Action, Mechanism, and Uses. New York: Nova Science Publishers, 2011.
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- Henriksson, Gunnar / Geilerstedt, Goran u.a.: Wood Chemistry and Wood Biotechnology. Berlin: De Gruyter, 2009.
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- Mortimer, Charles E. / Müller, Ulrich: Chemie. Das Basiswissen der Chemie. 12. Aufl. Stuttgart: Georg Thieme Verlag, 2015.