

1. Structure of Starch

Starch is a **plant storage polysaccharide** made up of **α -D-glucose** units.

General formula:



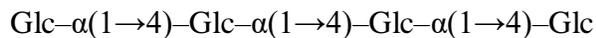
Starch consists of **two components**:

(A) Amylose (20–30%)

- Linear polymer of α -D-glucose
- Linked by **$\alpha(1\rightarrow4)$ glycosidic bonds**
- Forms a **helical (coiled) structure**
- About 200–1000 glucose units

Structure of Amylose

Glucose units are connected as:



Important features:

- C1 of one glucose links to C4 of next
- Alpha configuration at C1
- One reducing end and one non-reducing end

Because of α -linkages, the chain bends and forms a helix.

(B) Amylopectin (70–80%)

- Branched polymer of α -D-glucose
- $\alpha(1\rightarrow4)$ linkages in linear chains
- $\alpha(1\rightarrow6)$ linkages at branching points
- Branching every 24–30 glucose units
- Very large molecule

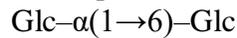
Structure of Amylopectin

Main chain:



Branch point:

At C6 position:



So structure contains:

- Linear chains
- Side branches

Amylopectin is highly branched but less branched than glycogen.

Key Structural Features of Starch

- Made of **α -D-glucose**
 - Bonds: $\alpha(1\rightarrow4)$ and $\alpha(1\rightarrow6)$
 - Coiled/branched structure
 - Digestible by humans (amylase enzyme)
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2. Structure of Cellulose

Cellulose is a **structural polysaccharide** present in plant cell walls.

It is made up of **β -D-glucose** units.

General formula:



Structure Details

- Linear polymer of β -D-glucose
- Linked by **$\beta(1\rightarrow4)$ glycosidic bonds**
- No branching
- Very long straight chains

Repeating Unit

Each glucose is rotated 180° relative to the next one.

Structure:



Because of β -linkage:

- Chain remains straight
 - No helix formation
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Hydrogen Bonding

Adjacent cellulose chains are held together by:

- Intermolecular hydrogen bonds
- Intramolecular hydrogen bonds

This leads to:

- Formation of microfibrils
 - High tensile strength
 - Rigid structure
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Structural Difference Between Starch and Cellulose

Feature	Starch	Cellulose
Monomer	α -D-glucose	β -D-glucose
Bond type	$\alpha(1\rightarrow4)$, $\alpha(1\rightarrow6)$	$\beta(1\rightarrow4)$
Shape	Helical/branched	Straight chain
Branching	Present (amylopectin)	Absent
Digestibility	Digestible	Indigestible
Function	Storage	Structural

Why Structural Difference Matters

- α -linkage \rightarrow Bent structure \rightarrow Digestible
- β -linkage \rightarrow Straight structure \rightarrow Strong fiber \rightarrow Not digestible in humans