

PYROLYSIS

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What is pyrolysis?

Heating of organic material without presence of oxygen



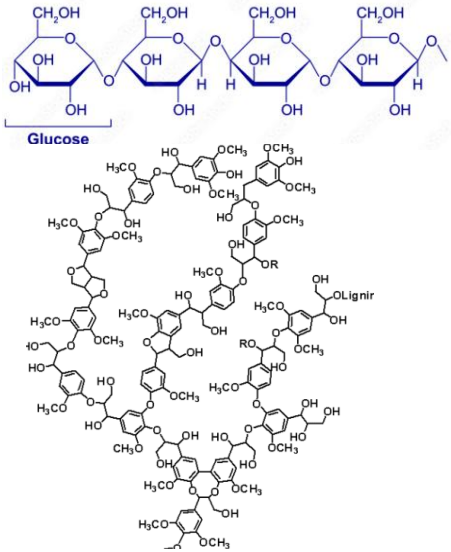
>400 °C
No oxygen



- Gases: CO, H₂, CH₄, CO₂
- Condensate: water, liquid organic
- Carbonised solid: biochar

Pyrolysis compared with other processes

Lignocellulosic



Process

Pyrolysis: heating without oxygen

Combustion: reaction with oxygen

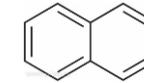
Gasification: conversion to combustible gases

Products

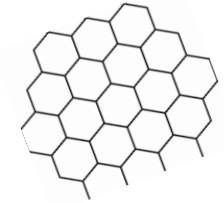
Gases



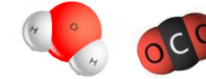
Tar



Biochar



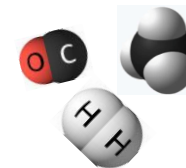
Gases



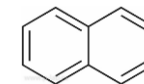
Ash

Heat

Gases

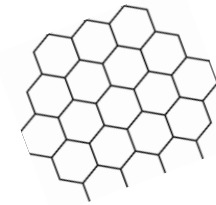
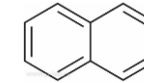
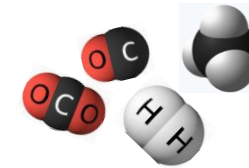
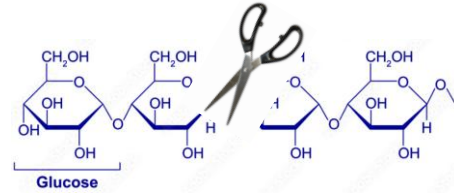
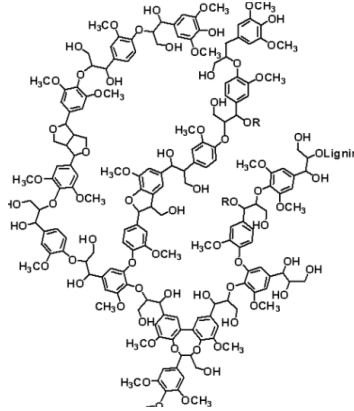


Byproducts

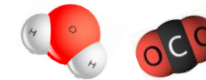


Pyrolysis reactions and others

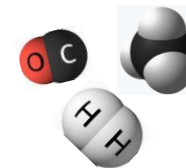
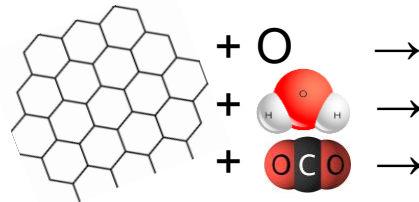
Pyrolysis:



Combustion:

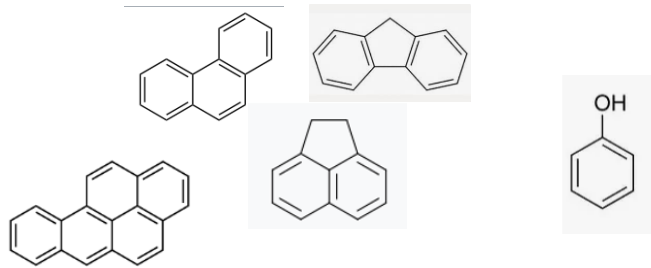


Gasification:



Pyrolysis oil

- Aldehydes
- Ketones
- Acids
- Alcohols
- Aromatics
 - PAH



Compounds

Acetaldehyde ($\text{C}_2\text{H}_4\text{O}$)

Ethanol ($\text{C}_2\text{H}_6\text{O}$)

Acetone ($\text{C}_3\text{H}_6\text{O}$)

Formic acid (CH_2O_2)

2-propanone ($\text{C}_3\text{H}_6\text{O}$)

Propanoic acid ($\text{C}_3\text{H}_6\text{O}_2$)

Acetoin ($\text{C}_4\text{H}_8\text{O}_2$)

1-Hydroxy-2-butanone ($\text{C}_4\text{H}_8\text{O}_2$)

| Cyclopentanone ($\text{C}_5\text{H}_8\text{O}$)

Pyridine ($\text{C}_5\text{H}_5\text{N}$)

Butanone ($\text{C}_4\text{H}_8\text{O}$)

2-cyclopentanone ($\text{C}_5\text{H}_6\text{O}$)

Butyrolactone ($\text{C}_4\text{H}_6\text{O}_2$)

Benzaldehyde ($\text{C}_7\text{H}_6\text{O}$)

Phenol ($\text{C}_6\text{H}_6\text{O}$)

Acetophenone ($\text{C}_8\text{H}_8\text{O}$)

Benzoic acid ($\text{C}_7\text{H}_6\text{O}$)

Ethanone ($\text{C}_8\text{H}_{14}\text{O}$)

Pyrolysis test bench at NSR

