



**Oregon State**  
University

# Hazelnut Shell Fast Pyrolysis Process

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# Background

## Significance of biomass convert to energy

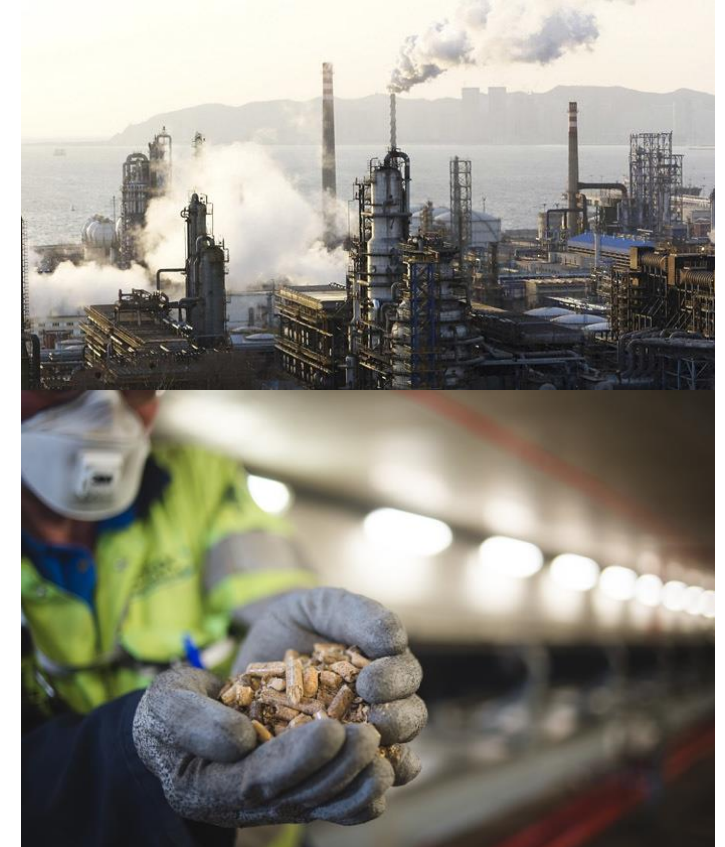
- Improve energy structure
- Reduce greenhouse gas emissions
- Develop a green and low-carbon economy

## Advantages

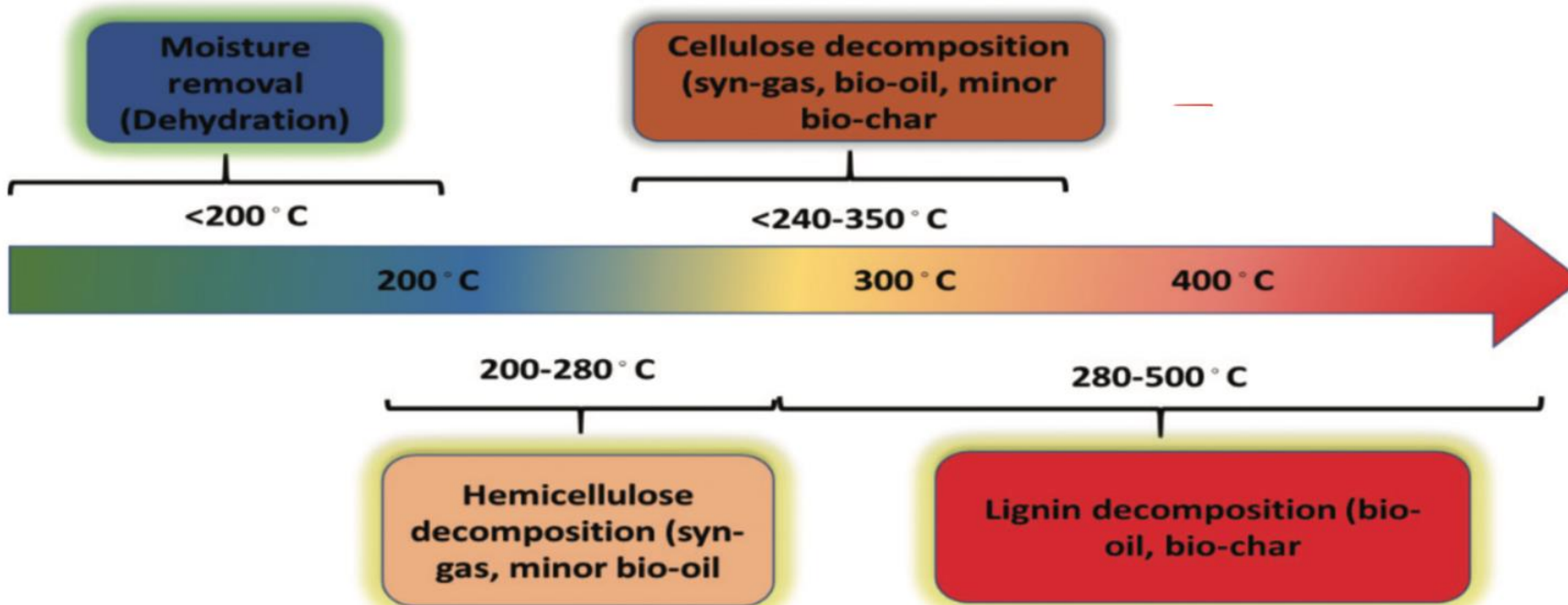
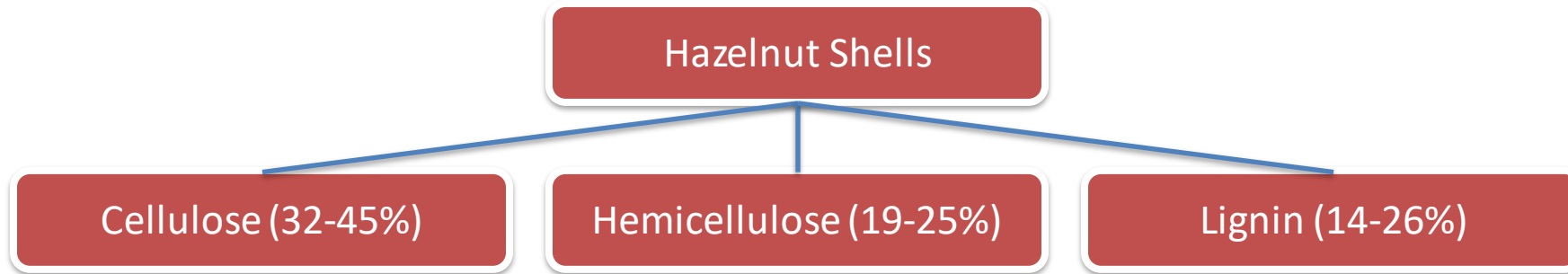
- As a renewable energy source, it has been widely used
- Reduced excessive dependence on fossil fuels
- Cheaper than fossil fuels
- Ect...

## Objective

- Design a pyrolysis unit system for the hazelnut food processing industry. The project expect to handle 10,000 tons of hazelnut shell per year. Converting biomass to biochar and gain profits as selling the product.



# Chemical Makeup



Reaction Yield (Fast Pyrolysis)	
Gas	8%
Bio oil	65%
Biochar	27%



# Reaction

## Pyrolysis Process

### Dehydration

- 9 wt% of Moisture will completely remove through vaporization

### Gasification

- An endothermic reaction that converts biomass to multiple flammable gases, such as  $\text{CH}_4$ ,  $\text{CO}$ ,  $\text{H}_2$
- $\text{CO}_2$  and  $\text{N}_2$  which are not flammable will also generate

### Carbonization

- A spontaneous process breakdown of fiber structure, ending until the charcoal remains (a kind of carbonized residue, can be treated as high concentration carbon element)





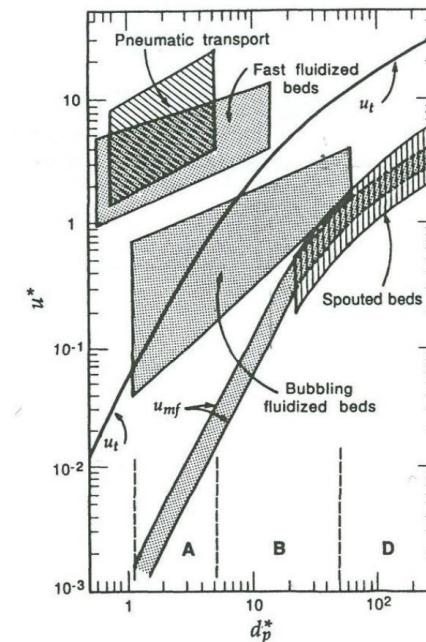
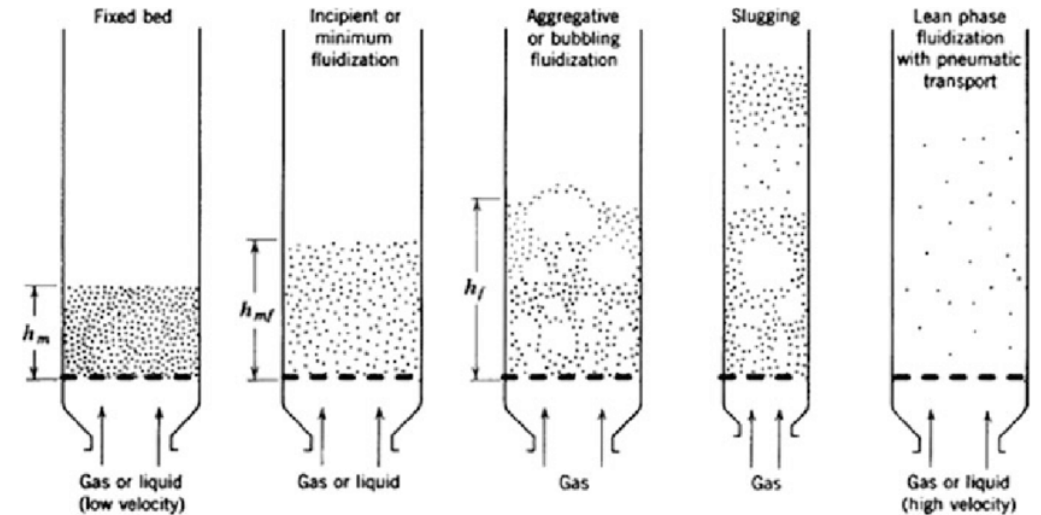
# Bubbling Fluidized Bed

## Fluidized Bed Reactor (FBR)

- A type of reactor can carry multiphase chemical reactions
- It use a gas or liquid fluid to pass through solid materials at high speeds, which will make the solid behave more like a liquid.

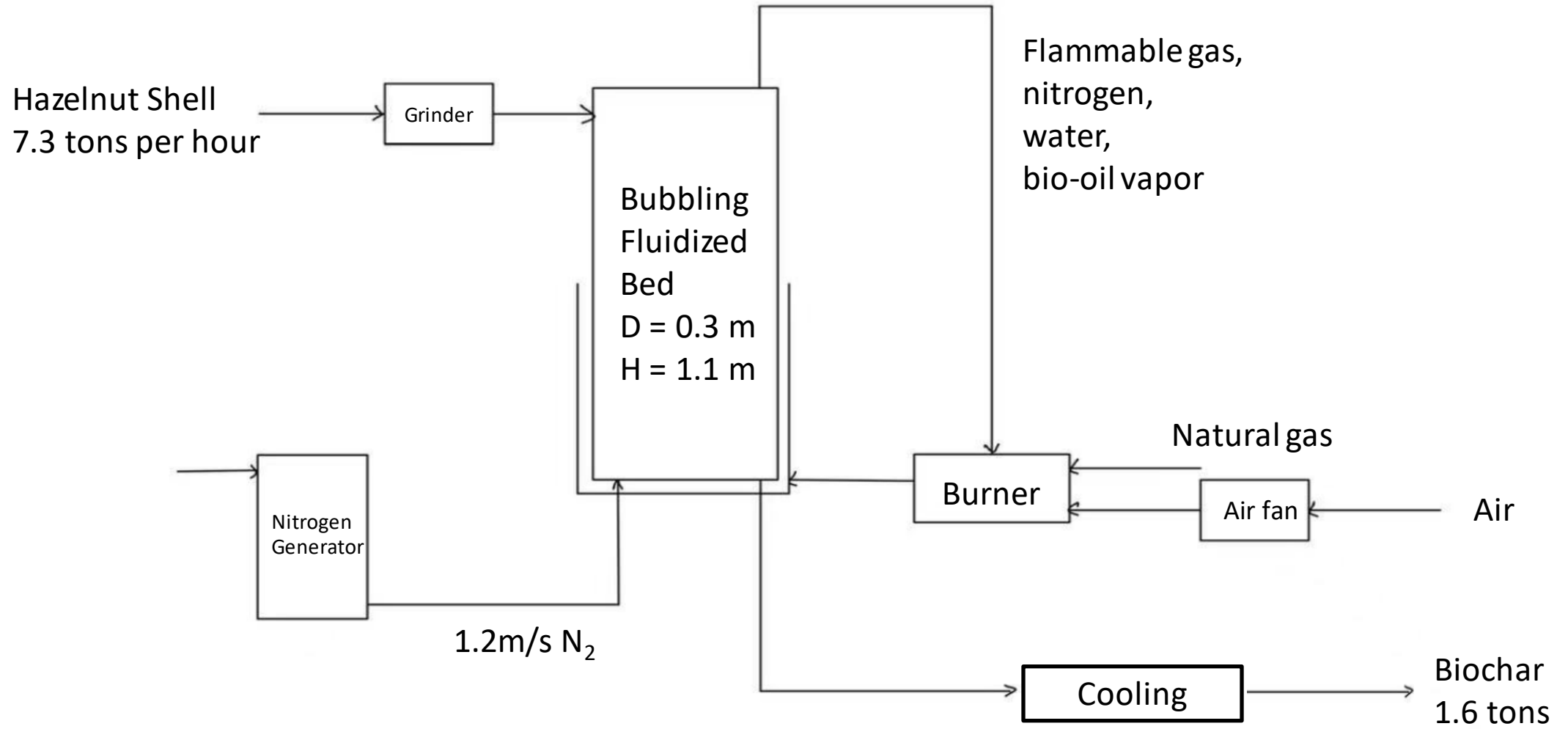
## Advantage of FBR

- Higher energy transfer efficiency than a batch reactor
- Small particles increase the surface area of thermal heat transfer
- It provides an option for continuous process with fast pyrolysis, which is easier to control and required a smaller reactor size.





# Design Result





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**THANK YOU**  
**and welcome to join the**  
**zoom to meet with us**