



UNIVERSITY SCHOOL OF CHEMICAL TECHNOLOGY
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**THERMO- CATALYTIC CONVERSION OF LIGNIN IN TWO STAGE
FIXED BED REACTOR FOR SYN- GAS AND VALUE ADDED
PRODUCTS**

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Presenter | 22 March 2023

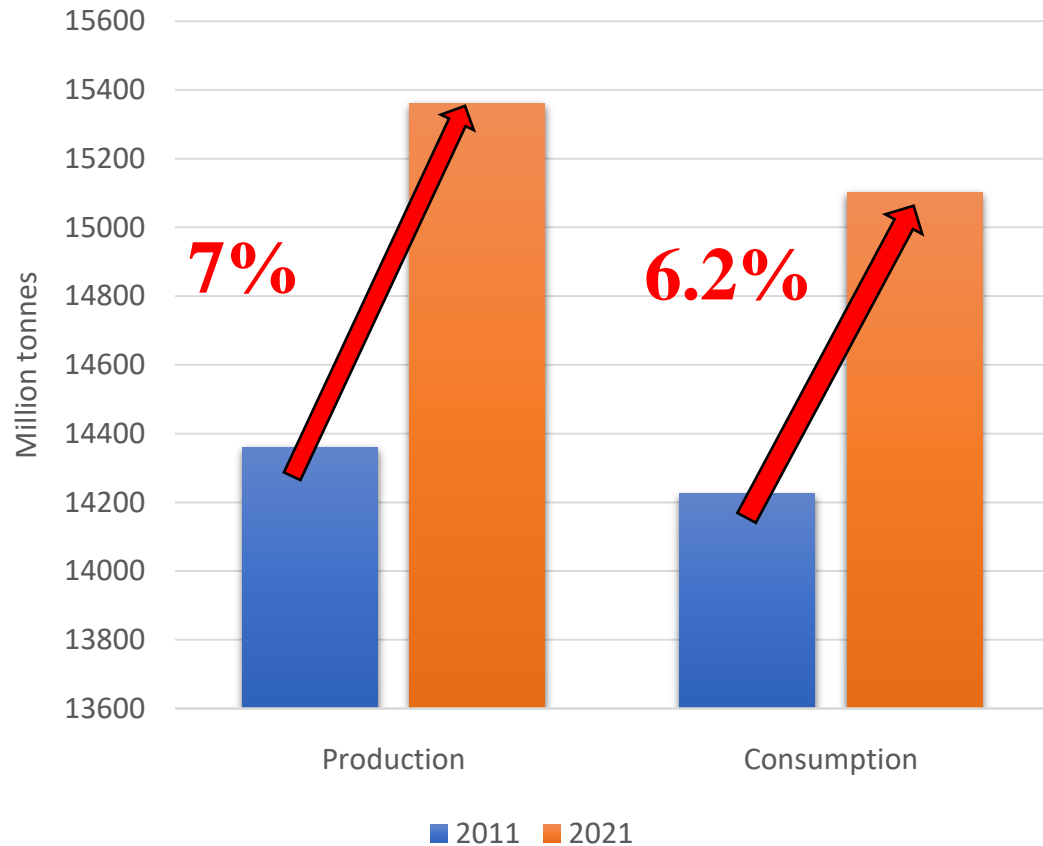
Under the supervision of:

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Mandal

INTRODUCTION (81% of the World's demand is fulfilled by Non-Renewable resources)

Non-Renewables: production and consumption statistics 2021*



Downside of Non-Renewables:

5.6%↑

Increase in Carbon Dioxide Emission from 2011 to 2021.

4%↑

Increase in deaths related to pollution and is expected to increase up to three times by the year 2050.

Lignin:

Lignin

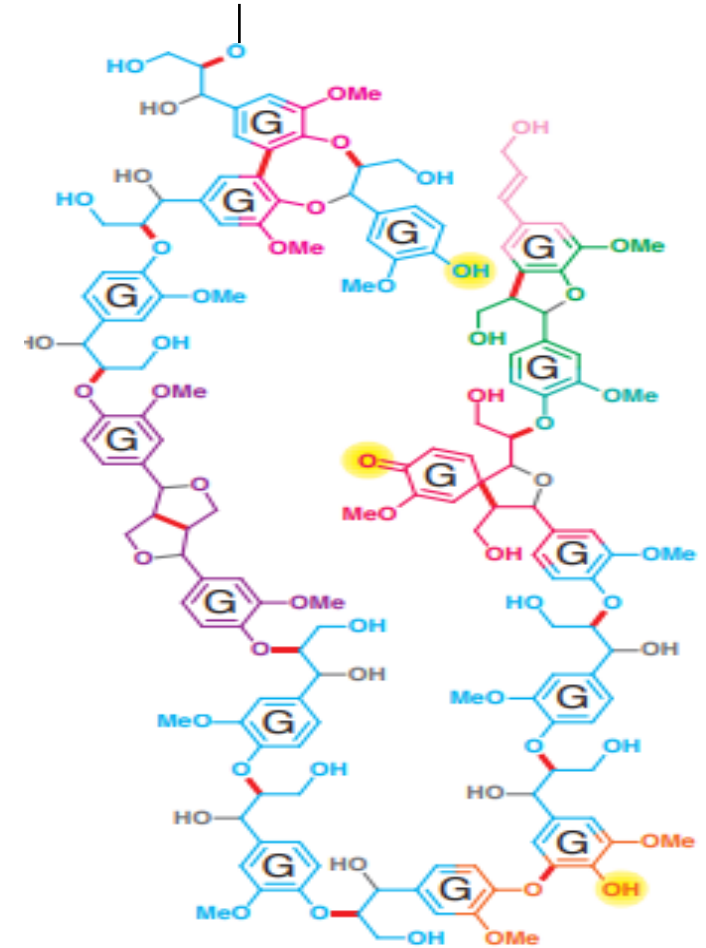
- 3-D amorphous structure made up of phenolic monomers.
- 2nd most abundant natural polymer.
- Acts as structural support for plants.

Challenges

- Chemical reactivity
- Solubility
- Different bonding

Common bonds present in lignin:

- Beta-O-4
- Beta-1
- Beta-Beta
- 4-O-5
- Beta-5



SELECTION OF BIOMASS: Coconut Coir fibre



Source: Google images

Proximate Analysis**	Percentage (%)
Moisture	5.3%
Volatile Matter	66.53%
Ash	3.15%
Fixed Carbon	24.93%

Coconut Agriculture Waste:

- India produces 280,000 metric tonnes/ annually.
- Leaching of polyphenols during rainy season pollute soil and water sources*.
- Current applications are such as ropes, mats and rugs.

*Chaudhary, R., & Dhepe, P. L. (2019) *Energy and Fuels*, 33(5), 4369–4377. <https://doi.org/10.1021/acs.energyfuels.9b00621>

**ASTM D-3173-87 (Moisture), ASTM D 3175-89 (Volatile Matter), ASTM D 3174-89 (Ash Content)

METHODOLOGY: Feedstock preparation (10 g biomass, 60 Mesh size was used)

Kraft lignin

PARAMETERS:

TEMPERATURE:

160⁰ C.

TIME: 2h

17% wt. NaOH 200ml solution and 25% wt. Na₂SO₄ 200ml solution



STEP 1:
Batch reaction



STEP 2:
Centrifuged to pH neutral



STEP 3:
Overnight oven at 100⁰C.



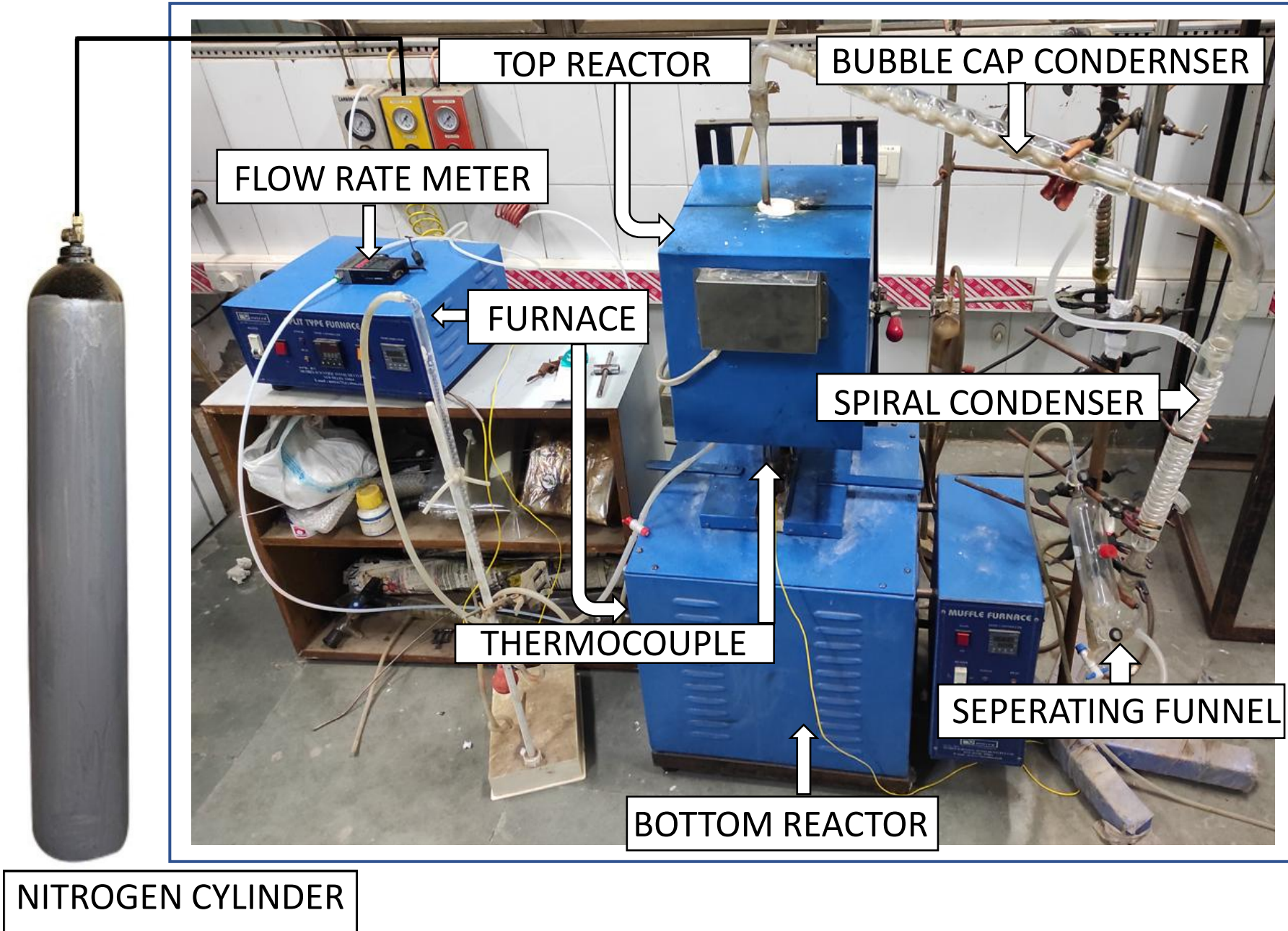
Dry Sample is obtained

After cooling to room temperature, centrifugation at 3000 rpm, 10 min and drying at 100⁰C for overnight has been carried out.

Yang et al. (2016). *Bioresource Technology*, 207, 361–369. <https://doi.org/10.1016/j.biortech.2016.01.123>.

Watkins et al. (2015). *Journal of Materials Research and Technology*, 4(1), 26–32. <https://doi.org/10.1016/j.jmrt.2014.10.009>

SEMI- BATCH REACTOR



CALCULATIONS:

Yield calculations:

SOLID RESIDUE YIELD%:

$$\left[\frac{\text{Weight of bottom reactor after reaction} - \text{Weight of empty bottom reactor}}{\text{Weight of feed sample}} \right] * 100$$

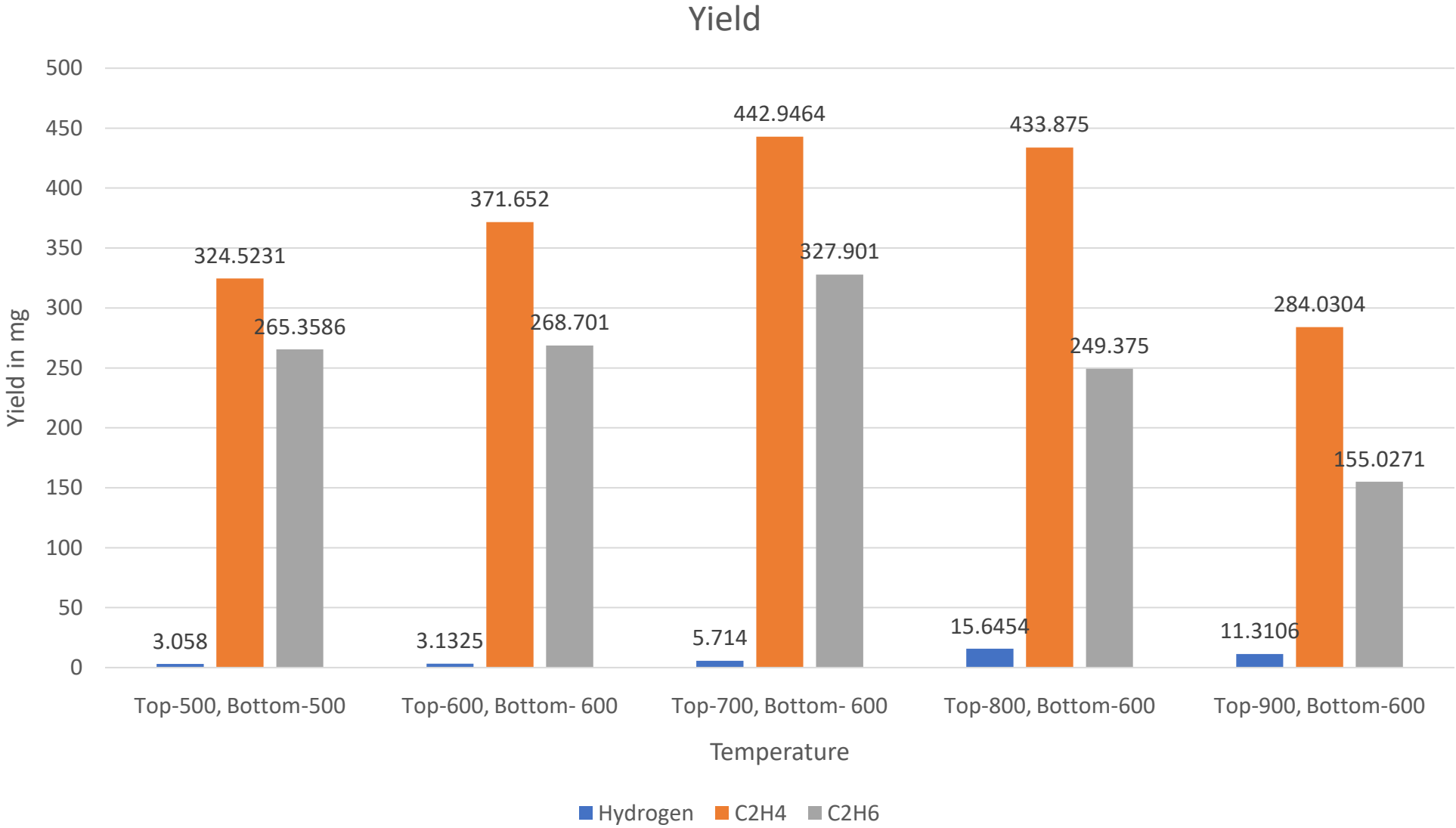
LIQUID YIELD%:

$$\left[\frac{\text{Weight of separating funnel with liquid} - \text{weight of empty separating funnel}}{\text{Weight of feed}} \right] * 100$$

GAS YIELD%:

$$100 - \text{Solid residue\%} - \text{Liquid\%}$$

YIELD:



THANK YOU