



Riding the wave of resilience

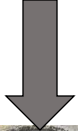
**Valorising Sewage Sludge through Co-Hydrothermal Treatment with Alum Sludge and Organic Waste: Unlocking Boehmite Generation and Solid Fuel Potential**

• Presented by

**Dr Kamrun Nahar, RMIT University**



Wastewater treatment Plant (WWTPs)



Sewage sludge(SS)

**Approx. 1.6 million**  
tonnes of wet SS  
produced in  
Australia 2023



Water treatment Plant (WTP)



Alum sludge (AIS)

**Approx. 0.8 million**  
tonnes of wet AIS  
generated in  
Australia



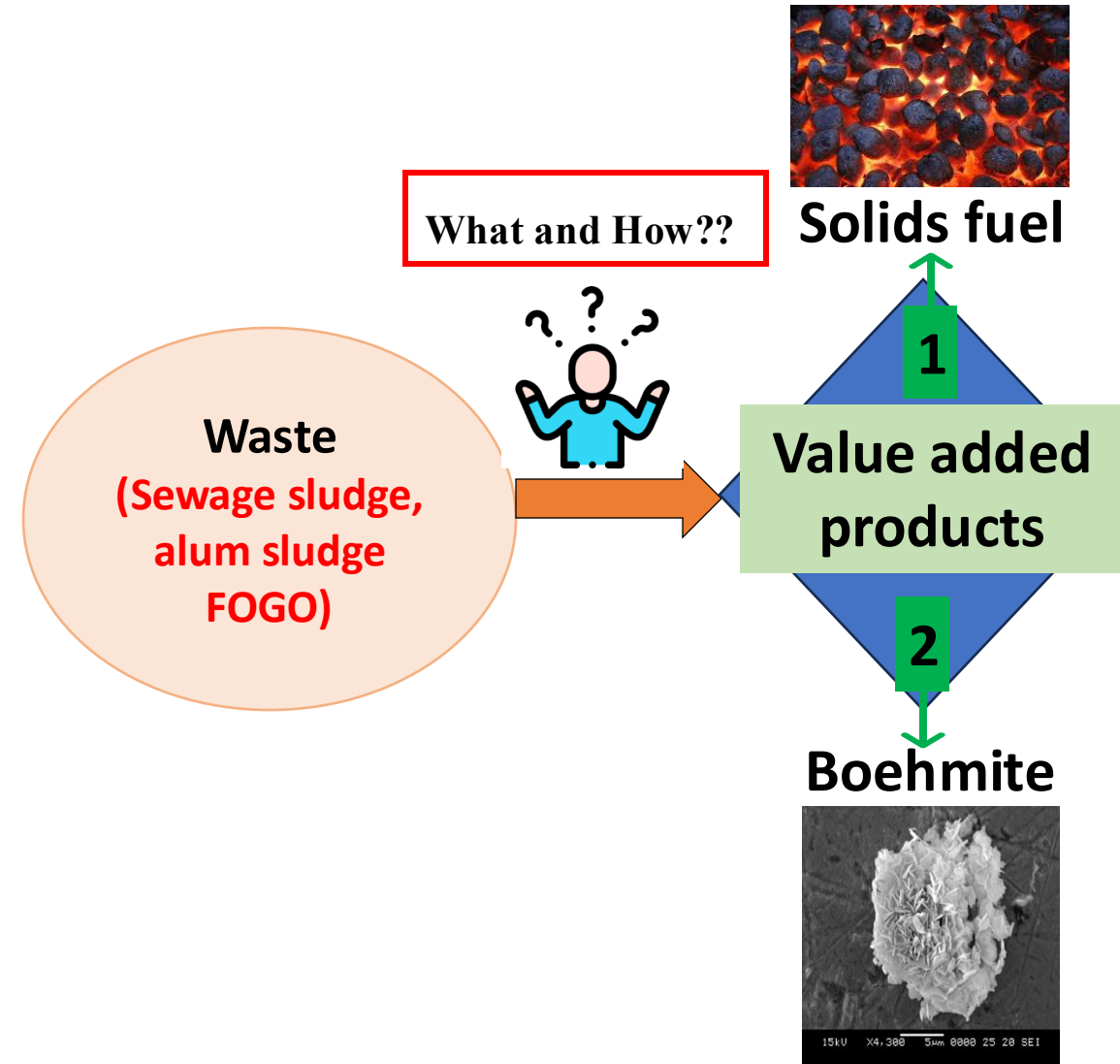
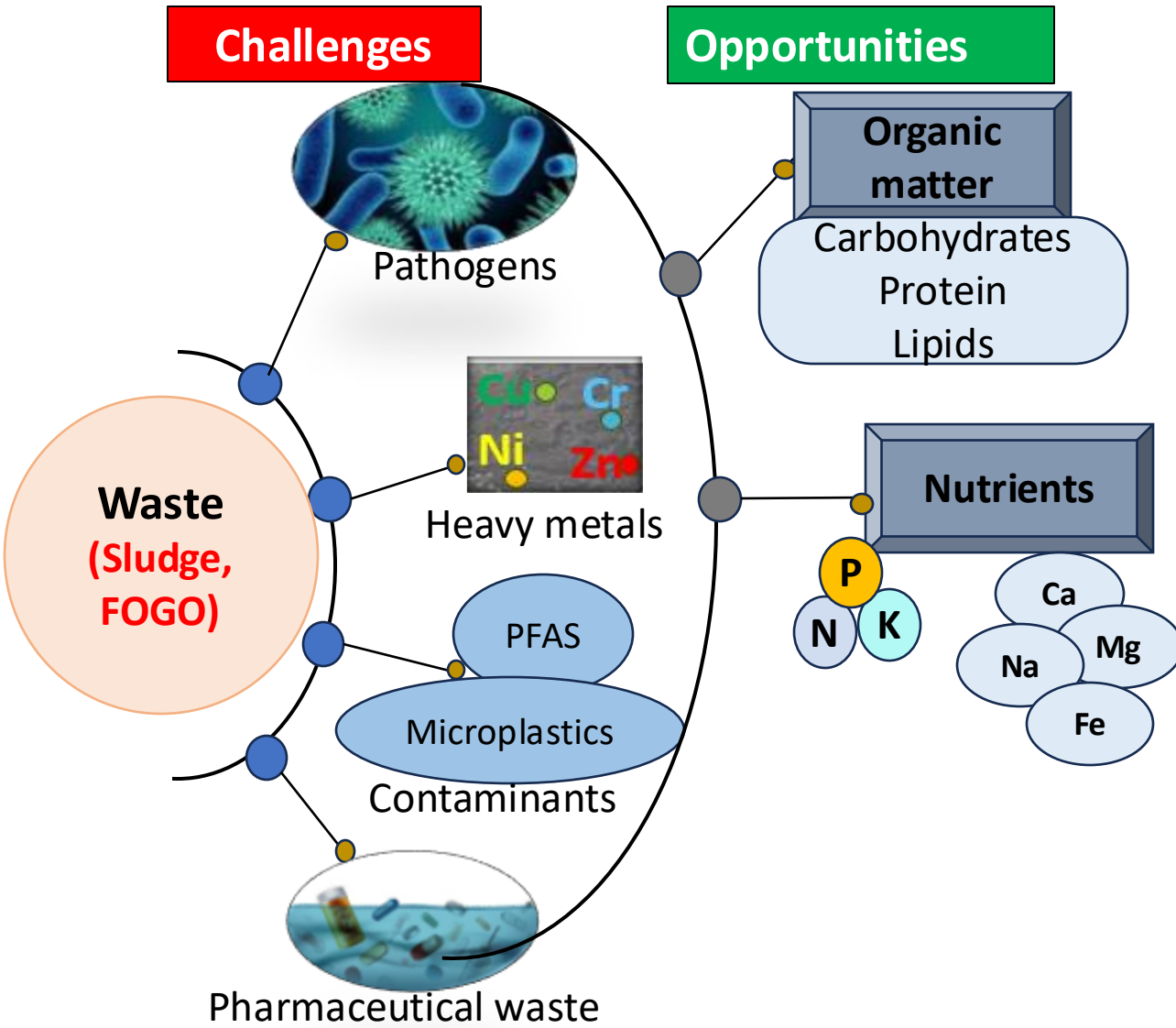
Households, commercial kitchens, supermarkets



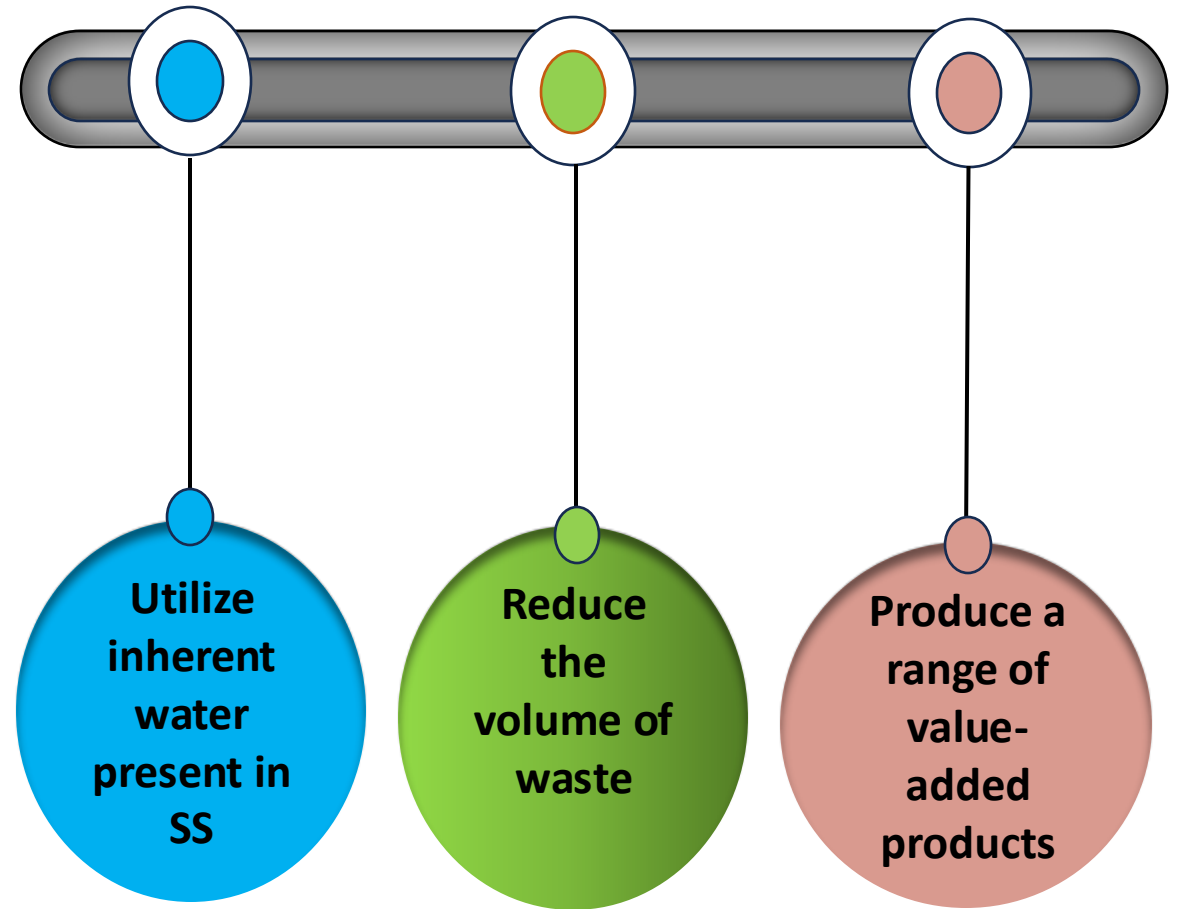
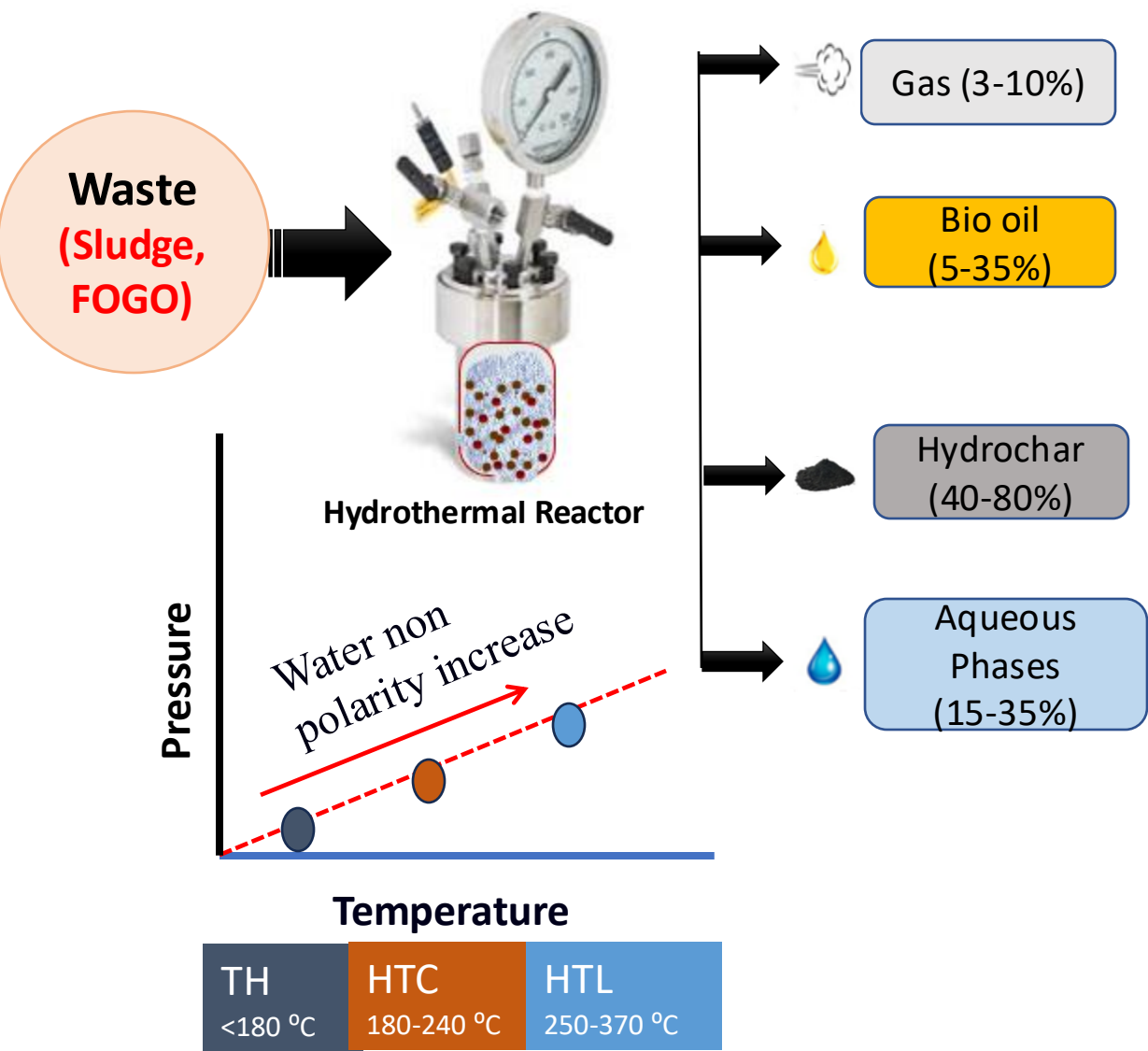
Food and Garden organic waste (FOGO)

**Approx. 14.6 million**  
tonnes of organic  
waste generated in  
Australia 2022-2023

**How to ride the Waves of Waste Toward Resilient Water Futures????**



# Hydrothermal treatment and its benefits



# Waste resources

1. Primary sludge (PS)
2. Alum sludge (AS)
3. Food organic and garden organic waste (FOGO): FO-40%, GO-60%



# What approach we adopted??



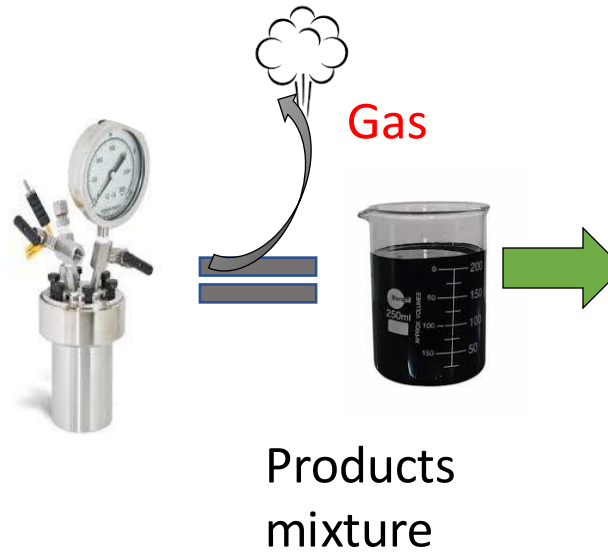
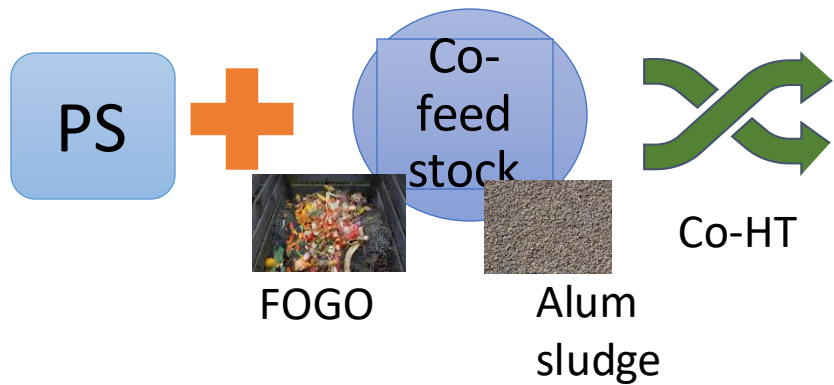
TEMPERATURE-  
270°C



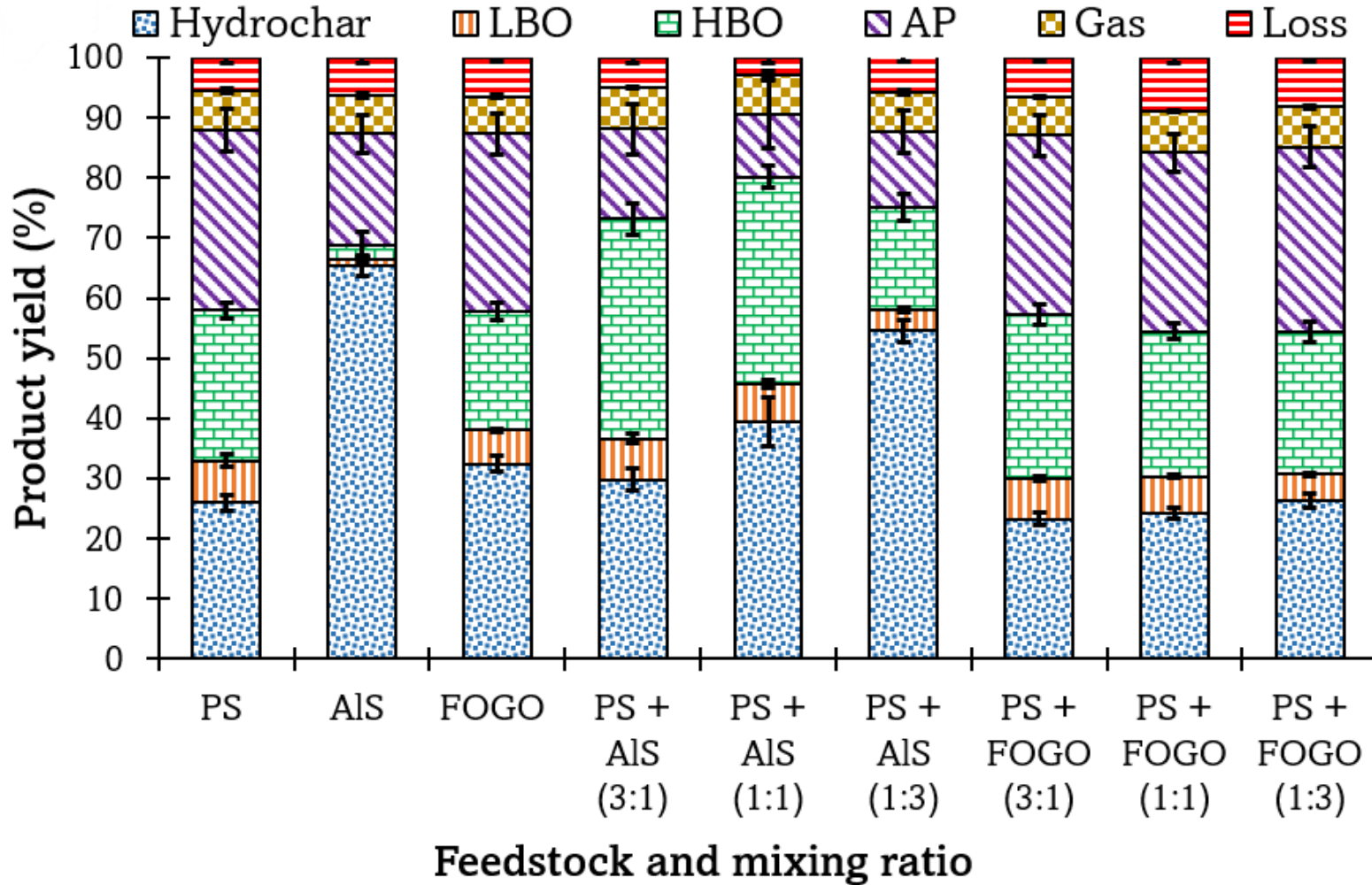
TIME-30 MIN



MIXING RATIO -3:1, 1:1,  
1:3

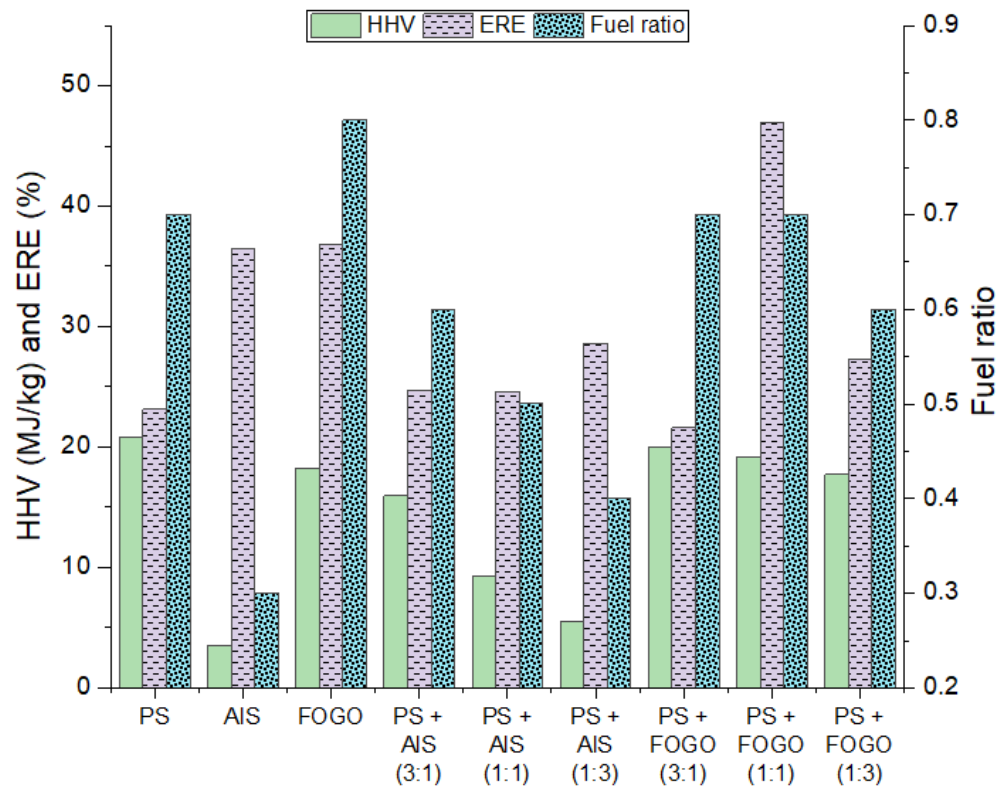


- Product separations (Hydrochar, Heavy bio-oil (HBO), Light bio-oil (LBO), Aqueous phase (AP))
- Estimation of product yield
- Characterization of the products (char and oil)
- Determination of the synergistic effect of Co-HT



- Co-HT using ALS resulted in higher hydrochar and oil yield
- There is no significant impact on product yield during co-HT of PS and FOGO

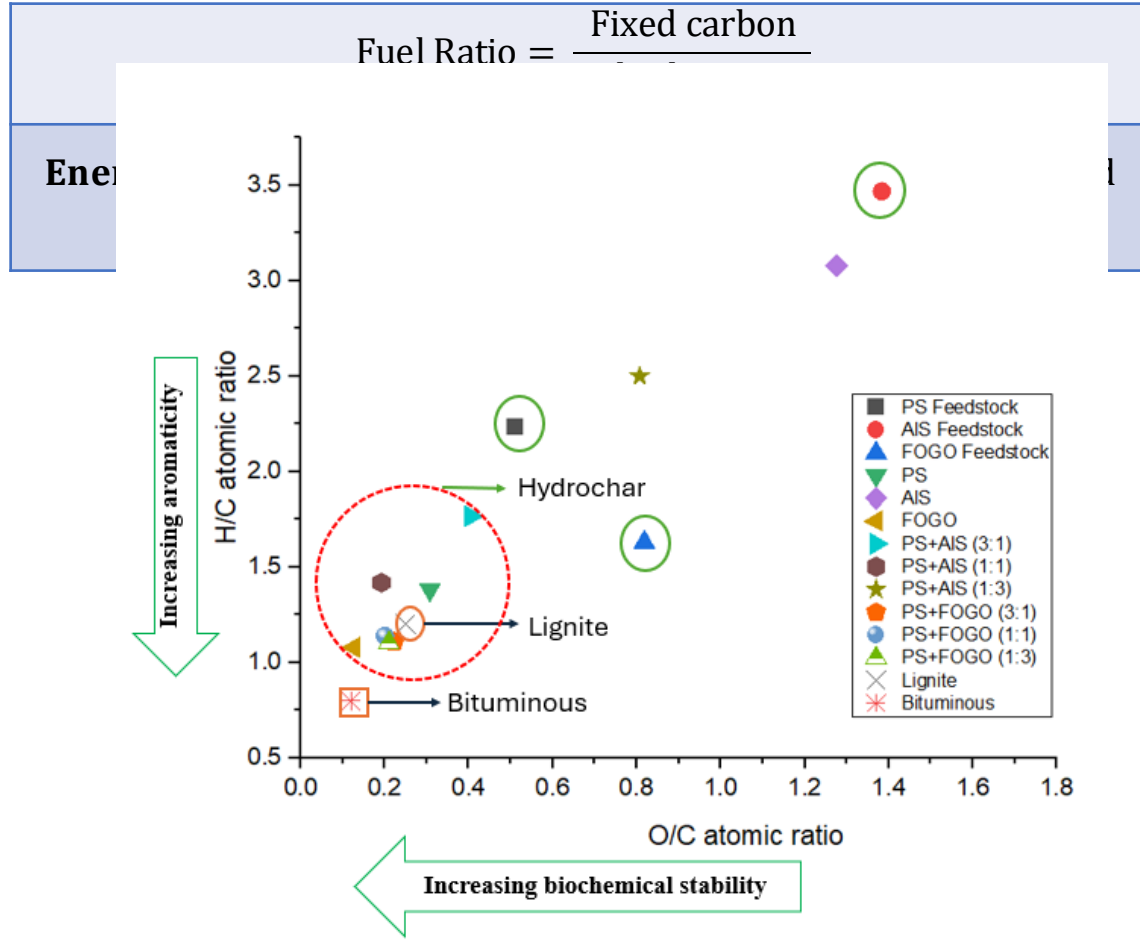
# Product properties (Hydrochar) as fuel



HT and co-HT of PS with AIS and FOGO

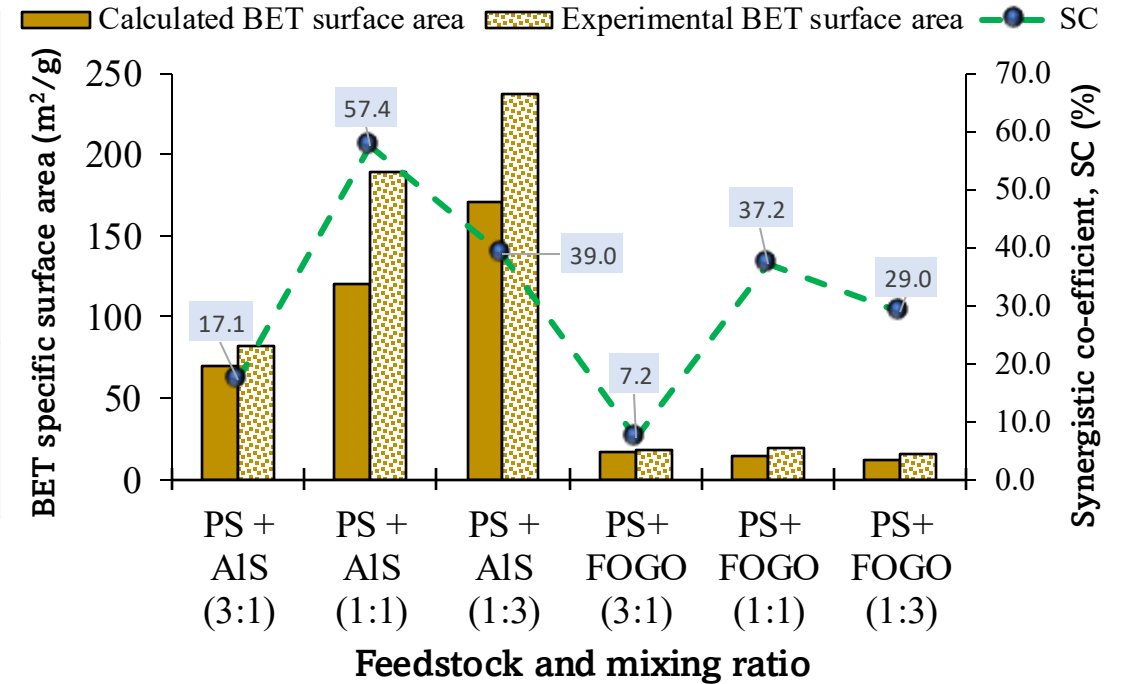
HHV, ERE, and Fuel ratio of hydrochar

Commercial fuel	HHV (MJ/kg)
Lignite-	10-17
Bituminous-	18-24



The hydrochar derived from PS+FOGO exhibits superior fuel properties and biochemical stability.

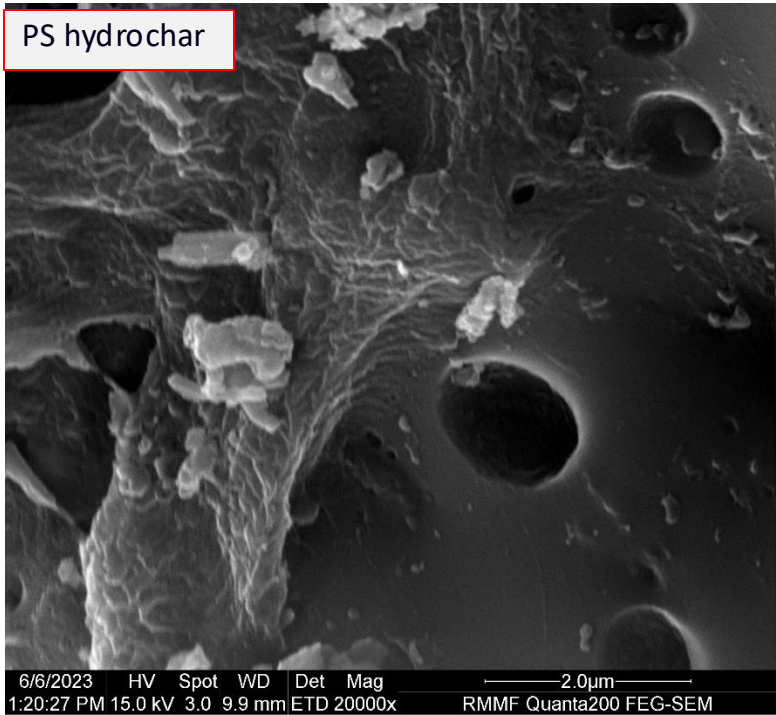
Parameters	PS	PS+AIS (3:1)	PS+AIS (1:1)	PS+AIS (1:3)	PS+FOG O (3:1)	PS+FOG O (1:1)	PS+FOG O (1:3)
<b>BET surface area (m<sup>2</sup>/g)</b>	19.3 ± 1.4	81.6 ± 4.2	189 ± 6.3	237 ± 7.8	17.9 ± 1.7	19.5 ± 1.3	15.1 ± 1.5
<b>Pore size (nm)</b>	18.1 ± 1.8	6.7 ± 1.1	5.6 ± 0.9	5.9 ± 0.7	20.9 ± 1.7	18.8 ± 1.5	20.2 ± 1.6



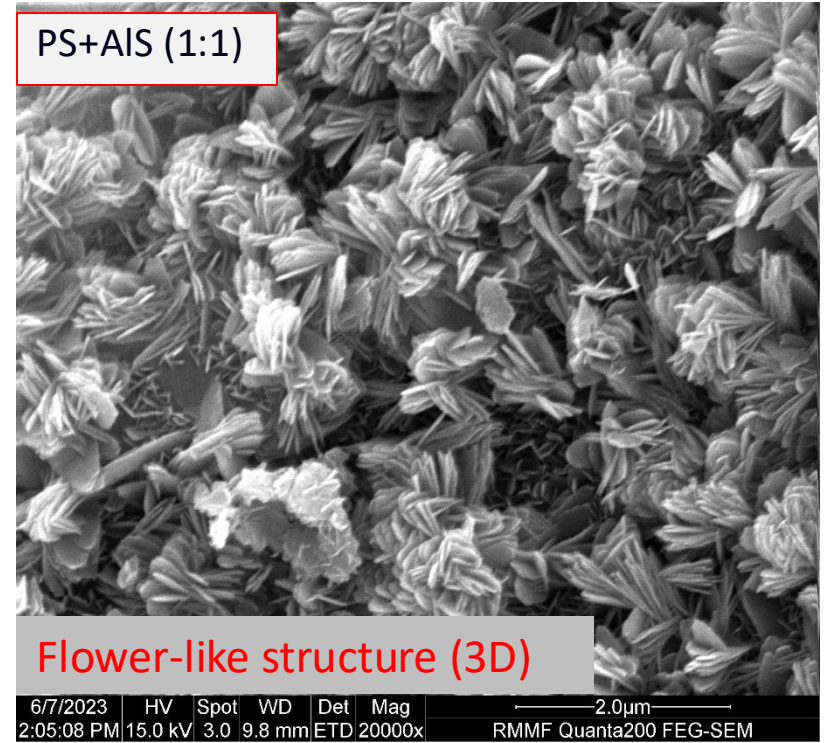
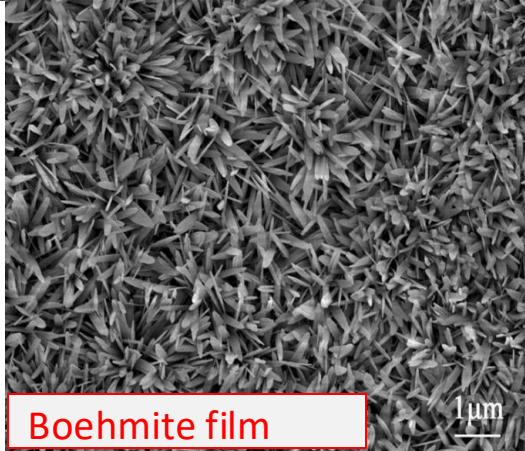
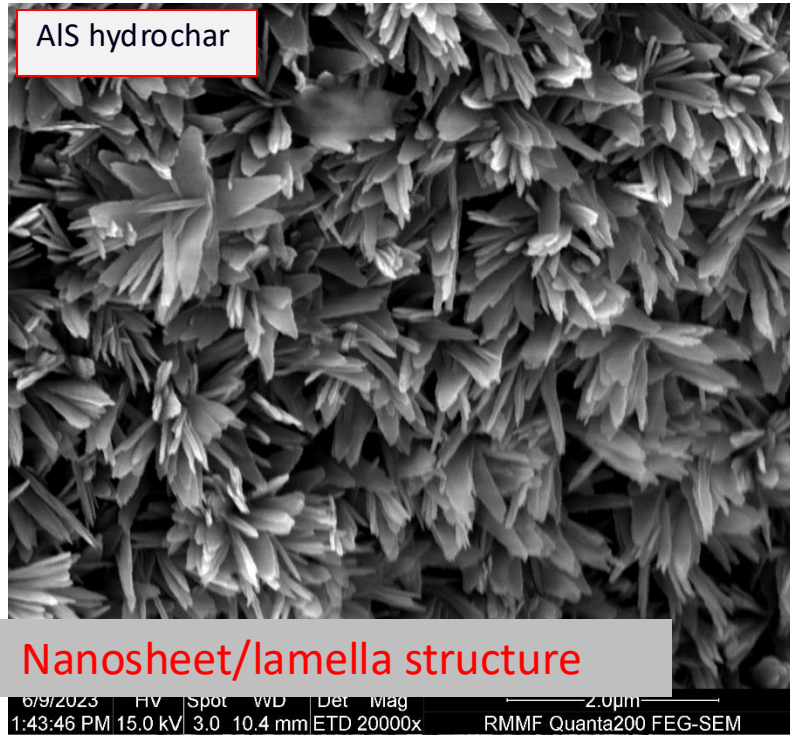
Synergistic effect of BET surface area

Porosity analysis suggests that PS+AIS could potentially be a good adsorbent.

# Co-HT of SS with AS: Hydrochar morphology



Surface area of PS: 19 m<sup>2</sup>/g



Surface area of PS+AIS (1:1): 189 m<sup>2</sup>/g

# Key take way message .....

Surface functional group of PS+ALS hydrochar exhibits the properties of boehmite

PS+FOGO reveals enhanced hydrochar properties as a solid fuel and soil amendment

Fuel properties of PS+FOGO hydrochar is comparable to Bituminous coal



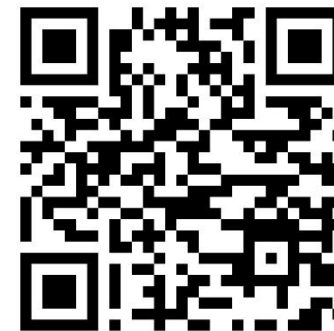
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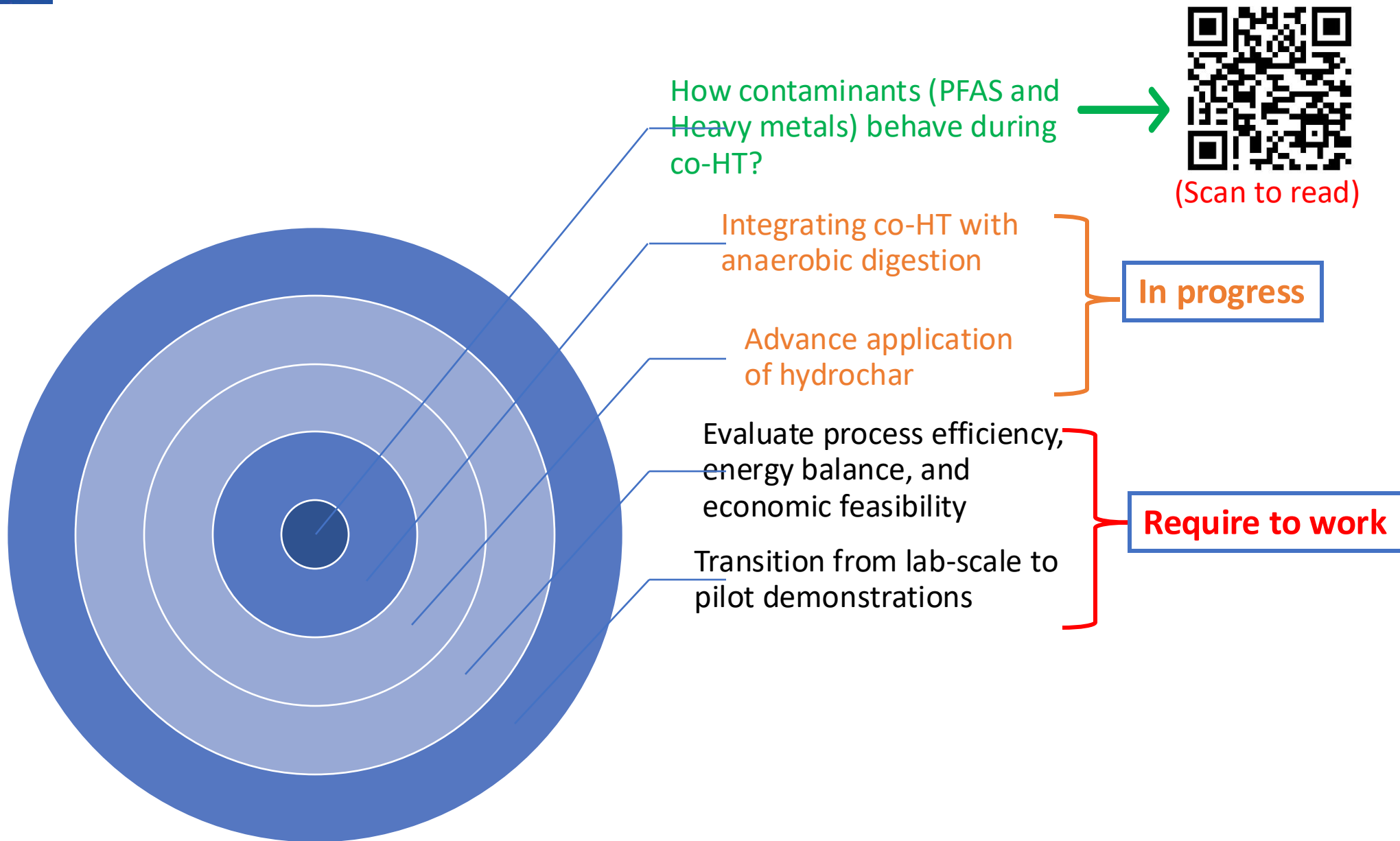


Co-processing of sewage sludge with alum sludge and food and garden organics: Towards boehmite generation and enhanced product properties

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(Scan to read full article)



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Thank you!



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