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# Catalytical seaweed pyrolysis over ZSM-5 and Y-Type catalysts under the different temperatures for the gathered products analysis

Lithuanian Energy Institute  
Laboratory of Combustion processes(13)

**Justas Eimontas\***, Nerijus Striūgas, Kęstutis Zakarauskas, Adolfas Jančauskas,  
Lina Vorotinskienė

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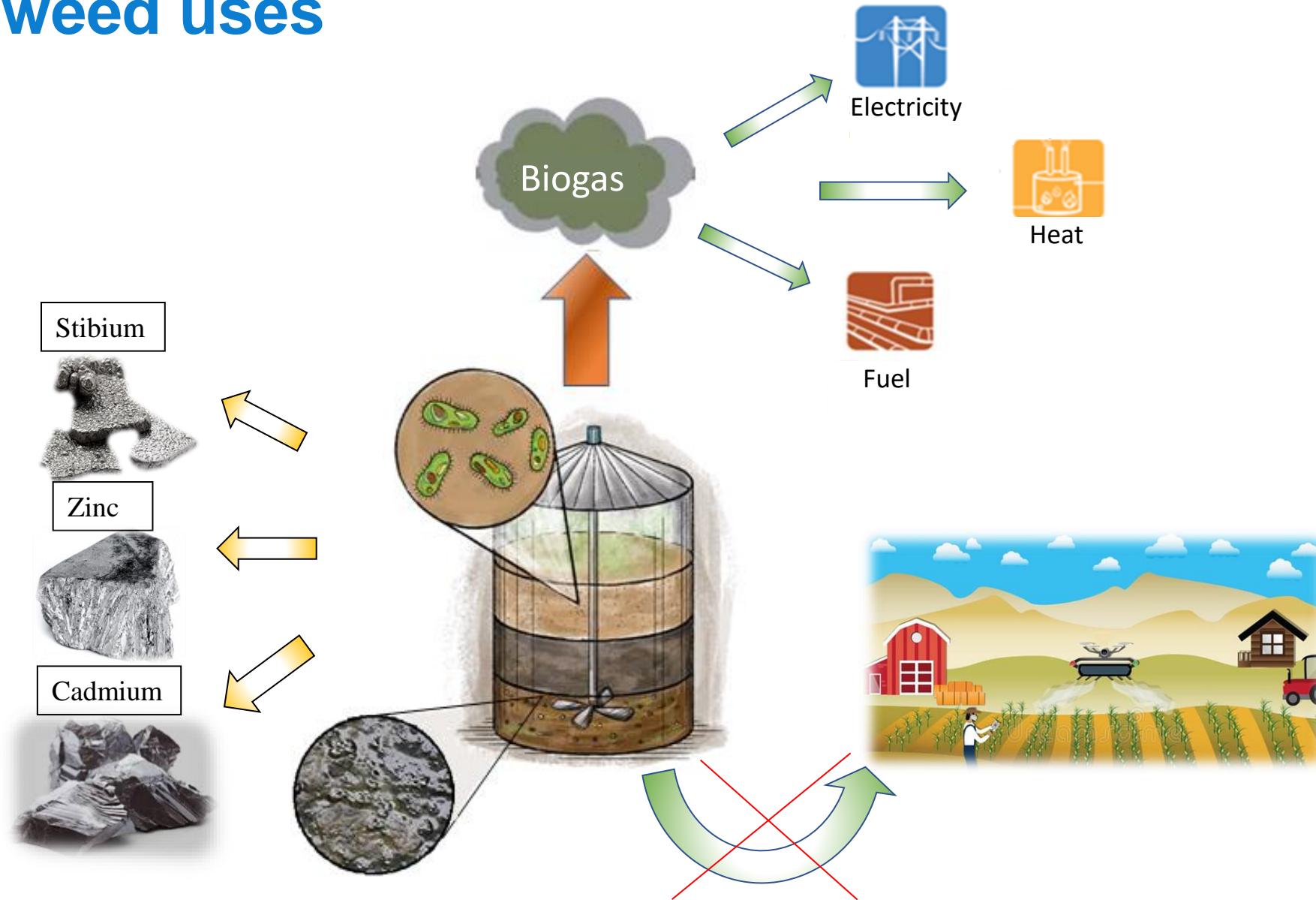
# Wastes on seash



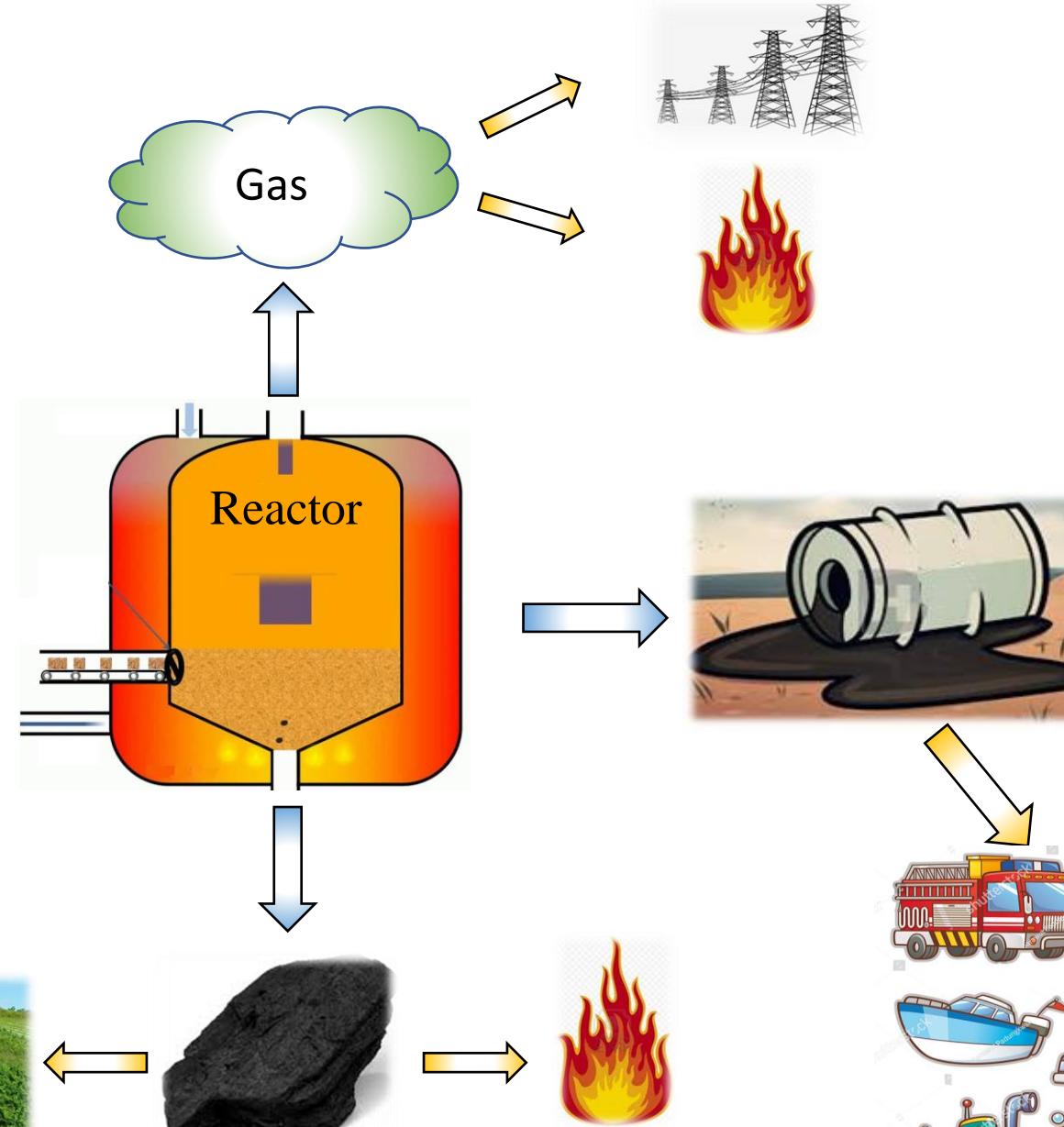
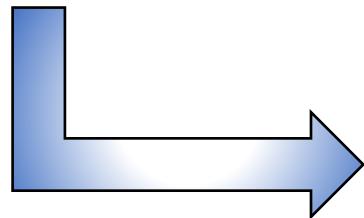
Segment	Example application	Primary functions	Benefits
Food	Raw salads, crisps, spaghetti, burgers	Source of energy, protein and vitamins	<span>♡</span> Supports healthier diets due to high minerals, vitamins, protein and fibre contents <span>♪</span> Lower environmental footprint than animal or land-based alternative protein sources
Additives	Gelatine substitutes, processed meat and dairy	Provision of thickening, stabilising and emulsifying properties	<span>♡</span> Natural and vegan-friendly <span>♪</span> Lower environmental footprint than animal-based alternatives
Animal feed	Livestock feed supplements, aquafeed supplements, pet food additives	Promotion of positive immune response and gut health; improvement of digestive processes	<span>♡</span> Improvement in animal health, production yields <span>♪</span> Reduction of methane emissions from livestock
Biostimulants	Seed treatments	Stimulation of plant growth, protection against abiotic stress	<span>♪</span> Lower environmental footprint than nitrogen fertiliser alternatives <span>♪</span> Promotes plant health, productivity and soil regeneration
Pharmaceuticals & nutraceuticals	Gastrointestinal protectors, biodegradable wound care products / nutrient health supplements	Source of bioactive and nutrient-rich ingredients	<span>♡</span> Disease prevention and treatment <span>♡</span> Natural health enhancers
Cosmetics	Anti-aging moisturisers, toothpaste	Source of bioactive and nutrient-rich ingredients; provision of thickening, stabilising and emulsifying properties	<span>♡</span> Natural and vegan-friendly <span>♡</span> Supports skin health
Bio-packaging	Packaging, coatings and plastic films for food containers	Source of marine-safe and compostable plastic molecules	<span>♪</span> Replacement of substances causing environmental damage in production (fossil fuel) and after end-of-life (ocean leakage)
Biofuels	Biodiesel for use in cars	Source of energy	<span>♪</span> Replacement for fossil fuels or land-intensive biofuels <span>♪</span> Made from seaweed processing by-products



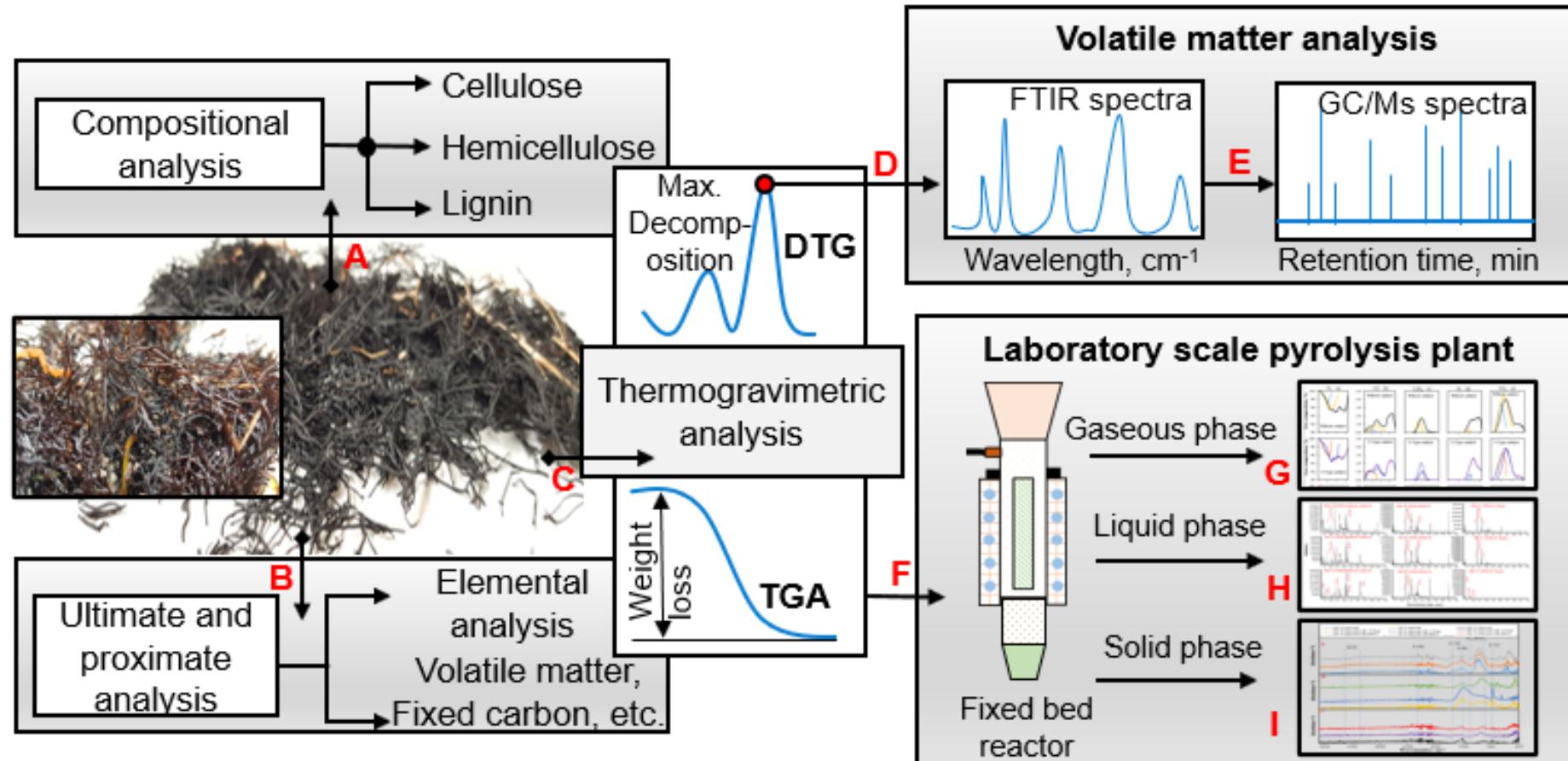
# Seaweed uses



# Pyrolysis tests



# The layout of the experiments and analysis' flowchart



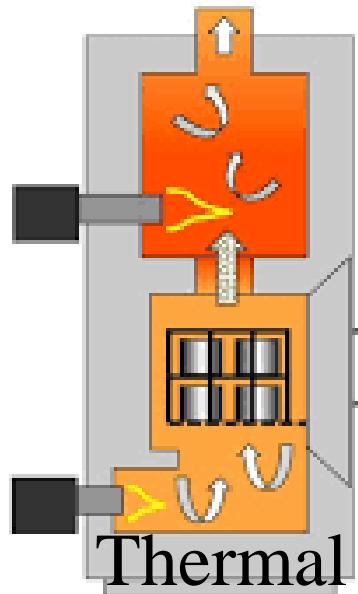
# Feedstock preparation



## Collection



## Washing



Thermal treatment



Shredding



Drying

# Ultimate and proximate analysis



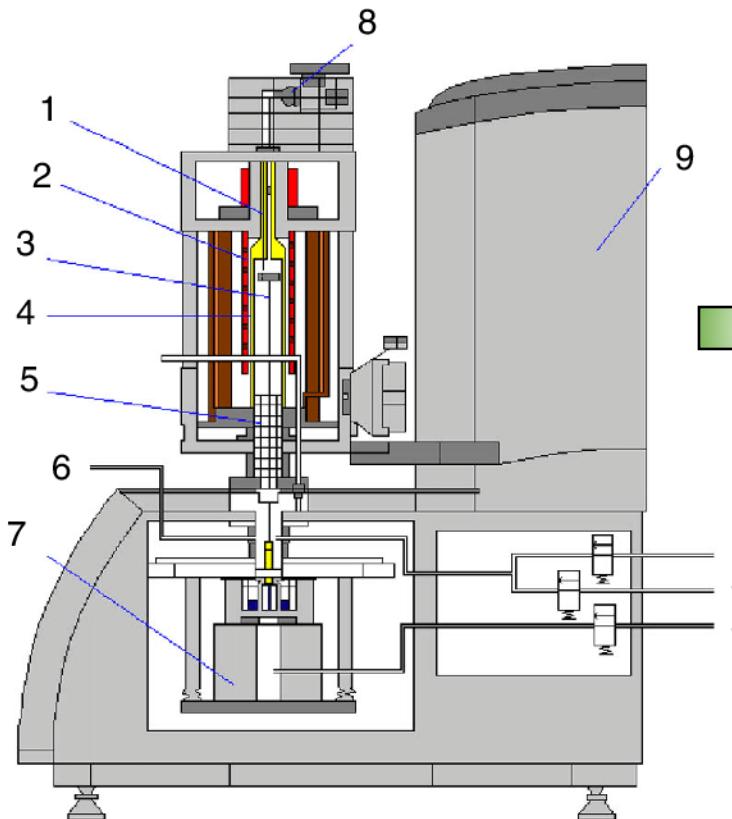
Parameter, d.b.	Seaweed
<b>Carbon, wt.%</b>	$46.93 \pm 0.05$
<b>Hydrogen, wt.%</b>	$4.73 \pm 0.06$
<b>Nitrogen, wt.%</b>	$4.13 \pm 0.14$
<b>Oxygen, wt.% (diff.)</b>	$30.16 \pm 0.51$
<b>Chloride, wt.%</b>	$0.05 \pm 0.01$
<b>Sulphur, wt.%</b>	$5.13 \pm 0.23$
<b>Volatiles, wt.%</b>	$58.30 \pm 0.19$
<b>Ashes, wt.%</b>	$8.87 \pm 0.04$
<b>Moisture, wt.%</b>	$0.55 \pm 0.01$
<b>Fixed carbon, wt.%</b>	$32.23 \pm 0.15$
<b>LHV, MJ/kg</b>	$16.51 \pm 0.07$



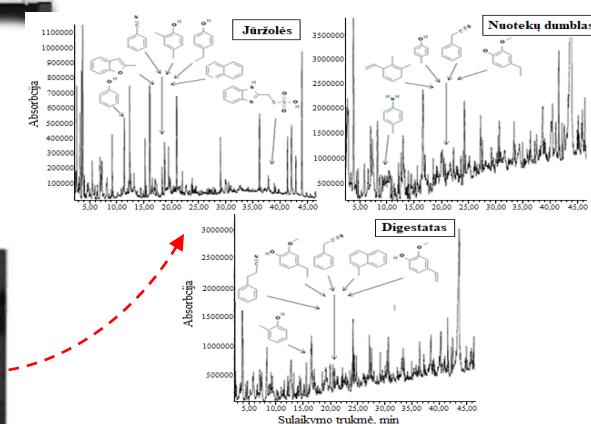
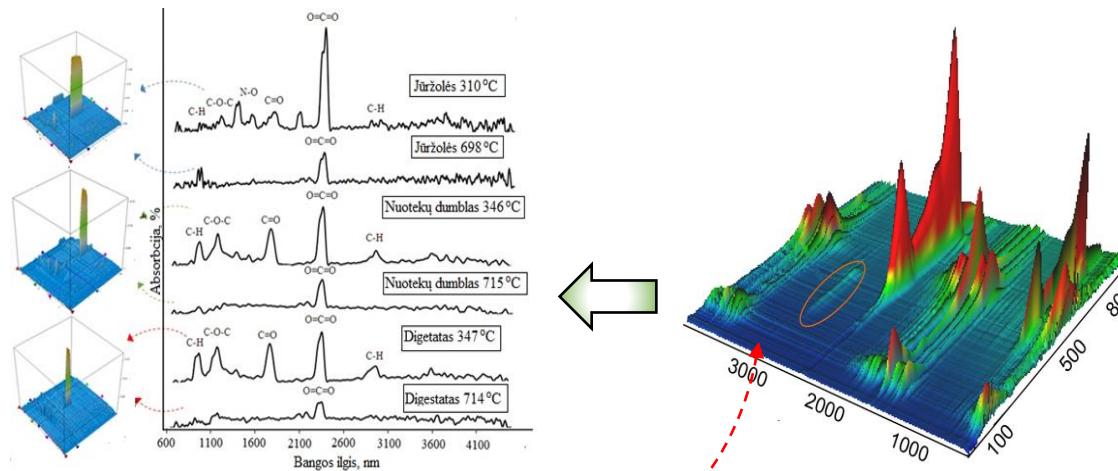
# Micro-thermal analysis



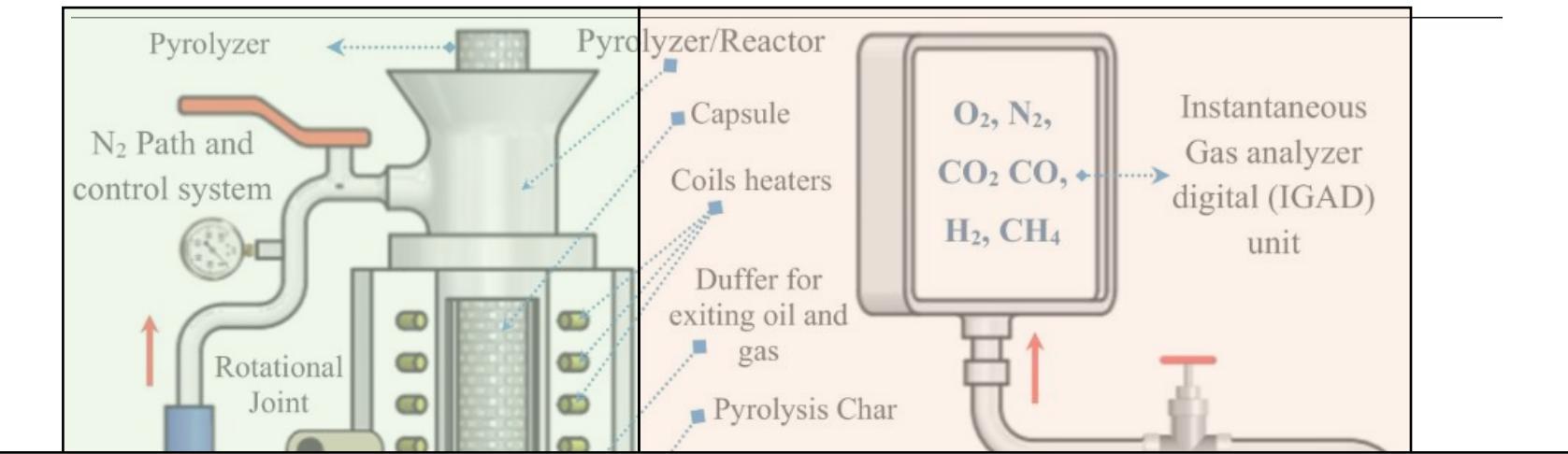
Netzsch STA F3 Jupiter



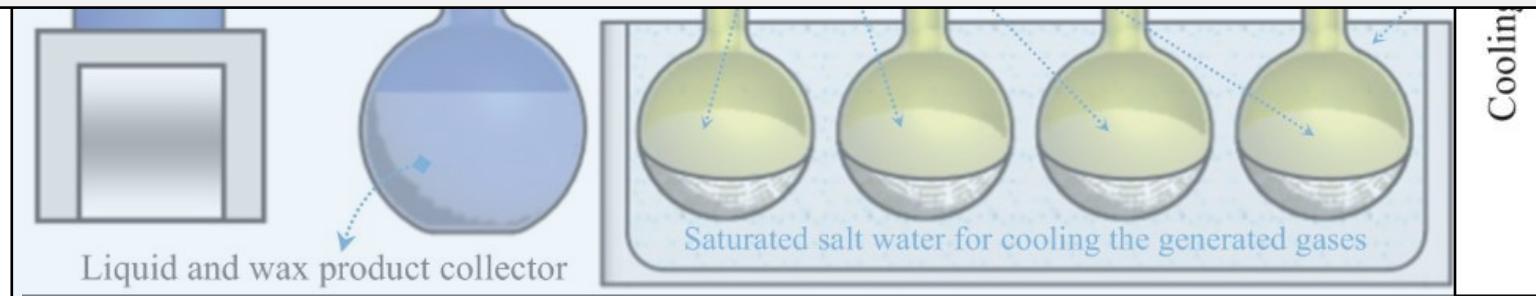
1 – furnace thermocouple, 2 – heating element, 3 – sample carrier, 4 – protective tube, 5 – radiation shield, 6 – evacuation system inlet, 7 – balance system, 8 – gas outlet valve, 9 – hoisting device, 10-12 – gas inlet.



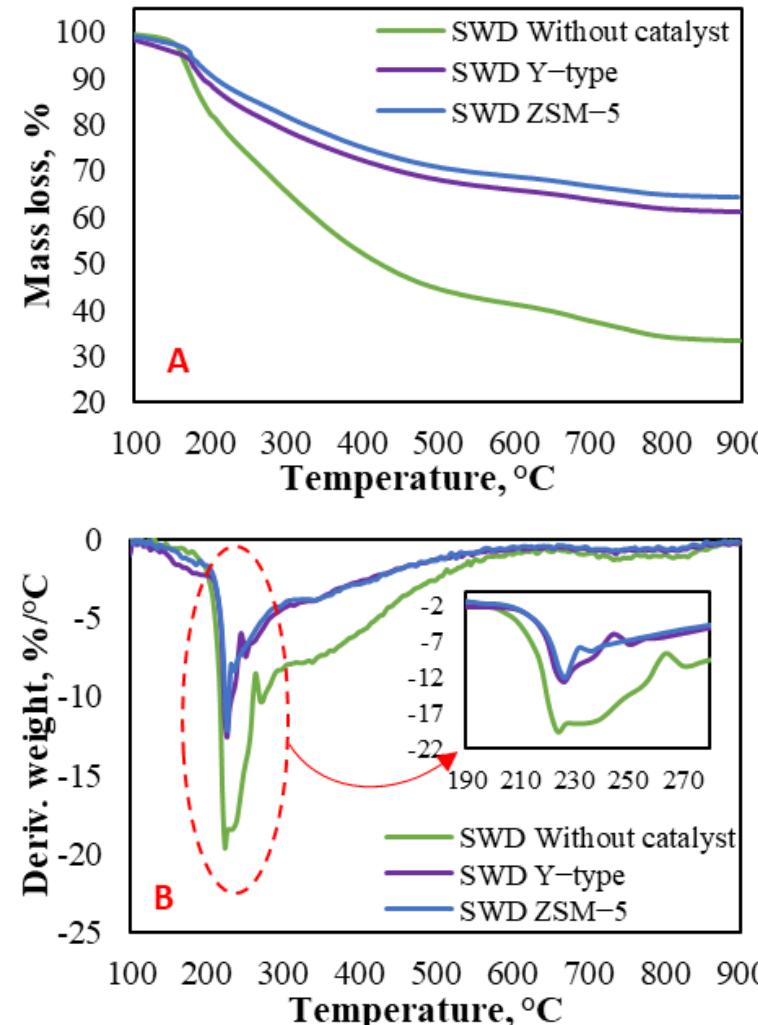
# Thermal treatment at laboratory scale bench



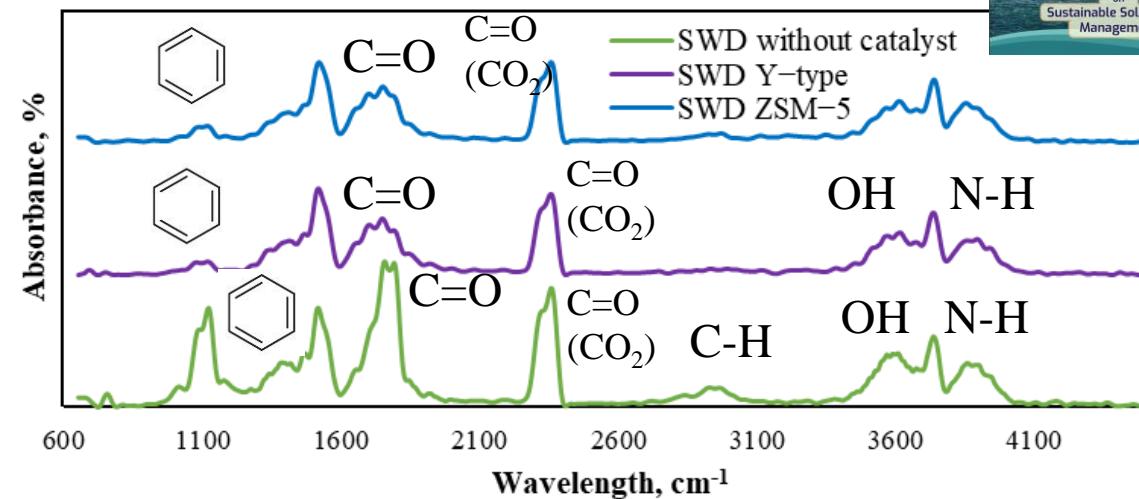
Parameter	Value
Temperature	500 °C, 700 °C, 900 °C
Catalyst	ZSM-5, Y-Type
Flowrate	1.5 L/min
Heating rate	25 °C/min
Feedstock:Catalyst ratio	1:1



# Micro-thermal analysis combined with FTIR

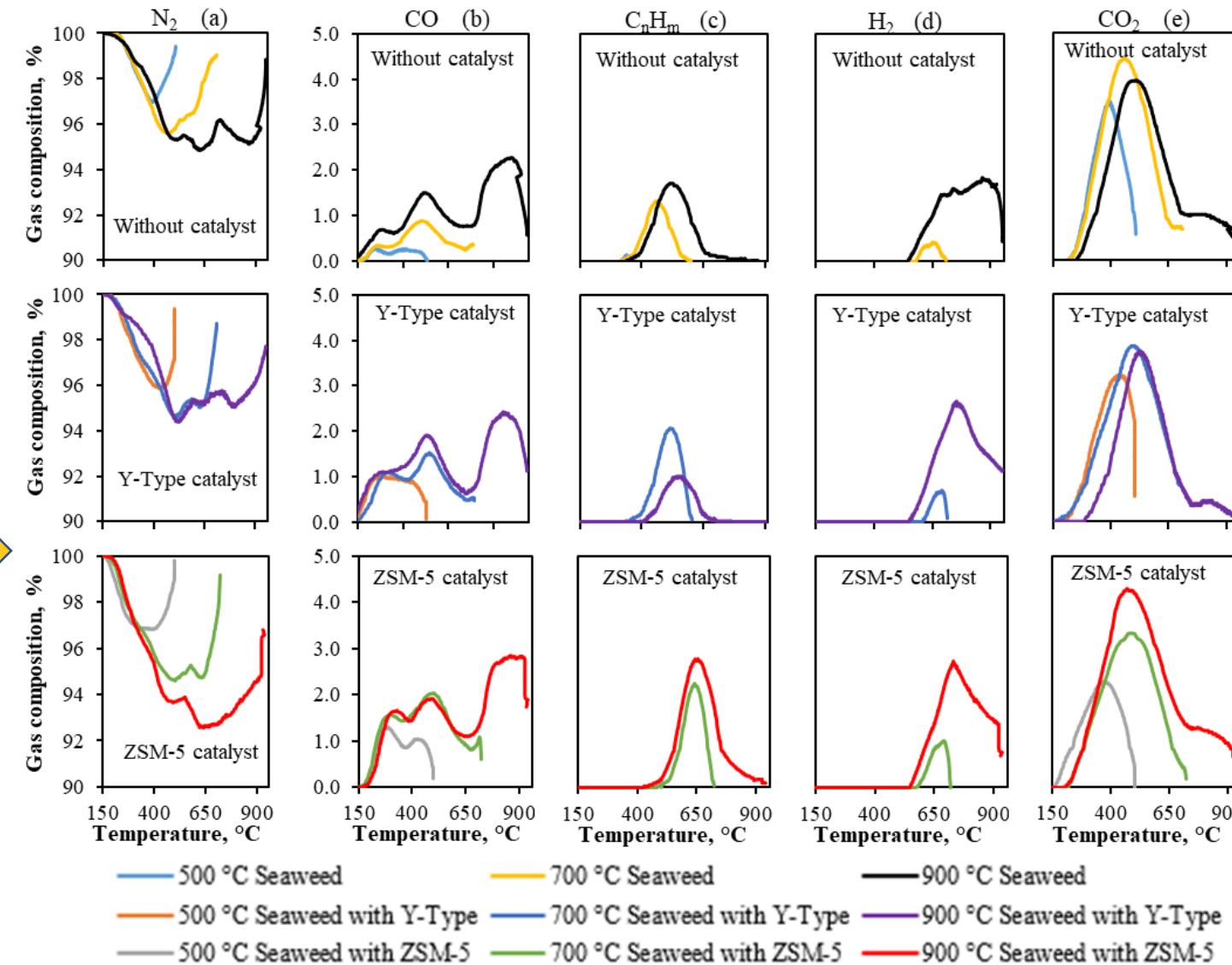


FTIR

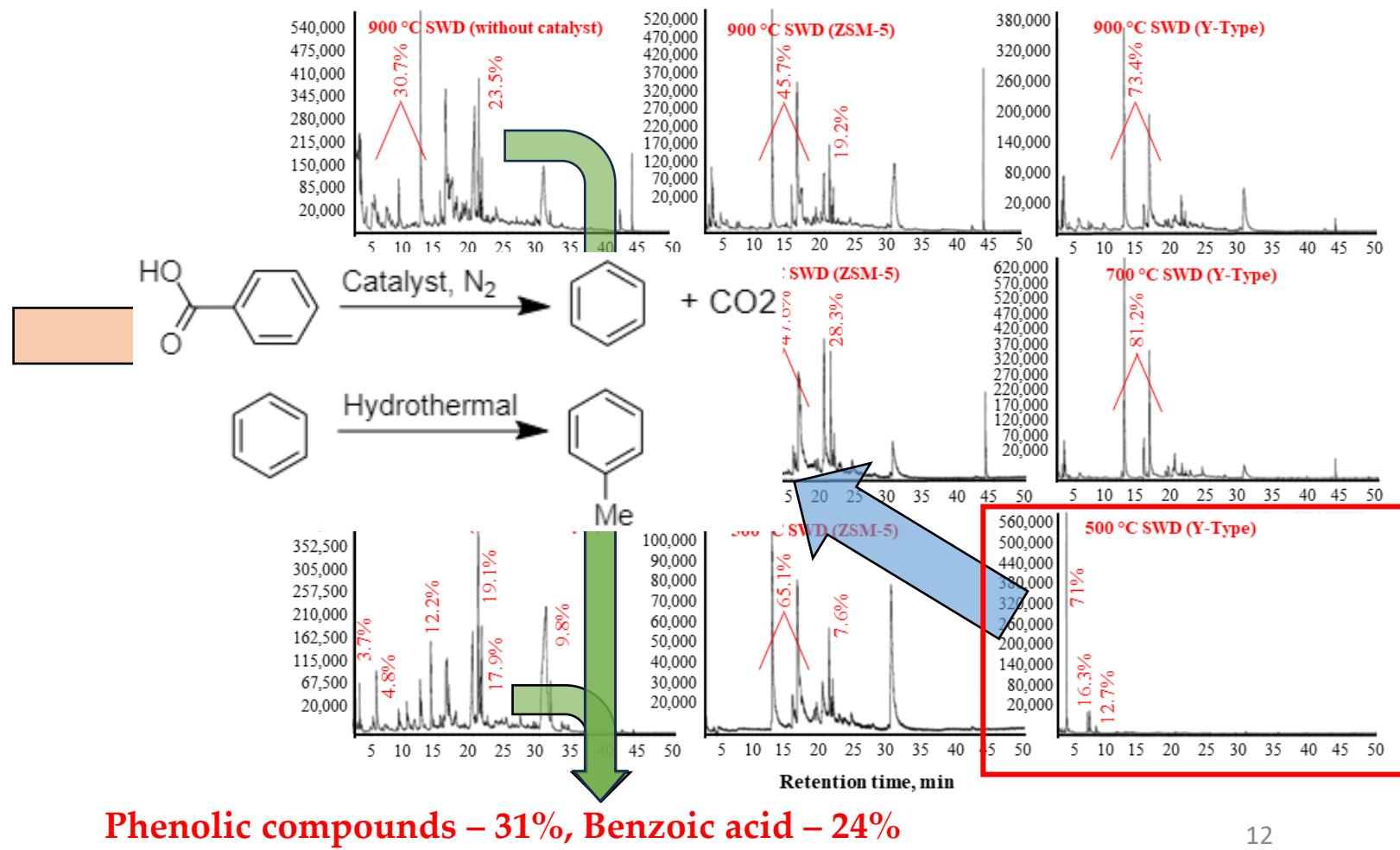


A – TGA curve; B – DTG curve.

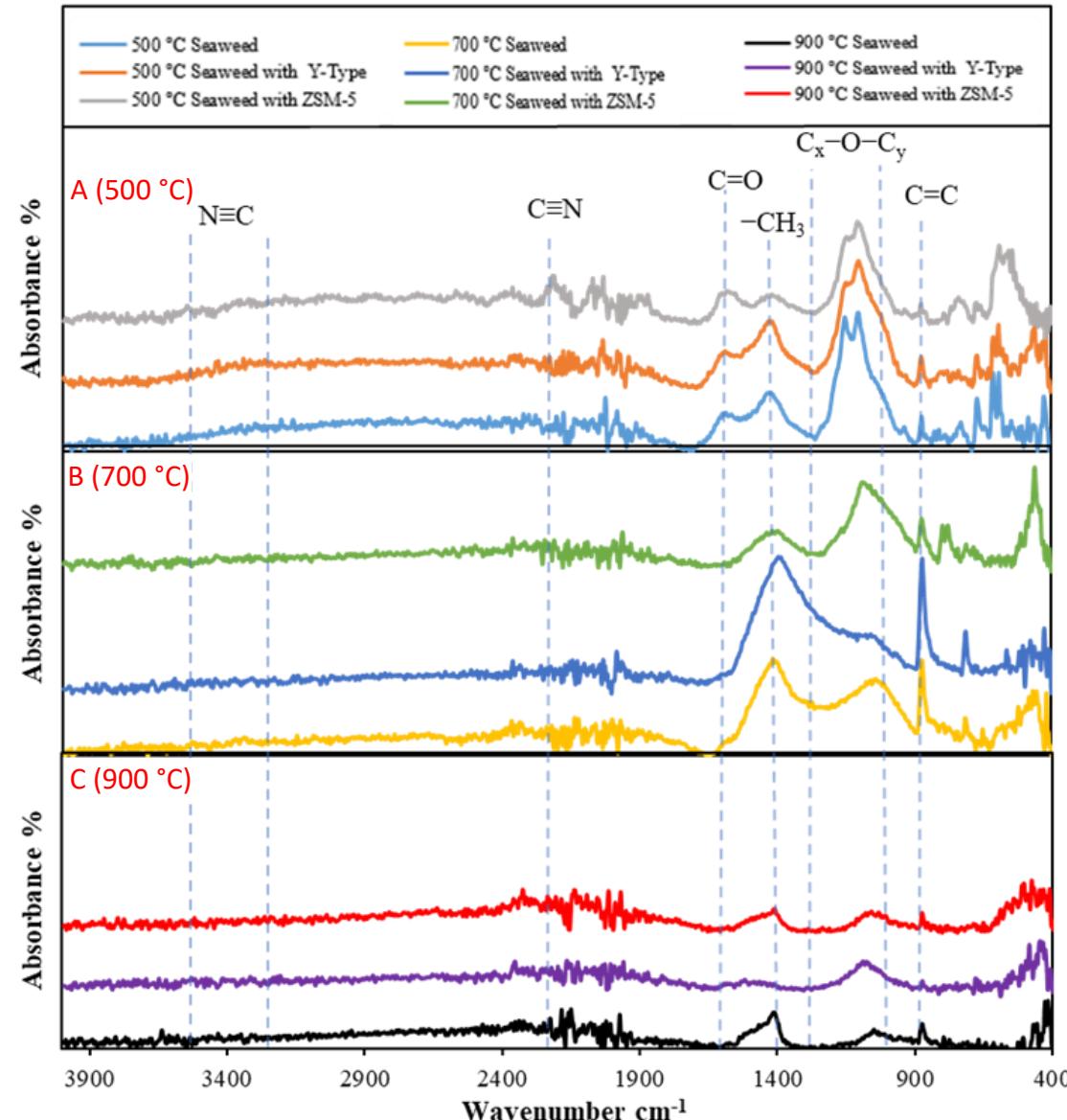
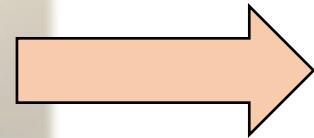
# Gaseous products analysis of the Seaweed



# Liquid product analysis



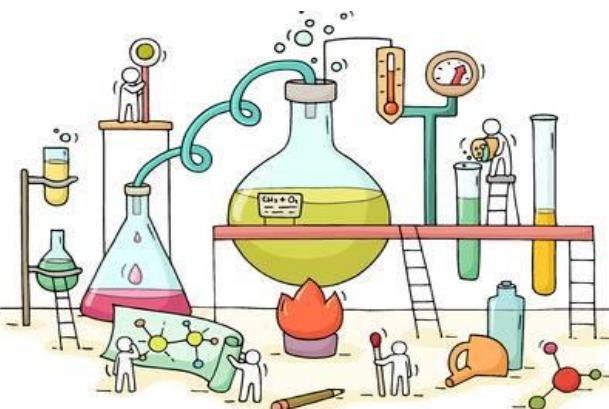
# Char FTIR analysis



# Formed products yield after the thermal treatment



Sample	Liquids, wt.%	Gasses, wt.%	Solids, wt.%
Seaweed 500 °C	20.22	32.51	47.27
Seaweed 700 °C	19.33	42.45	38.22
Seaweed 900 °C	18.27	47.44	34.30
Seaweed 500 °C ZSM-5	24.04	34.66	41.30
Seaweed 700 °C ZSM-5	21.97	39.72	38.31
Seaweed 900 °C ZSM-5	19.81	45.55	34.64
Seaweed 500 °C Y-Type	25.87	29.62	44.51
Seaweed 700 °C Y-Type	22.21	39.19	38.60
Seaweed 900 °C Y-Type	20.53	44.22	35.25





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Thank you for your  
attention

**Justas Eimontas**

**Justas.Eimontas@lei.lt**

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