

# Marine biomass and plastic waste thermal utilization over the commercial and biochar catalyst for energy products recovery

Lithuanian Energy Institute  
Laboratory of Combustion processes(13)

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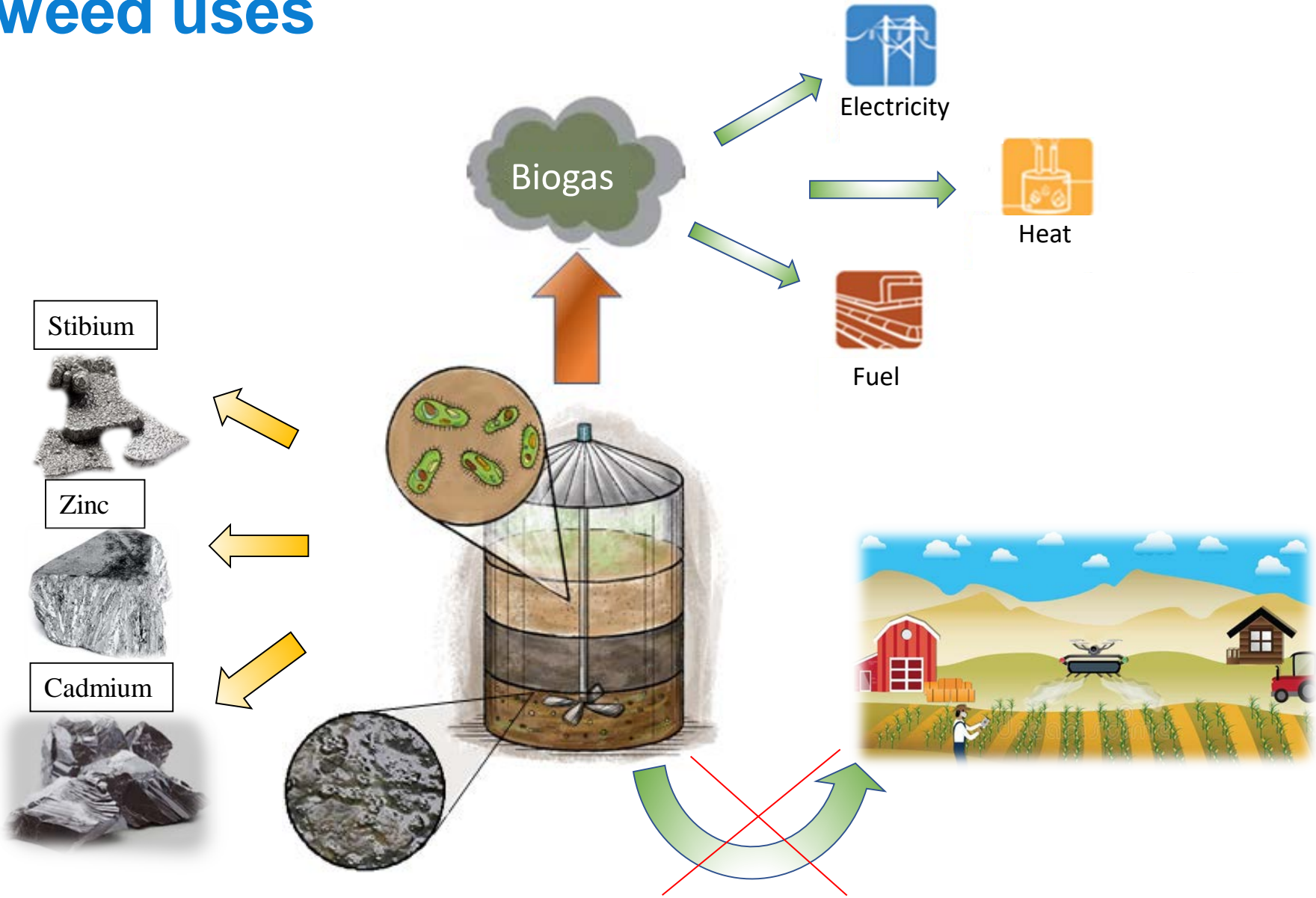
2022, Kaunas



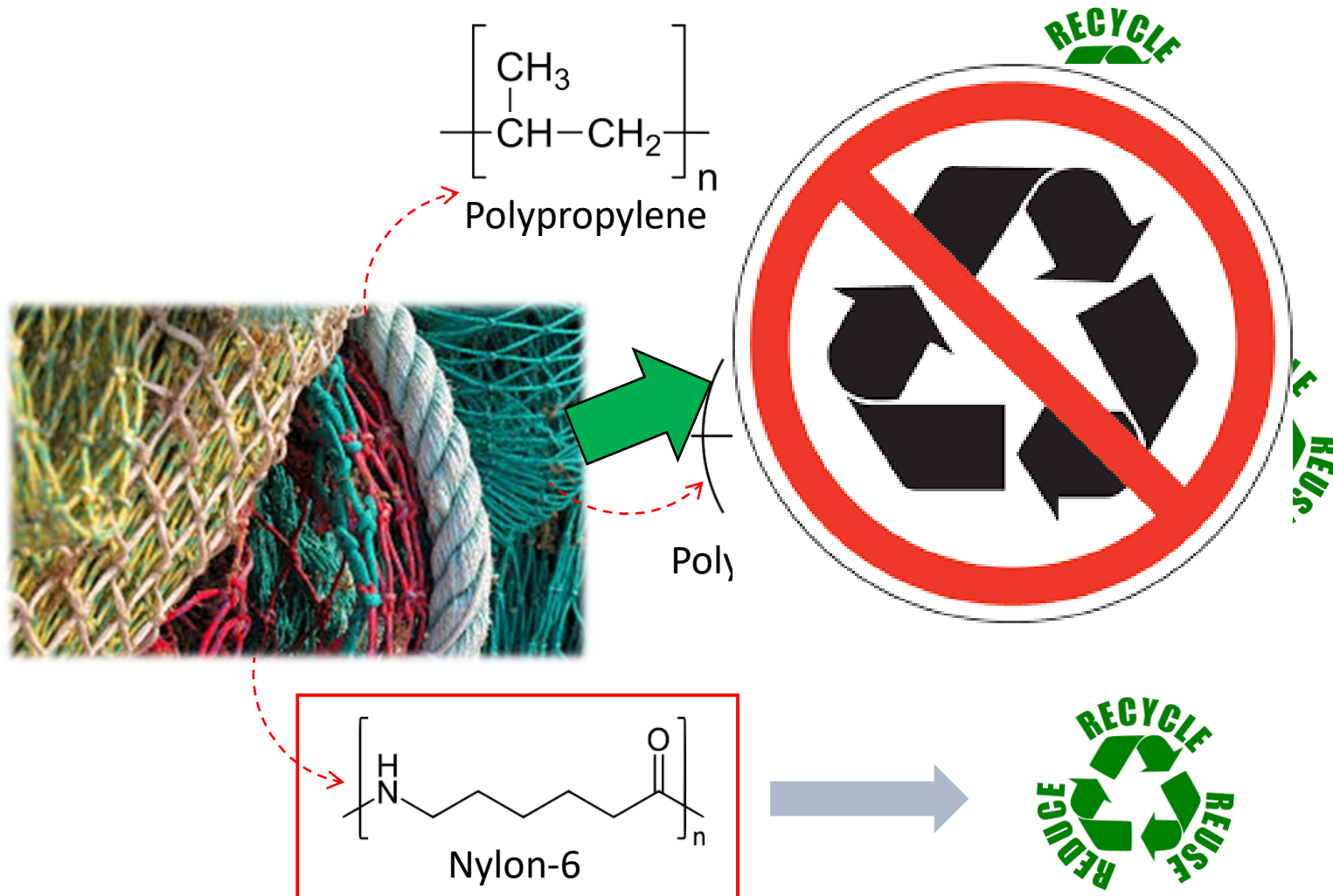
# Wastes on seashores



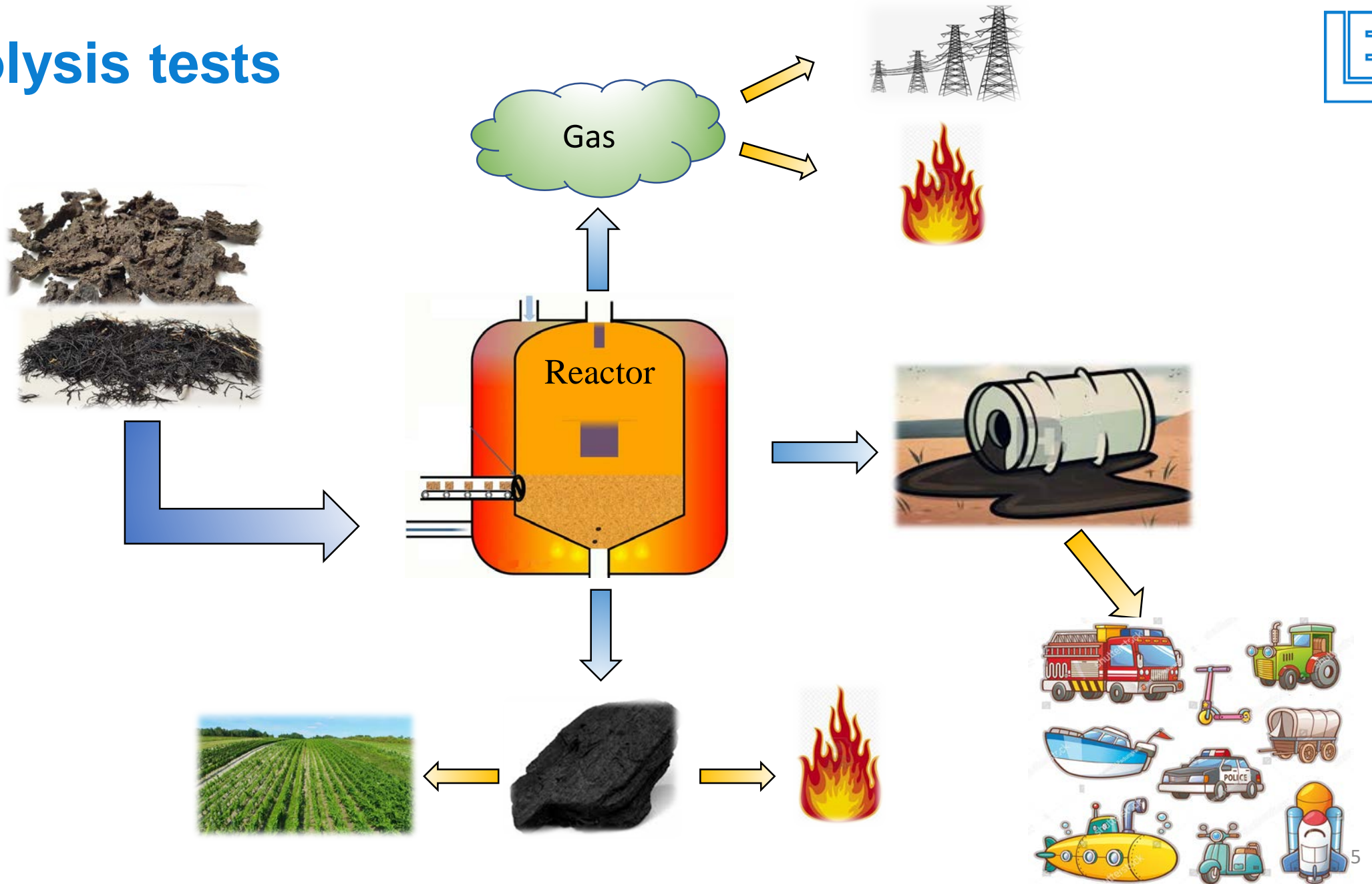
# Seaweed uses



# Fishing nets



# Pyrolysis tests



# Feedstock preparation



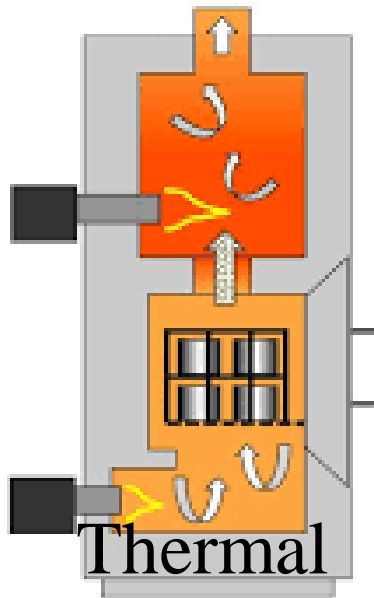
## Collection



## Washing



## Drying

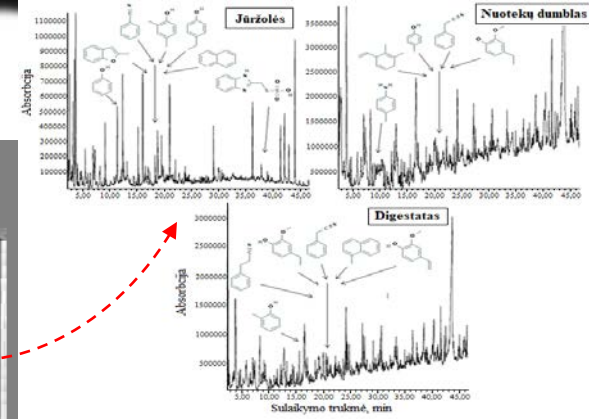
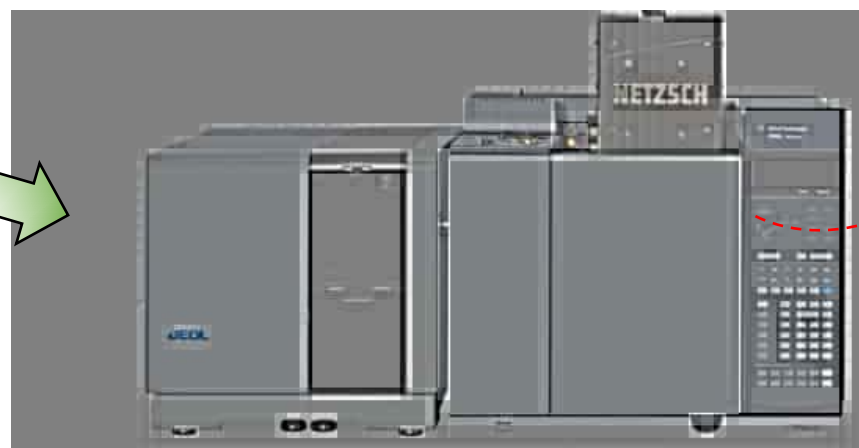
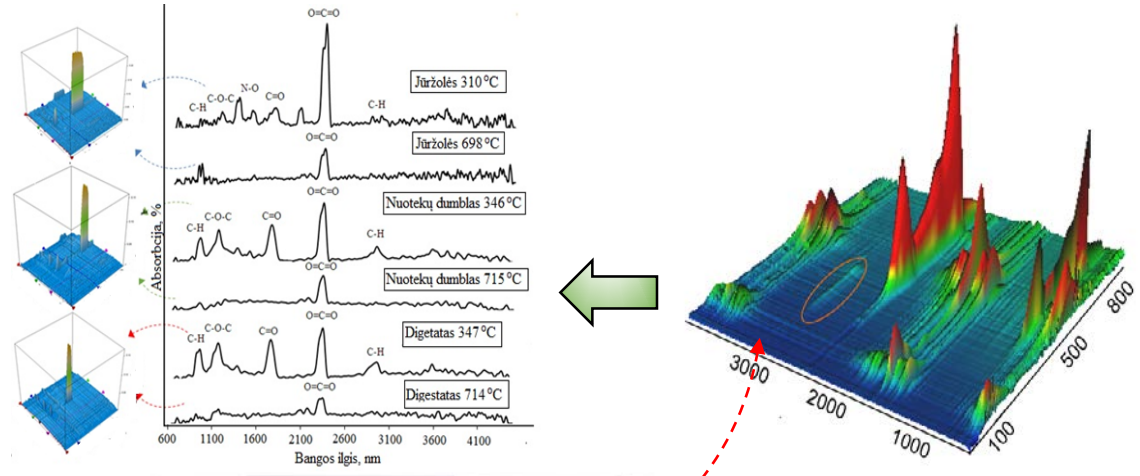
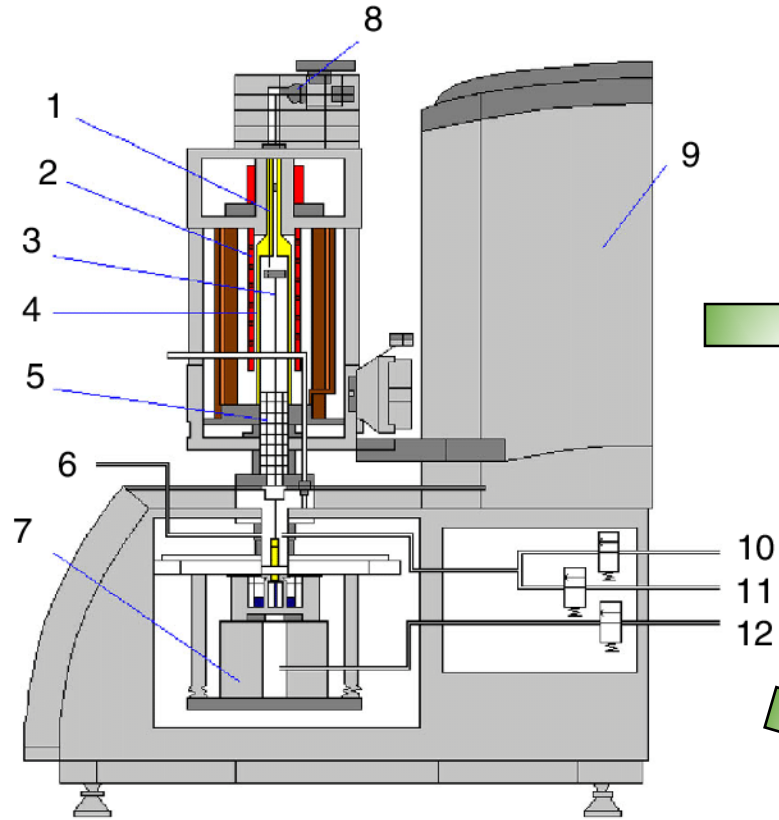


## Thermal treatment

# Micro-thermal analysis

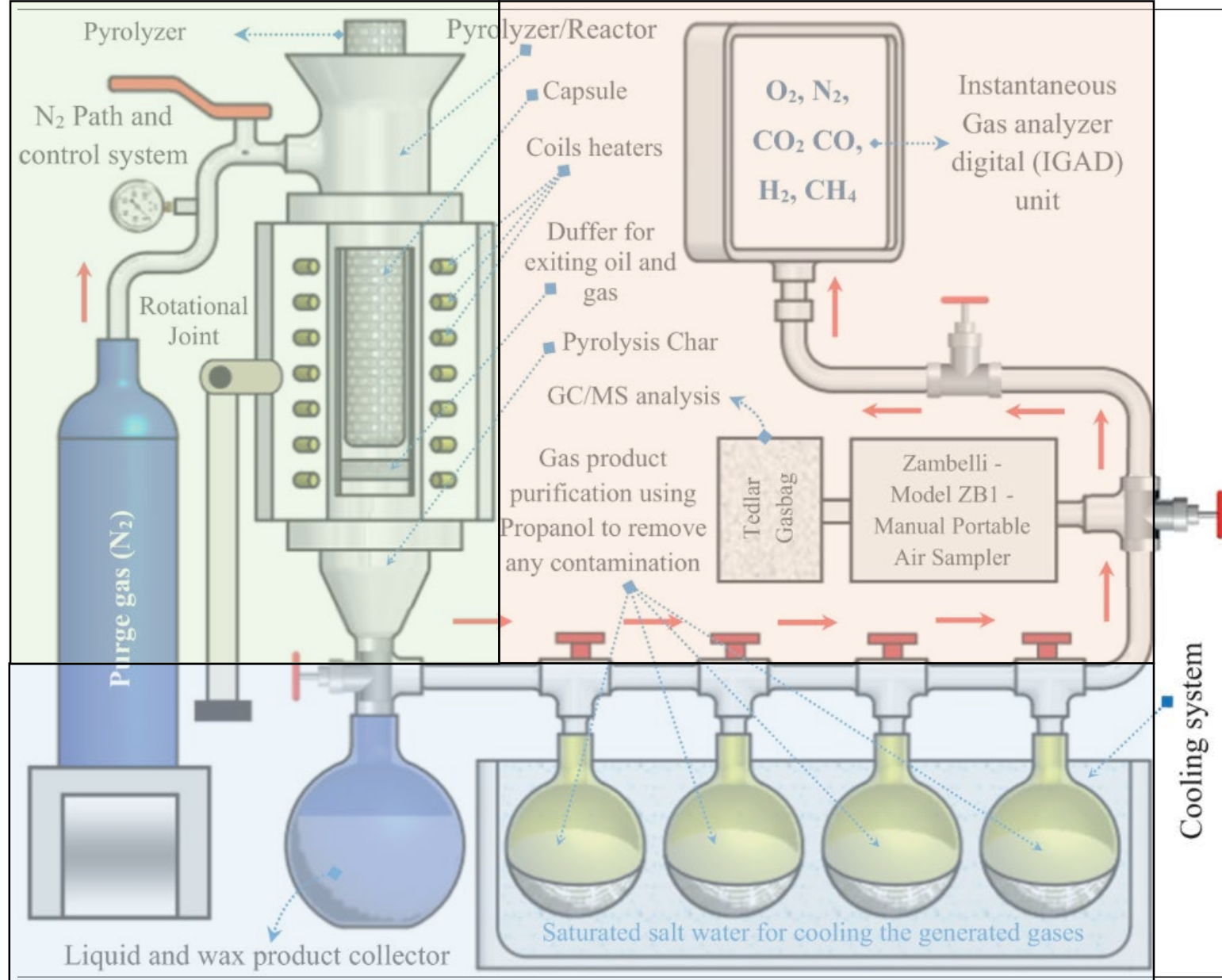


Netzsch STA F3 Jupiter



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



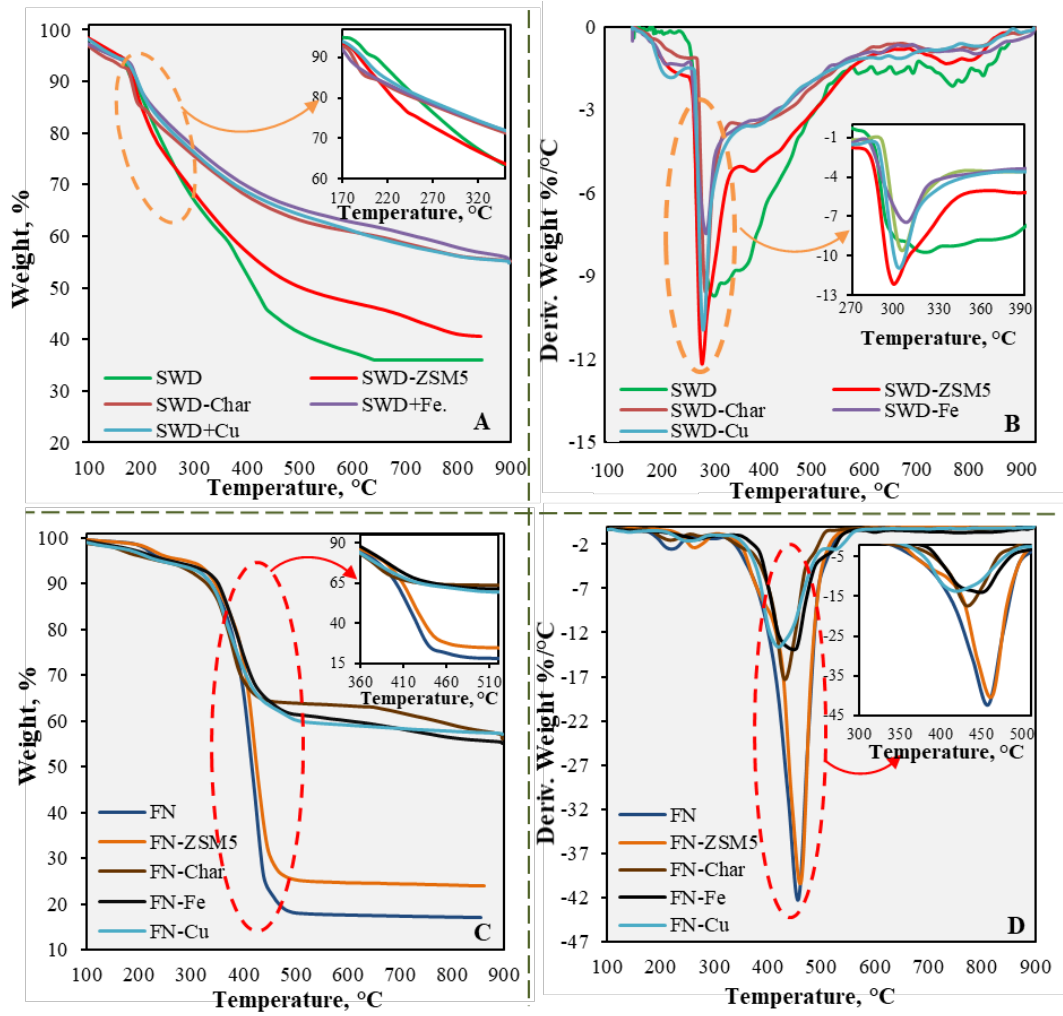


# Bio-char catalyst characterization

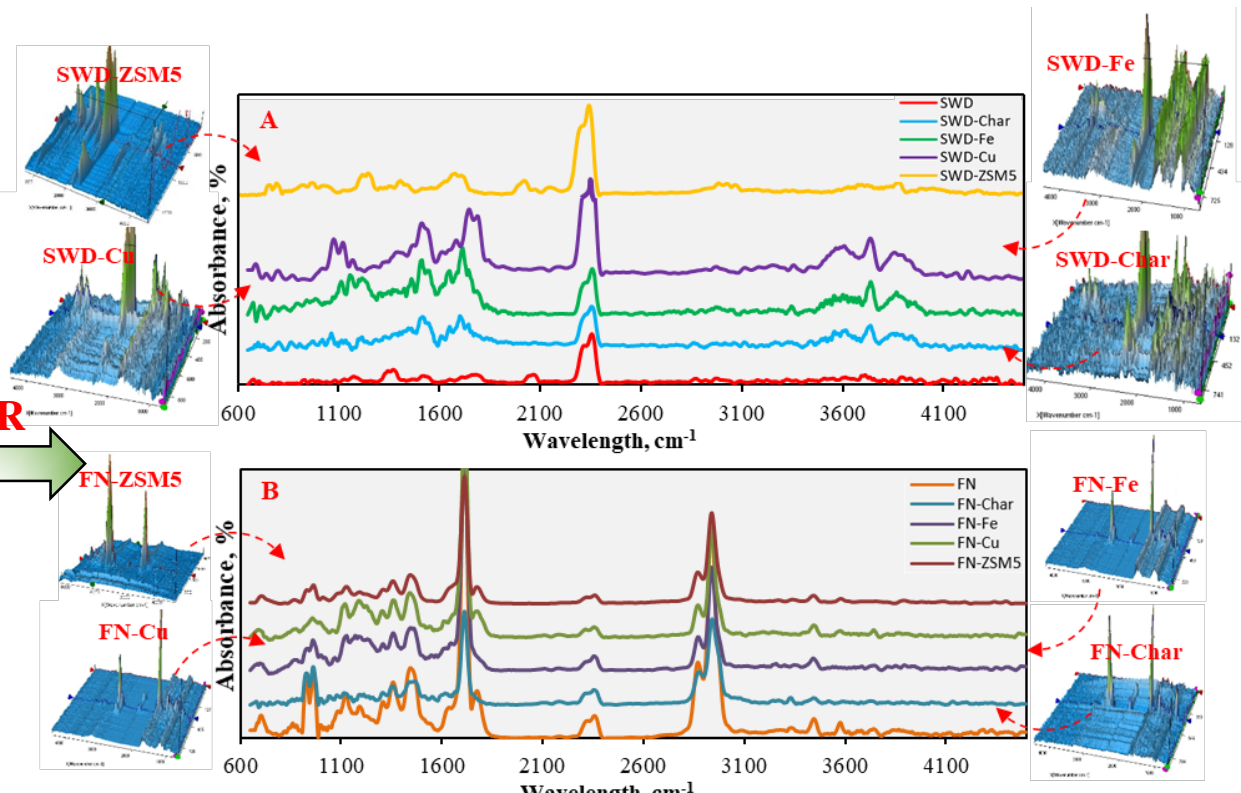


Element	Non-impregnated char	Impregnated char, Fe	Impregnated char, Cu
C, wt.%	73.73	32.46	51.52
H, wt.%	1.18	1.01	0.92
N, wt.%	4.84	1.01	2.00
S, wt.%	0.52	n.d.	n.d.
O, wt.% (by diff.)	8.87	7.42	8.11
Ash, wt.%	10.86	58.10	37.45
BET, m <sup>2</sup> /g	2010	790	1070
Fe, mg/kg	300	64490	280
Cu, mg/kg	690	200	83290

# Micro-thermal analysis combined with FTIR

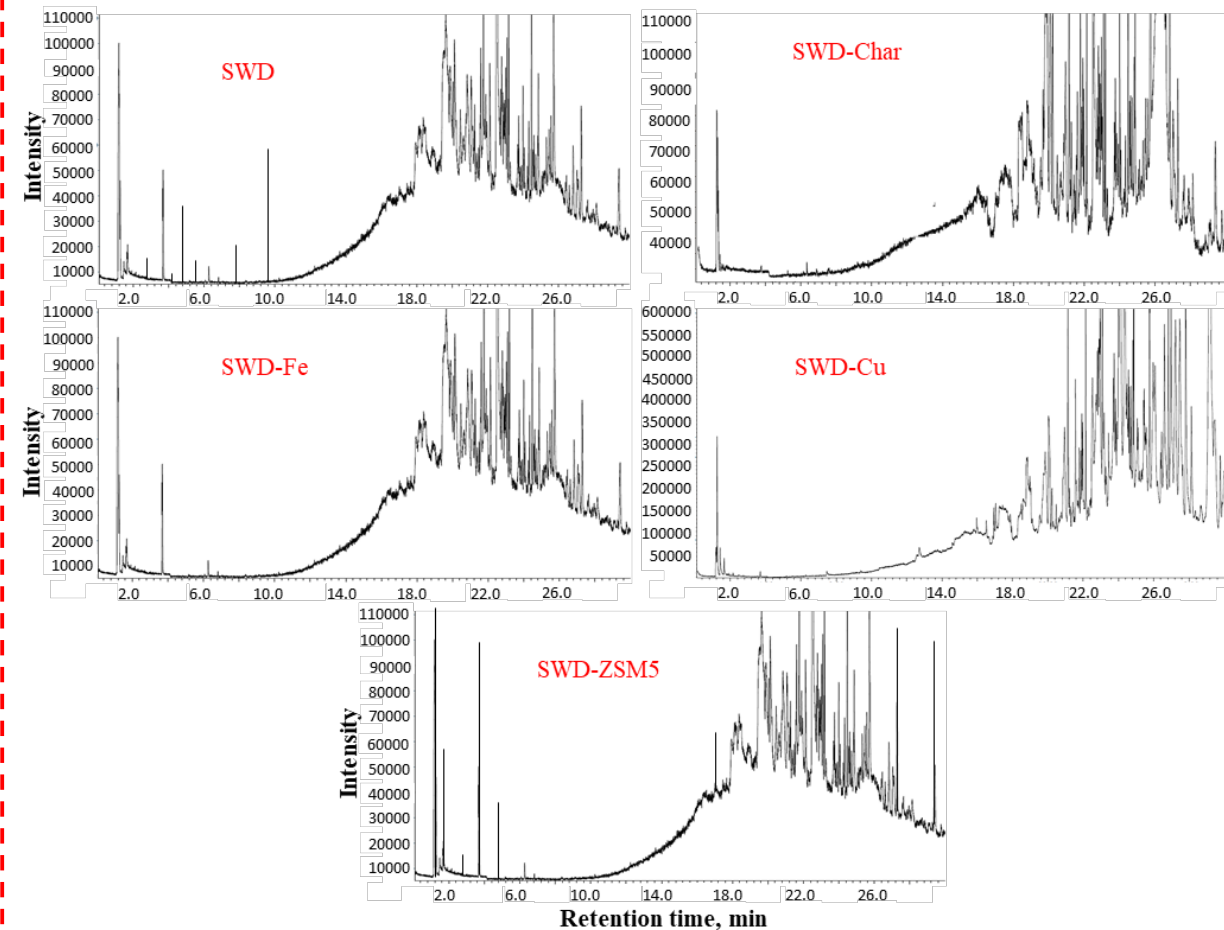
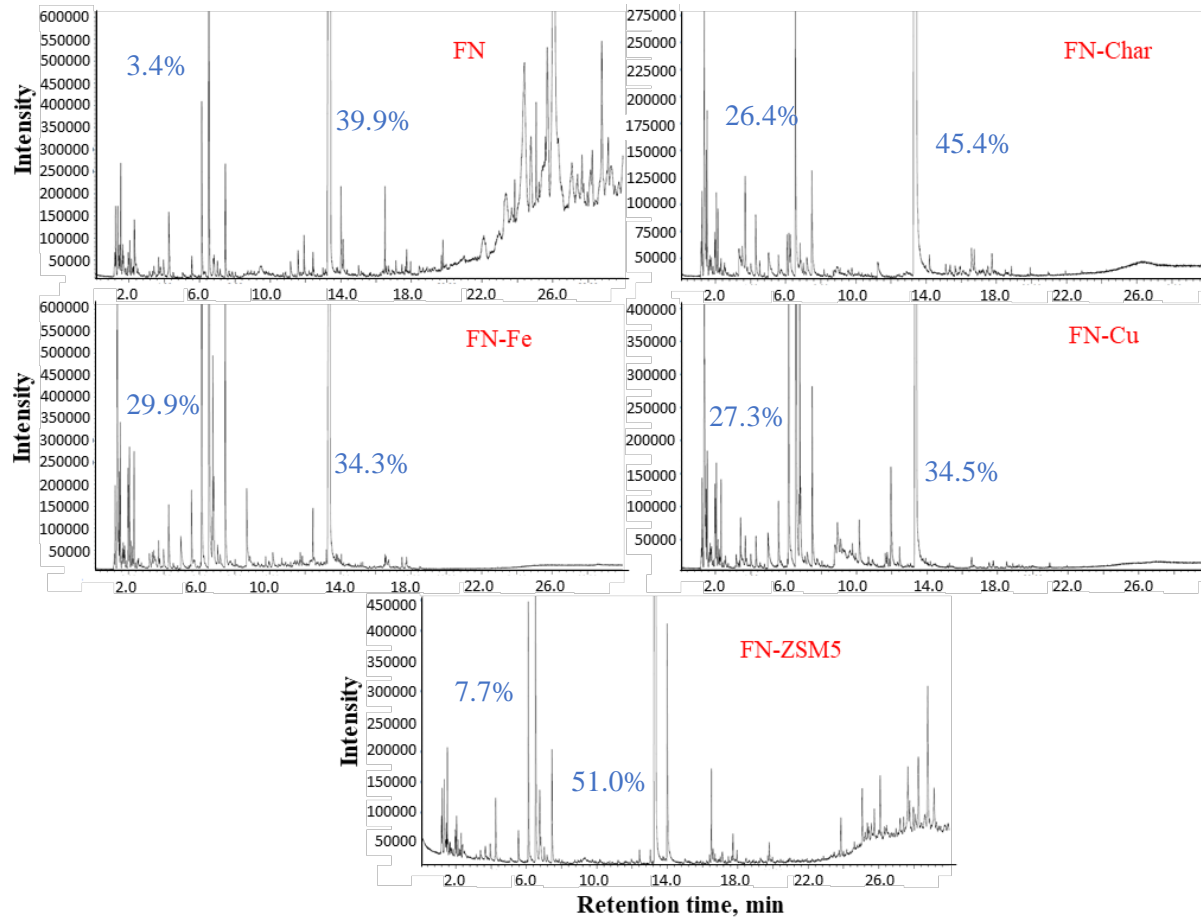


FTIR



A-B Seaweed results, C-D Fishing nets results.

# Micro-thermal analysis combined with GC/MS



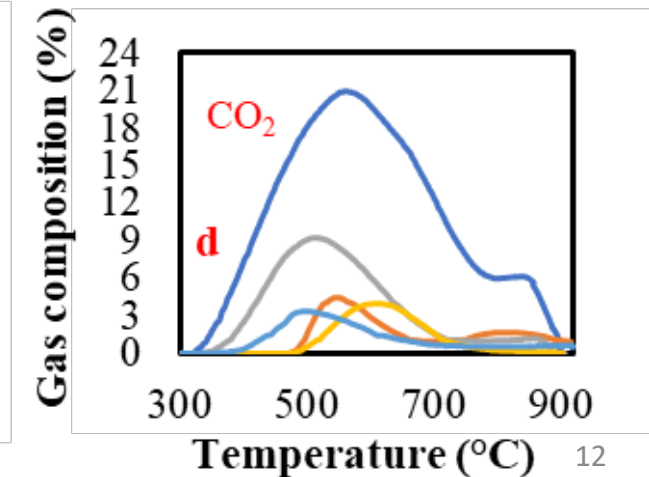
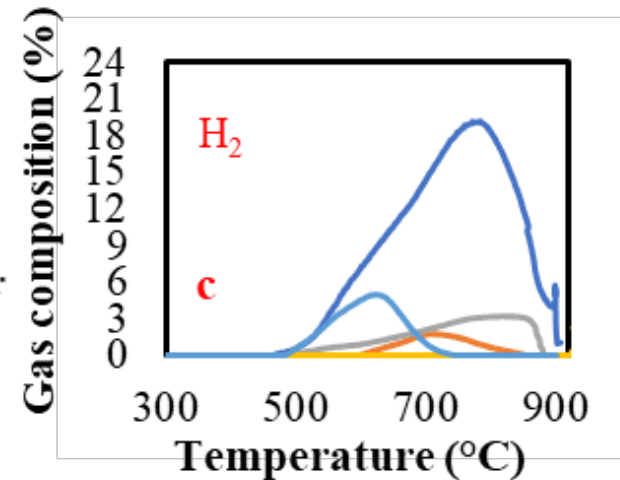
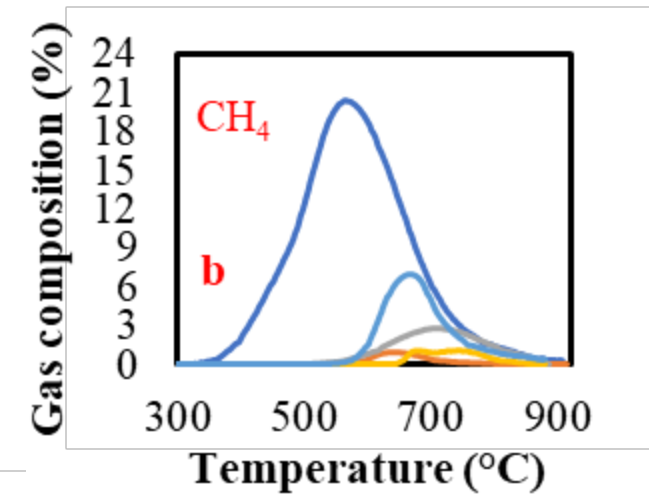
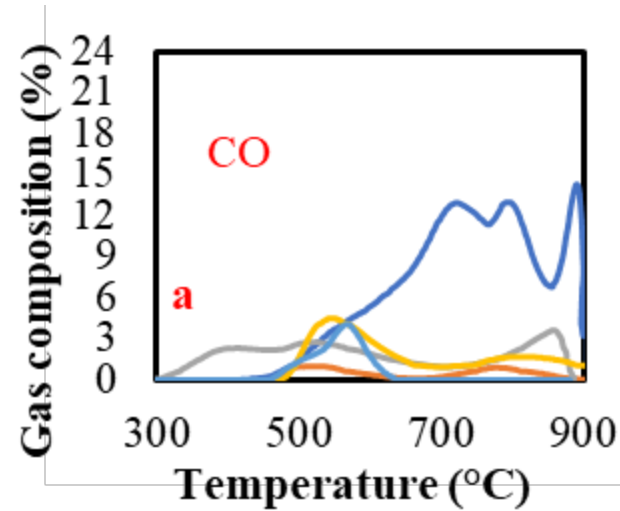
Caprolactam, hexanitrile, aromatic polycyclic compounds, acids.

Variously substituted aromatic, phenolic, and furans compounds, such as toluene, m-cresol, hydroquinone, styrene, furfural, and p-xylene

# Gaseous products analysis of the Seaweed



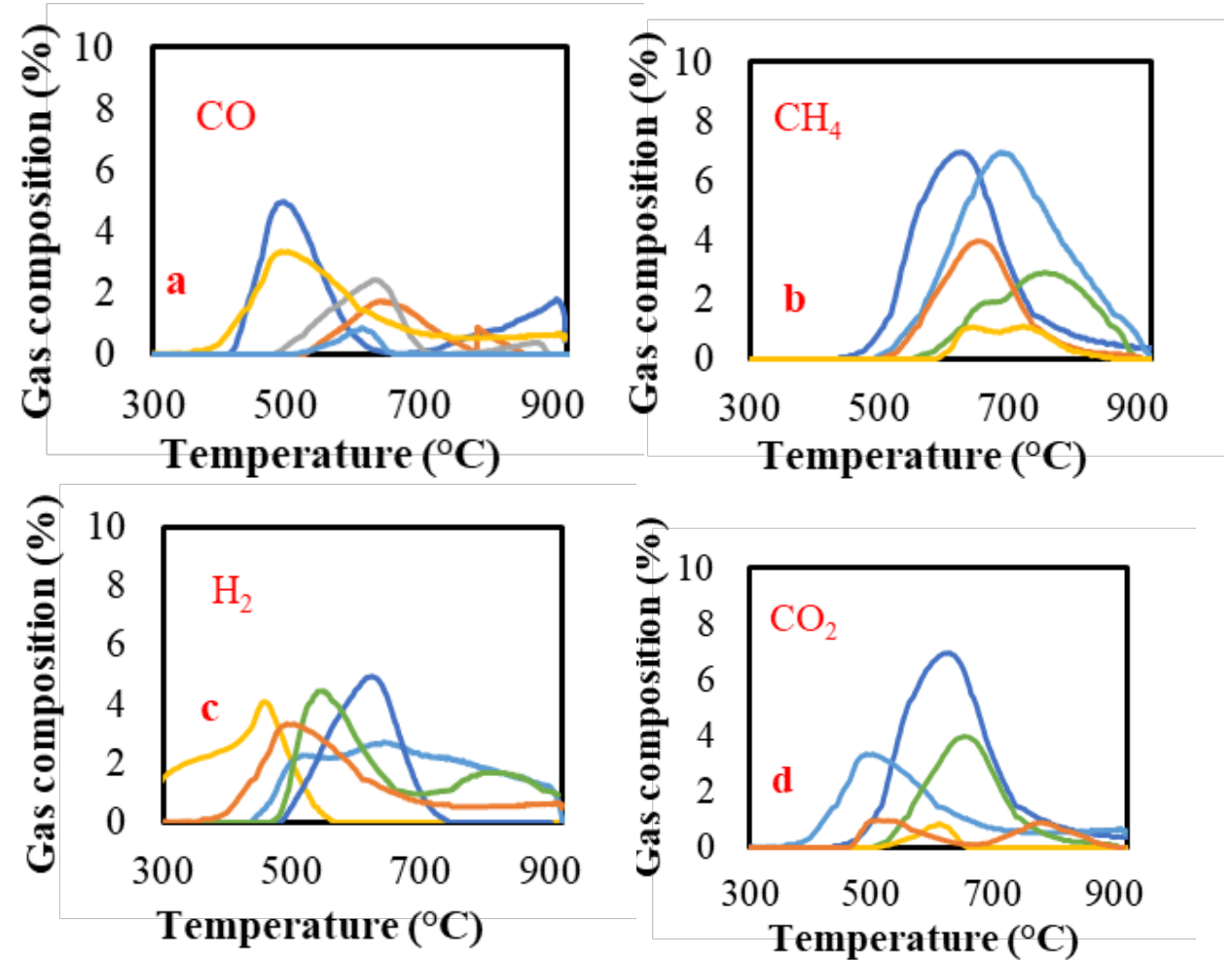
- Seaweed without catalyst
- Seaweed with non-impregnated char
- Seaweed with Char-Fe
- Seaweed with Char-Cu
- Seaweed with ZSM-5



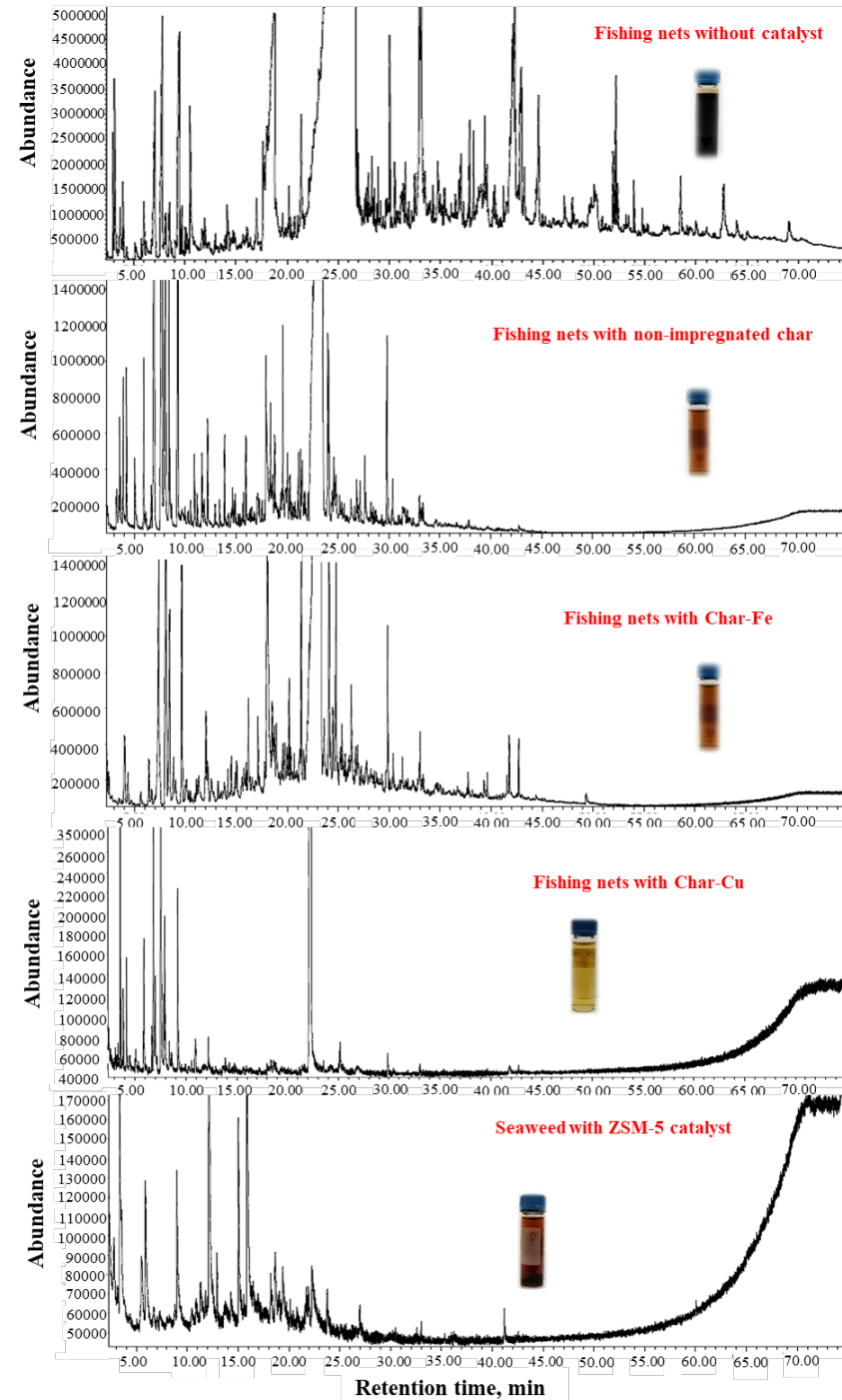
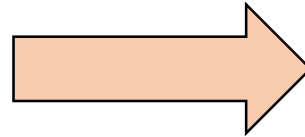
# Gaseous products analysis of the Fishing nets



- Fishing nets
- Fishing nets with non-impregnated char
- Fishing nets with Char-Fe
- Fishing nets with Char-Cu
- Fishing nets with ZSM-5

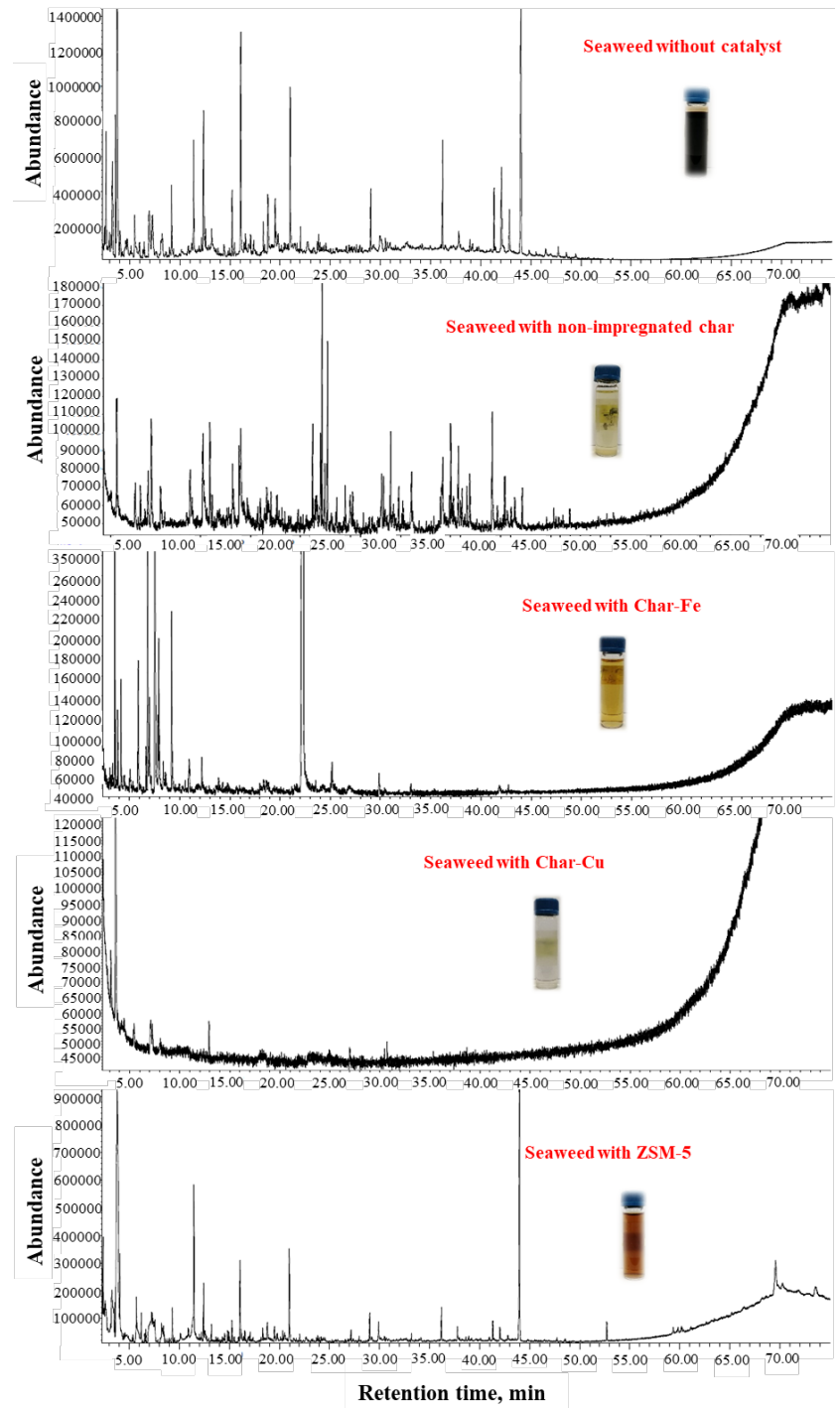
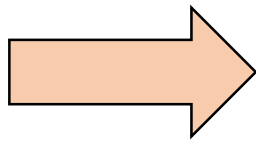


# Liquid product analysis



Substituted benzene and naphthalene derivatives, alcohols.

# Liquid product analysis



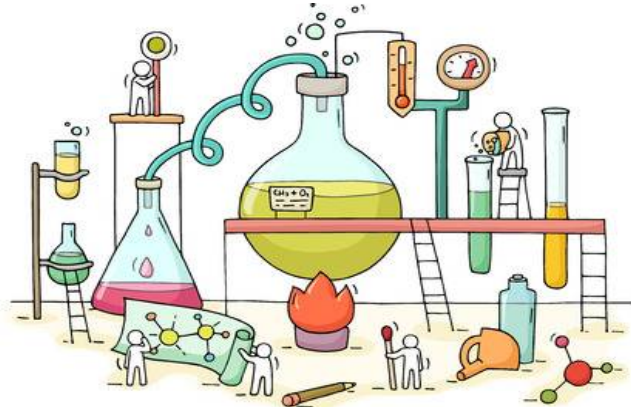
Substituted phenolic compounds, acids, alcohols.

# Formed products yield after the thermal treatment



Sample	Seaweed	Seaweed non-impregnated char	Seaweed Char-Fe	Seaweed Char-Cu	Seaweed ZSM-5
Pyrolysis oil, wt.%	17.20	38.73	42.12	41.83	41.12
Pyrolysis gas, wt.%	43.70	22.16	19.44	18.65	19.67
Pyrolysis char, wt.%	39.10	39.11	38.44	39.54	39.21

Sample	Fishing nets	Fishing nets non-impregnated Char	Fishing nets Char-Fe	Fishing nets Char-Cu	Fishing nets ZSM-5
Pyrolysis oil, wt.%	66.63	70.21	71.22	68.44	72.15
Pyrolysis gas, wt.%	26.02	22.51	21.14	24.45	20.24
Pyrolysis char, wt.%	7.35	7.28	7.64	7.11	7.61







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# Thank you for your attention

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2022

