



SOOT FORMATION IN THE PYROLYSIS OF 1-BUTANOL. ECO-TOXICOLOGICAL STUDY

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To study the formation of soot in the process of pyrolysis of 1-butanol at different temperatures, as well as evaluate the eco-toxicity characteristics of the soot formed.

Soot samples produced in the pyrolysis of the 1-butanol at 1000, 1050, 1100, 1150 and 1200 °C have been evaluated

OBJECTIVE

**Soot samples
production**

GPT
Thermo-Chemical
Processes Group



instituto
de investigación
en ingeniería de Aragón



**Universidad
Zaragoza**



Dipartimento di Ingegneria Chimica, dei Materiali e della Produzione Industriale
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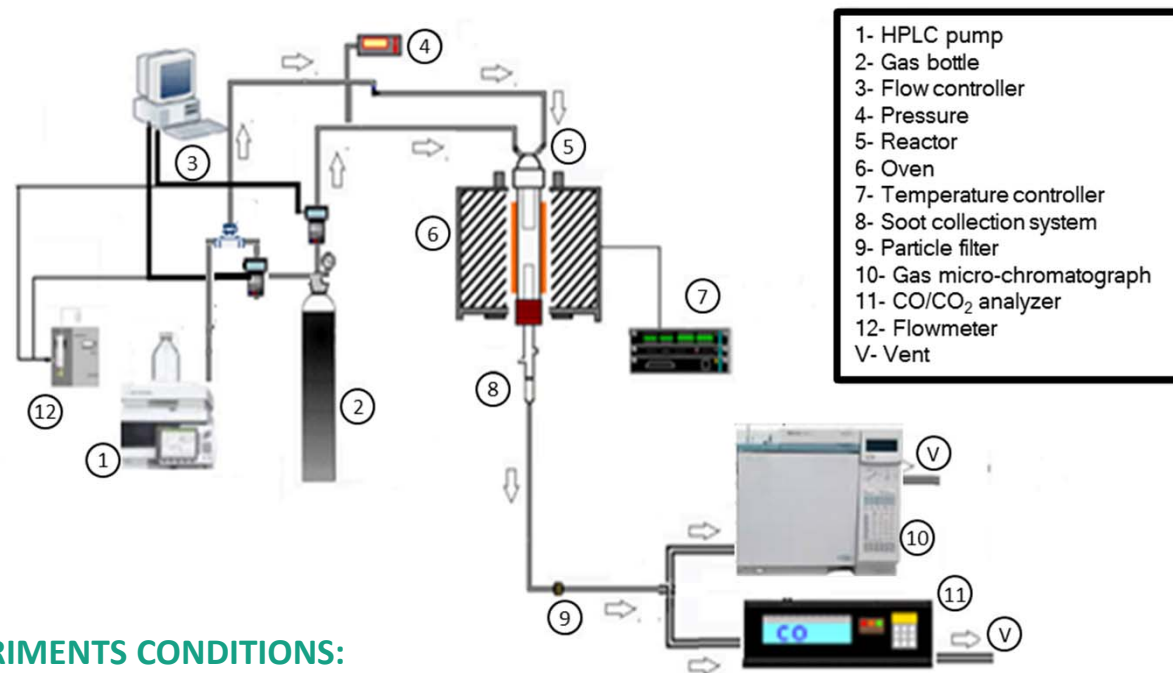
Understanding through Research for Education and Innovation

**samples
preparation**

**Eco-toxicological evaluation
(subcontract)**



EXPERIMENTAL SETUP



PYROLYSIS EXPERIMENTS CONDITIONS:

- 1-Butanol concentration: 22500 ppm
- Temperature range: 1000-1200 °C
- Pressure: 1 atm
- Total flow rate: 1 L (STP)/min
- N₂ to balance

■ 1-BUTANOL PYROLYSIS RESULTS

Temperature (°C)	950	1000	1050	1100	1150	1200
Time (h)	7	4	8	4	4	4
Soot (g)	0.02	0.57	4.37	2.28	2.76	3.70
Total C fed (g)	20.30	11.60	23.20	11.60	11.60	11.60
Yield (%)	0.09	4.96	18.82	19.68	23.80	31.93

$$Yield [\%] = \frac{Soot [g]}{Total\ C\ fed [g]} \cdot 100$$

The increase in the formation of soot as the temperature increases is probably due to the favoring of **pyrolysis reactions at high temperatures**.

■ ECO-TOXICOLOGICAL RESULTS

Soot	Cellular death	Cellular proliferation	IL-1 α	IL-1 β	IL-6	TNF α	Toxic
1-butanol 1000 °C	NO	YES	NO	NO	NO	NO	NO
1-butanol 1050 °C	NO	NO	NO	NO	NO	NO	NO
1-butanol 1100 °C	NO	NO	NO	NO	YES	NO	NO
1-butanol 1150 °C	NO	NO	NO	NO	YES	NO	NO
1-butanol 1200 °C	NO	NO	NO	YES	YES	NO	PRO-INFLAMMATORY

- Cellular viability assay:**
 No statistical difference in cells was observed in any of the assays.
- Cellular proliferation:**
 The 1000 °C soot sample reached statistically different percentage of proliferation vs. the control basal levels.
- ELISA assay:**
 IL-1 α , IL-1 β , IL-6, TNF α cytokines were analyzed. Only the 1200 °C soot sample induced inflammatory processes.

- \uparrow Temperature \rightarrow \uparrow Soot yield
- Soot particles did not lead to cell death.
- 1000 °C soot sample resulted in cell proliferation.
- 1200 °C soot sample could be considered as pro-inflammatory.

- To study the toxicity of the soot formed in the pyrolysis of the rest of butanol isomers: 2-butanol, iso-butanol and tert-butanol.
- To evaluate the contribution of the PAH adsorbed on soot to the toxicity of soot.



WASTE2FUELS

Thank you for listening!

Partners



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