Impact of blending high and low ash content feedstocks on the properties of fast pyrolysis bio-oil

S W Banks and A V Bridgwater

Energy and Bioproducts Research Institute (EBRI), Aston University, Birmingham, Untied Kingdom

Aims

The aim of this research is to identify if **low ash content biomass** can improve fast pyrolysis conversion of a **high ash content feed** in terms of bio-oil yield, calorific value and characteristics.

Biomass

Contaminated Willow and Miscanthus will be used for this research. It was identified that **potassium was the largest contaminant** within Willow and Miscanthus (2.84 and 3.30 wt. % respectively, dry bases). A comparison of fast pyrolysis Willow and Miscanthus products and previous research on uncontaminated Willow and Miscanthus was conducted (Table 1.).

Fast pyrolysis processing

A **1 kg h-1 continuous bubbling fluidised bed reactor** was used to fast pyrolyse biomass to produce bio-oil. The rig operated at 500^{o}C with a hot vapour residence time of less than 2 s. Bio-oil was collected using a quench column and electrostatic precipitator. Char was collected using two cyclones.

Figure 1. 1 kg h-1 continuous bubbling fluidised bed reactor including product collection.

Table 1. Mass balances for fast pyrolysis experiments.

Products	Willow	Contaminated Willow	Miscanthus	Contaminated Miscanthus
Actual K content (wt. % $^{d.b}$)	0.38	2.84	0.27	3.30
Char total	**16.09**	**21.56**	**21.13**	**25.37**
Bio-oil total	**62.55**	**32.85** ^{L}	**53.46**	**28.16** ^{L}
Phases	Single	Separated	Single	Separated
Organics	48.67	21.11	35.83	15.80
Reaction water	13.88	11.74	17.64	12.36
Gas total	**16.45**	**39.63**	**22.22**	**41.47**
Closure	**95.10**	**94.04**	**96.81**	**95.00**

$^{d.b}$ – dry bases, L – liquid product (majority light volatiles)

Blending to be conducted

- Different ratios of **low** to **high** ash content biomass will be studied (1:2, 1:1 and 2:1)
- **Mixability of two biomasses** with different particle shapes (needle and chips) will be studied
- **Fast pyrolysis** experiments will be performed at 500^{o}C for all feedstock blends. Products will be characterised and results will be compared and trends identified.

Dr Scott Banks
EBRI, Aston University
s.banks@aston.ac.uk
0121 204 3419

Supergen Bioenergy Hub

supergen-bioenergy.net
supergen-bioenergy@aston.ac.uk
@SupergenBioHub