

CASE STUDY

Investigating the thermal performance and properties of olive husk under fast pyrolysis conditions



Elias Christoforou of Frederick University in Cyprus highlights the benefits of his visit to Aston University in the UK. This was made possible through the [BRISK](#) initiative which is funded by the European Commission's Seventh Framework Programme (Capacities).

Through BRISK, he received a grant for his travel and subsistence. The cost of him accessing EBRI's laboratories was also funded by BRISK.

I am a PhD student in the Civil Engineering Department at Frederick University Cyprus, and since 2013 I have been a research associate in the Sustainable Energy Research Group (SERG) in Frederick University and Frederick Research Centre (<http://sus-energ.org>). Our research group mainly deals with solid biomass and sustainable energy technologies. My research is focused on the field of biomass resources and the promotion

of utilization technologies for second generation biomass derived biofuels.

The BRISK initiative provided the opportunity to access and use the facilities of one of the best established academic bioenergy research groups; the Bioenergy Research Group (BERG) within the [European Bioenergy Research Institute](#) (EBRI) at Aston University, Birmingham, UK.

The application procedure for visiting EBRI was very simple since all the required information was available on the BRISK website (www.briskeu.com). After contacting the host organization (EBRI), the experimental planning was developed with the kind advice of EBRI's laboratory staff. The purpose of the visit was to investigate the thermal performance and properties of olive husk; a solid residue derived from the olive oil industry, under fast pyrolysis conditions and to evaluate its potential exploitation as an energy source.

Oven dried, 3-phase olive husk (3POH) was used as the biomass feedstock. Fast pyrolysis experiments were conducted in a bubbling fluid bed continuous reactor with a maximum capacity

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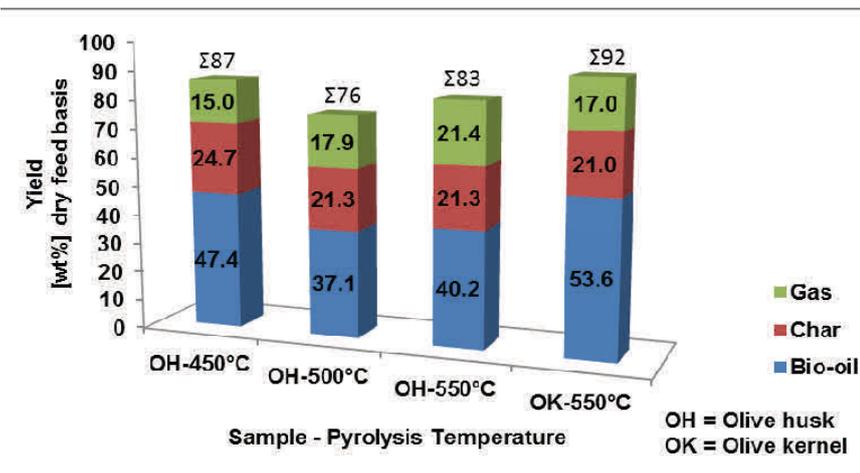
Figure 1: Fast pyrolysis experiment preparations.



Figure 2: Working on the pyrolysis reactor.

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at 500°C. The duration of the olive husk pyrolysis runs was 1.5 hours while the last run with olive kernel lasted for less than 50 minutes.

The yields of the pyrolysis products are graphically presented in Figure 3. All olive husk feeds give a phase separated product due to the high ash content and the mixed nature of the feed. The resultant high water content results in loss of water from the system giving lower mass balance closures. The relative proportions of organics and aqueous phase is being evaluated.

Figure 3: Fast pyrolysis product yields.

of 1kg/h, using a constant feed rate and nitrogen as the fluidising gas. The objective was to determine the effect of temperature on the yield of pyrolysis products and on the quality of the obtained bio-oil.

Prior to the pyrolysis processing, a series of analytical experiments was conducted to characterise the feedstock. (i.e. Pyrolysis – gas chromatography – mass spectrometry (Py-GC-MS), thermogravimetric analysis (TGA), elemental analysis, water content, ash content etc.). The composition, water content, calorific value as well as the acidity and dynamic viscosity of the obtained bio-oil was also determined. Non condensable gases were analysed using an on-line Varian CP 4900 Micro-GC micro-gas chromatograph.

Three different pyrolysis temperatures were investigated using olive husk as feedstock; 450, 500 and 550°C. A pre-treated sample which consisted only of olive kernels was also processed

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Visiting EBRI through the BRISK Transnational Access programme was a fantastic experience for me. BRISK is definitely a useful and valuable research initiative promoting the cooperation and transfer of knowledge between researchers interested in the field of biomass.

I would like to acknowledge all EBRI staff and particularly Dr Scott W. Banks and Dr Daniel Nowakowski for their assistance during my visit at Aston University.



Figure 4: Dr Scott Banks of EBRI (left) with Elias Christoforou of Frederick University outside the EBRI building.