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## Hydrothermal carbonization of biomass to produce reduced-ash fuel

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Hydrothermal carbonization (HTC) is potentially an attractive option, as a pre-treatment process, to produce an energy dense, friable, reduced-ash and chlorine free solid biofuel (also referred to as biocoal) from biomass. It is particularly attractive for waste feed-stocks with a high moisture content, which would not require drying before treatment. HTC experiments have been conducted on a range of biomasses, including wood pellets, olive cake, miscanthus pellets, and sewage sludge over the temperature range of 200-300°C with residence times up to 4 hours, using a Parr reactor. The resultant char was then subjected to proximate analysis with the alkali and alkaline earth metal contents of the process water being determined by ion chromatography and induction-coupled plasma (ICP) analysis. To complete the mass and carbon balance, gas chromatography was used to analyze the gas generated by the process and the dissolved organic carbon content of the process water was determined. The biocoals produced had considerably higher fixed carbon contents than the feed-stocks with the HTC process generating additional quantities of fixed carbon compared to the feed-stocks. At 200°C, the biocoal represented 82% (dry, ash free basis) of the wood, which corresponds to over 90% of the initial carbon. Although increasing temperature increases fixed carbon content further, the yields of biocoal were reduced markedly. HTC was also shown to reduce ash content considerably through extraction of alkali and alkaline earth metals.

### Biography

Robert J Stirling has completed his Master's degree in Chemistry with Industrial Experience (MChem) in 2014 from the University of Edinburgh, UK. The industrial experience was a year-long placement conducted at Cytec Industries, based in Stamford, Connecticut, USA, researching minerals separation technology. He is currently conducting research towards an Engineering Doctorate (EngD) at the Centre for Doctoral Training (CDT) in Carbon Capture and Storage and Cleaner Fossil Energy, based at the University of Nottingham, UK.

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