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# Experimental Investigation of Oxy-combustion Behaviour of Single Biomass Pellets using High-speed Imaging and Colour Processing Techniques

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Biomass fuel has been widely accepted as renewable energy in conventional power generation plants. Biomass fuels, however, can vary widely in properties, composition and structure, leading to drastically different 'fuel performance', particularly under oxy combustion conditions. Whilst considerable research has been carried out on the experimental studies and modelling of single biomass particle's ignition and combustion under conventional air combustion conditions, limited work has been undertaken in this area under oxy combustion conditions. This is largely due to the lack of a quantitative means to measure and characterise the combustion behaviours of biomass particles/pellets. In this study, a combination of high-speed and spectroscopic imaging, and image processing techniques is employed to investigate the combustion behaviours of single biomass pellets in a V-DTF (Visual Drop Tube Furnace) under oxy-fuel combustion conditions. Five different biomass pellets (i.e., wood, straw, peanut shell, miscanthus and terrified wood) combust under air and three oxy conditions (i.e., 21%O<sub>2</sub>/79%CO<sub>2</sub>, 25%O<sub>2</sub>/75%CO<sub>2</sub>, and 30%O<sub>2</sub>/70%CO<sub>2</sub>) for the pre-set furnace temperatures of 800 °C and 900 °C. Images of burning pellets are recorded using a high-speed camera (up to 900 fps) and an EMCCD camera for each test condition. Characteristic parameters of the burning pellet, such as flame size, temperature, are colour features, defined and computed based the images obtained, which are then used to study the impact of the oxy conditions on the combustion behaviour of the tested biomass fuels. The experimental results provide a useful reference for improved understanding in the fundamental aspects of physical and chemical behaviours of biomass fuels under oxy-firing conditions. Fig. 1 illustrates typical images of a miscanthus pellet under air and oxy conditions. Detailed experimental results will be presented at the conference.

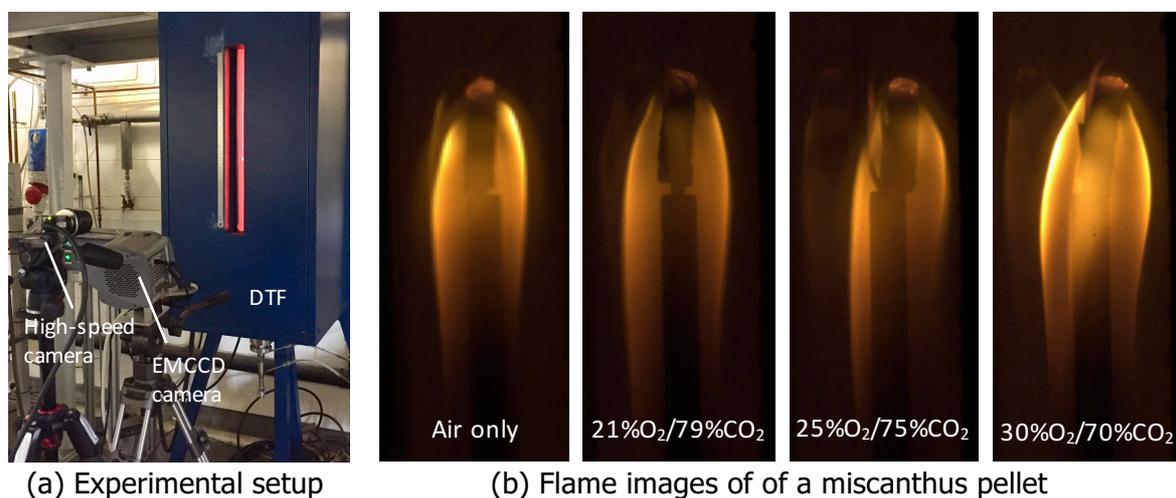


Fig. 1 Experimental setup and flame images of a miscanthus pellet.

**Keywords:** Biomass pellets, oxy-fuel combustion, V-DTF, high-speed imaging, colour processing.

**Acknowledgement:** Authors wish to acknowledge UKCCSRC for providing a grant (Project No: 132206) in aid of this research.

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