ABSTRACT

An evaluation of the production and combustion of fuel pellets from oilseed rape (*Brassica Napus* L.) straw

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Energy generation from biomass combustion is a renewable alternative to fossil energy. Alternatives are needed to reduce reliance on wood, which is currently the predominant biomass combustion fuel. The project aims to investigate the production and utilization of OSR straw pellets for combustion purposes by considering the storage of OSR straw and its compression into higher density products and the storage and combustion of OSR straw pellets.

The study demonstrated oilseed rape (OSR) straw presents a suitable alternative due to its availability, relatively high calorific value and low moisture content. Pelletisation enabled the bulk density of OSR straw to be improved, enhancing its potential as an alternative combustion fuel. Statistically significant changes occurred in the biological, physical and chemical properties of OSR straw bales and pellets during 20 months storage on-farm, but these changes were not of practical significance.

Combustion of OSR straw pellets that had been stored for 1, 3, 6, and 12 months prior to combustion in a Fluidised Bed Combustion (FBC) test facility demonstrated high combustion efficiency and gaseous emissions that were below the emission limit values specified by the Large Combustion Plants Directive (LCPD). Whilst the concentration of gaseous HCl and SO_2 present in combustion emissions reduced with the length of storage of OSR straw pellets prior to combustion, the amount of deposition of condensed vapours increased. The concentration and composition of gaseous emissions and deposits determined experimentally agreed with theoretical predictions.

The compression behaviour of OSR straw into briquettes was investigated and it was shown the density of the briquettes increased with increasing applied pressure and the use of milled straw. In comparison to unmilled straw, milled straw required less energy to form the briquette and was associated with lower levels of relaxation. However, additional energy was required to mill the straw and briquettes were more durable when unmilled straw was used. A novel model was developed and verified to predict the pressure required to reach a particular briquette density. The model correlated with experimental data (R^2 = 0.99).