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Investigating Downdraft Gasification of Biomass

A thesis presented in partial fulfilment of the requirements for the degree of

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Abstract

Gasification of biomass is a potential source of renewable energy. Downdraft gasifiers are comparatively cheap and can produce gases with low tar content. We constructed a simple, phenomenological model of downdraft gasification which we compared to both previously published data and our own experimental results. The steady-state gas compositions predicted by the model were quite close to those found experimentally, although the model tended to over-predict the amount of methane in the dry product gas. The steady-state gas composition predicted depended upon the conditions assumed at the top of the gasifier.

The experimental part of this investigation looked at the effect of the air flow rate into the gasifier and the length of the gasifier bed. However, the uncertainties in the experimental measurements were too large to determine whether the experimental results followed the same trends as predicted by the model.

The gasifier was run successfully using both 18.7% moisture content pine chips and 12.3% moisture content walnut shells (weight percentage, dry basis) as fuel. Both fuel types produced dry exit gases of similar compositions.

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