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Design of an optimal biorefinery network under biomass cost and availability uncertainty

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Key limitations of previous studies undertaken to assess the impact of bioenergy on greenhouse gas (GHG) mitigation (and energy security) is that the predictions are largely decoupled from any financial drivers. Financial drivers are dealt with implicitly and somewhat artificially by imposing limits on the fraction of available biomass resource diverted to biofuels and dictating which, when and at what rate bioenergy feedstocks are consumed. This would seem a significant weakness in such analyses given that the mitigations of GHG emissions will almost certainly be implemented through market mechanisms to ensure the associated costs are minimised. This paper therefore addresses a novel methodology of using predominantly cost based decision tree to predict the rate of uptake of specific technologies, and optimising biomass supply chain process as a means of increasing biomass availability, the two main uncertainities impeding commercial viability of any bioenergy project.

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Explosibility and burning properties of pulverised rice husk and their dependence on particle size

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Replacement of environmental damaging coal with sustainable renewable fuel is needed to promote renewable electricity and heat generation. Renewable biofuel is an appropriate substitute of coal for existing coal power generation plants. The biofuels are pulverised and flame propagation occurs in a mixed pulverised biomass and air flow. The physics of flame propagation relevant to burners is identical to that which occurs in propagating pulverised biomass flames in explosions, which was the experimental technique used in the present work. Biofuels carry fire/explosibility risks in their handling and there is little published in formation on this as the standard equipment does not work with fibrous biomass. The reliable measurements of the reactivity parameters for these biofuels depend on multiple factors such as fuel properties and their size distribution. Thermal pre-treatments of biofuels such as torrefaction and steam explosion break up the biomass fibres and the resultant fuel mills in a similar way to coal and the standard injection equipment for explosibility tests can be used. In this work, different size fractions of steam exploded wood (black pellets) were tested using a modified 1 m^3 vessel and compared for their burning characteristics with the original yellow pine biomass. Explosibility properties, K_{st} and flame speed, were higher for the fine fraction as compared to the coarse size fraction. MEC were measured from 0.14 to around 2 in terms of burnt equivalence ratio for fine to coarse size range fractions. Maximum explosion pressures relative to atmospheric pressure and dust constant were measured to be 7 to 8.6 barg and K_{st} 43 to 122 bar m/s depending on the fineness of the fraction. Surface morphological study showed more fines for the steam exploded sample in comparison to its raw wood.

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