CHAPTER 6

CONCLUSION AND RECOMMENDATIONS

This study indicates that it is possible to gasify selected schredded biomass in an open top gasifier, in particualar rice hulls, shredded or milled rice hulls, wood shavings, bagasse fibers, cut water hyacinth stems, hammermilled corn cobs. However the following biomass did not gasify successfully: sawdust, bagasse as received from sugar mills, carbonized rice hull pellets, and shredded corn cobs.

The problems relating to the gasification in an open top gasifier of schredded biomass or biomass pieces all of which have a low bulk density are the problems of cavitation in the fuel bed, and of gas quality. Concerning fuel reactivity it was found that some fuels such as sawdust would not ignite at all, others did ignite but the flame were not self sustaining and quickly died out such as in the case of corn cob shredds (hammermilled corn cobs passing through a 0.5 by 0.5 cm sieve) or raw bagasse. Thus the main item concerning fuel reactivity is believed to be the undesirability to gasify fuel with a high content of fines. Another problem found during the course of this study was the problem of cavitation in the fuel bed during gasification. Such problem is due to biomass being converted into a gas in the reaction zones and cavities being formed and failure of unreacted biomass on top to fall down by its own weight. This phenomena results in gas being unsteady in quality. The following biomass were found to have some cavitation problems during gasification: ordinary rice hulls (100-150 kg/m3), corn cobs both as

whole cobs and hammermilled cobs, bagasse fibers (95 kg/m3). For these fuels poking in the reactor with a stick was often necessary to force the fuel down to fill up the cavities. Flow of fuel was easier for schredded rice hulls (280 kg/m3), wood shavings, and water hyacinth stems (97.5 kg/m3). The answer to this second problem would be to either mount the batch gasifier on the same frame as an eventual engine or place a weight on top of the fuel. For the case of an open-top, rotating grate continuous gasifier the cavitation problem may not be as serious and has been solved for rice hulls , however for the above mentionned biomass no data exists on this matter. The third point relating to gasification of biomass shredds is the gas concentration or calorific content. It was found that gas calorific contents were generally lower by a percentage ranging from 0 to 50 compared to gas calorific contents that could be obtained from traditional tuyered charcoal gasifiers. It was also observed that measured temperature levels in the reduction zone were generally low and according to the equilibrium Gumz model should lead to lower calorific contents as found in this study.

The recommendations to be made are as follows. On a practical basis it should be possible to design a batch gasifier to operate on selected shredded biomass and with proper gas cleaning apparatus run internal combustion engines. The technical details recommended would be to install the gasifier on the same frame as the engine and design the unit in such a way as to provide for strong vibrations , to place a weight on top of the biomass so that both measures would decrease cavitation. Also on a practical basis it will interesting to test the open top gasification concept in a

continous gasifier with the mechanical agitation being supplied by a rotating grate and no previous experience in this exist except for the case of ordinary rice hulls. On a practical basis there exist no experimental data on batch gasfication of biomass chips in such open top gasifiers. This idea would be interesting as the bulk density of the biomass would be greatly increased this way , and the temperature levels would also be increased which would lead to higher calorific value gas. On a theoretical basis the understanding of gasifier operation regarding the height of reduction zone so as to loose the least carbon and so as not to create fines in the bottom of the reduction zone is of importance and should be studied further in connection with continuous gasifiers.