STUDIES ON BIOMASS GASIFICATION

THESIS SUBMITTED IN
PARTIAL FULFILMENT OF REQUIREMENTS
FOR THE AWARD OF
DOCTOR OF PHILOSOPHY
IN CHEMICAL ENGINEERING

by

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Dedicated to
My
Parents

CERTIFICATE

This is to certify that the thesis entitled, **'STUDIES ON BIOMASS GASIFICATION'** being submitted by Mr. Siddhartha Gaur, to the **INDIAN INSTITUTE OF TECHNOLOGY, DELHI,** for the award of the degree of 'Doctor of Philosophy', is a record of bonafide research work carried out under our guidance and supervision and has fulfilled the requirements for the submission, which to our knowledge, has reached the requisite standard.

The results obtained in this thesis have not been submitted in part or in full to any other University or Institute for the award of any degree.

April, 1989

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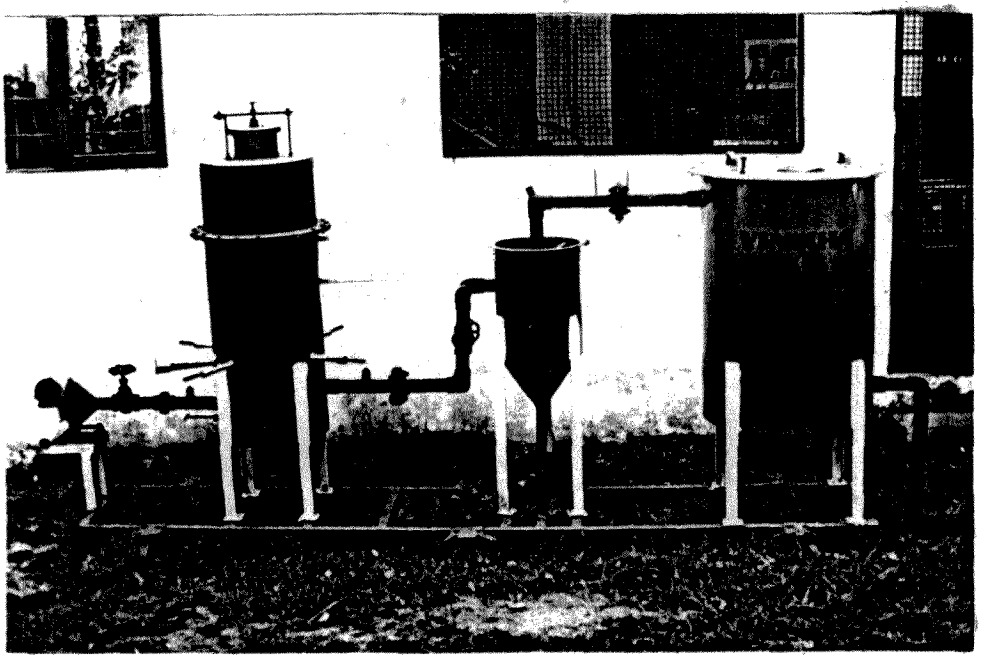

Commercial Model (VG-45) of Biomass Gasification System developed during the course of this work

ABSTRACT

The rapid depletion of conventional sources of energy with their ever increasing demand has significantly affected the global energy economics. In the Third World nations like India, oil price rise wiped out half of its foreign exchange ($ 7 billion) in the year 1979. Since then serious efforts have been made to exploit regenerable sources of energy so as to decrease dependence on the conventional sources.

Biomass utilization for the production of electrical and mechanical energy through gasification and use in I.C engines forms the text of this work.

The chronological development of gasification technology has been presented in Chapter Two. Part A of this chapter is devoted to the technology evolution while Part B analyses the fundamental and technical aspects of the relevant work on gasification.

The influence of fuel on gasifier performance and hypothesis in the favour of use of partially pyrolysed biomass as against raw biomass for small scale applications is brought out in Chapter Three.

Chapter Four presents the details of the design, development and testing of Co-current moving bed gasifier operating on partially pyrolysed biomass fuels to power 3.5KW I.C. engine-pump and generator system. This includes the field trial testing, performance analysis and economics of the system.

Chapter Five deals with single pellet kinetic studies on major gas-solid reactions taking place inside this gasifier. These studies have been carried out on thermogravimetric analyser under

various operating conditions. The experimental data has been analysed to develop kinetic equations for these reactions.

A predictive mathematical model for Co-current moving bed gasifier has been developed by using kinetic free and kinetic dependent approach to modelling. The objective is to evolve design procedures for this type of gasifiers in terms of the reactor dimensions, gas concentration profile and the temperature distribution.

Discussion of results obtained and recommendations for future work emerged during the span of this work are presented in Chapter Seven.

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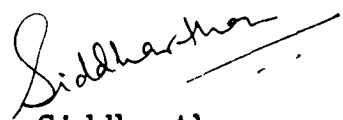
When the last word of this thesis was typed I heard Vibha addressing to herself 'I have done it.' She thanked me for completing her work. This was the extent of her involvement. The minute details and the major ones all have been worked out by her.



Siddhartha

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