

An Indian-Australian research partnership

Project title

Gasification Characteristics of High Ash Lignites for Power Generation or Co-production of Chemicals

Project number: IMURA0133

Monash University supervisors: A/Professor Sankar Bhattacharya and Professor Paul Webley

Monash University contact: A/Professor Sankar Bhattacharya;

Email:sankar.bhattacharya@eng.monash.edu.au

IITB supervisors: Professor Anuradda Ganesh

IITB contact: Professor Anuradda Ganesh; Email: aganesh@iitb.ac.in

The research problem

High-ash coals represent almost 30% of the world's coal reserves, and contribute significantly to power generation in several countries, such as India, Bulgaria, China, Poland and South Africa. Current power generation processes based on conventional pulverised coal combustion result in low efficiency and high CO₂ emissions when used with low-rank coals, such as lignites having high ash content. Potentially, a more efficient way to utilise these lignites (>30% ash content) is to gasify them first into combustible fuel gases and then use the gases for power generation and/or co-production of chemicals. Among the three major gasification technologies – entrained flow gasification, fixed bed gasification and fluidized bed gasification - the first two technologies are not suitable for use with high ash coals. The appropriate gasification technology for use with high-ash lignites is fluidized bed gasification. However, information on the gasification characteristics of (eg. extent of conversion of coal into fuel gas, gas composition, pollutant formation, agglomeration problems due to high levels of ash) high-ash lignites are scarce. Such information is essential for the development of the gasification-based technologies using high-ash lignites.

Project aims

The project will involve experimental work, analysis including electron microscopy and mathematical modelling of gasification. By generating fundamental information, the project will serve two major aims: advance the understanding of gasification characteristics of high-ash lignites, and development of the gasification-based technologies using these lignites for power generation or chemicals co-production.

Expected outcomes

Major outcomes will include:

- Optimized process conditions to maximize the yield of combustible gases, in particular hydrogen
- Composition of the combustible gas, unconverted char and pollutants over a range of process conditions and coal quality
- Preliminary assessment of the agglomeration/fouling problems in solids and gas phase
- Development of a mathematical model for a fluidized bed gasifier

Which of the above Theme does this project address?

Clean Energy

How will the project address the Goals of the above Theme?

High efficiency is a pre-requisite to reduction in coal consumption and reduction in CO₂ emission from any coal conversion process. This project addresses the issue of cleaner utilization of a large resource in several emerging economies – high ash lignites – through gasification. It is also expected that the project will result in a person trained in the fundamental and practical aspects of gasification. Shortage of such trained manpower is felt by the rapidly expanding gasification industries in several countries.

Trained personnel for the gasification industry.