Co-gasification of high ash coal and high ash biomass in downdraft gasifier

Sonal K Thengane, Ankita Gupta and **Sanjay M Mahajani**
Indian Institute of Technology Bombay, India

The thermo chemical process of gasification has the potential to produce heat and electricity from different feedstocks such as coal and biomass. In Indian context, biomass gasification has received significant interest in recent years as an alternative to coal gasification owing to the problems encountered due to high ash content (> 30 %) in Indian coal. Co-gasification offers environmental and technical benefits over individual feed gasification and has been explored as a preferable option for various biomass and coal mixtures. The present paper investigates the effect of mixtures of high ash coal (35 - 40 %) and high ash biomass (e.g. garden waste pellets with 10 % ash) in different proportions on the composition of syngas in a fixed bed downdraft reactor of 5 kg/h capacity. The feedstock mixtures having composition (by weight) of 100 % coal, 25 % coal – 75 % pellets, 50 % coal – 50 % pellets, 75 % coal - 25 % pellets and 100 % pellets are prepared. Air is used as a gasifying agent and the grate is rotated every 20 minutes to ensure smooth operation. The feedstock mixtures are characterized and the producer gas is analyzed for its composition, tar and particulates. The catalytic effect induced by the inorganic content in garden waste pellets on co-gasification is studied. The issue of clinker formation that is common in gasification of high ash containing feedstock is also addressed. The co-gasification of coal and biomass shows the synergistic effect in terms of increase in release of total volatiles and decrease in char yield and emissions. The mixture with higher percentage of coal generated more clinker due to ash fusion at higher temperatures. The mixture with higher percentage of biomass increased the conversion to gas on a carbon basis, and decreased the conversions to char and tar. The results of the present study would successfully establish the optimum operating conditions for stable co-gasification operation for high ash coal and high ash biomass.

Speaker Biography

Sonal Thengane is a Post Doctoral Fellow at Tata Centre for Technology and Design, IIT Bombay, working on the project on biomass gasification with major focus on utilizing garden waste and agro residue for community level cooking. The project is supervised by Prof. Sanjay Mahajani, IIT Bombay in collaboration with Prof. Ahmed Ghoniem, MIT USA. The process involves pelletisation of processed garden waste / agro residue followed by its gasification to obtain producer gas that could partially replace LPG consumption. Sonal has obtained his Ph.D. from IITB-Monash Research Academy working on a project funded by Orica Mining Services, Australia in the field of thermochemical water splitting for ammonia and nitric acid production. His research interests are waste to energy, thermochemical conversion processes, chemical looping, process modeling and thermodynamic analysis. He is actively involved in establishing an integrated waste management facility at IIT Bombay with the objective of making the campus a zero waste campus..

e: thenganesonal@gmail.com

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