

# 12<sup>th</sup> World Congress on **Biofuels and Bioenergy** & 13<sup>th</sup> Global Summit and Expo on **Biomass and Bioenergy** September 04-06, 2018 | Zurich, Switzerland

## Biomass Gasification: Sustainable technology for waste to energy

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**Statement of the Problem:** Biomass is a potential source of renewable energy. Agro residue and organic industrial and civic waste provides a huge potential to harvest energy from waste. Biomass gasification is a quite mature technology finding its use in various sectors. Downdraft gasification system is widely used to generate produce gas coupled with IC engine to generate electricity. Oxy-steam gasification yields syngas of high energy density (8-10 MJ/Nm<sup>3</sup>). High H<sub>2</sub> fraction in syngas and its combustion characteristics motivates towards developing a more efficient gasifier-engine system. Also, high silica ash content in few agro residue like paddy waste has motivated to evolve a system to extract useful silica from waste ash.

**Methodology & Theoretical Orientation:** Oxy-steam gasifier was designed using oxygen and superheated steam mixture as reactant. Woody biomass as well as agro residue was used for study. Steam to biomass ratio was varied from 0.75 to 2.7 and ER from 0.2 to 0.3. Syngas with varying H<sub>2</sub>/CO ratio was obtained and results analysed. System efficiency was evaluated and CFD based numerical model developed from fundamentals. Silica extraction from paddy waste ash was performed using acid leaching method.

**Findings:** Oxy-steam gasification proved to be highly efficient system with over 80% efficiency achieved at lower steam to biomass ratio of 0.75. The high energy density in the range of 8-9 MJ/Nm<sup>3</sup> has been achieved which makes it better fuel compared to producer gas obtained from air gasification. Analysis showed upto 68% silica content in paddy waste ash. High purity Silica was extracted from residual ash of paddy waste gasification. SEM results showed high quality silica which is in demand in market. Over 62% Silica was extracted from ash in high purity form.

### Recent Publications

1. Sandeep K, S. Dasappa, Modeling and analysis of single particle conversion of biomass in a packed bed gasification system. Applied Thermal Engineering. 2017;112:1382-1395
2. Mahapatra S, Sandeep K, Dasappa S. Gasification of wood particles in a co-current packed bed: Experiments and model analysis. Fuel Processing Technology. 2016;145: 76-89
3. Sandeep K, Dasappa S. First and second law thermodynamic analysis of air and oxy-steam biomass gasification. International Journal of Hydrogen Energy. 2014;39(34): 19474-19484
4. Sandeep K, Dasappa S. Oxy-steam gasification of biomass for hydrogen rich syngas production using downdraft reactor configuration. International Journal of Energy Research. 2014;38:174-188
5. Anmol Garg, Sandeep K. Oxy-enriched air gasification of wet biomass. Proceedings of the International Conference on Sustainable Energy and Environmental Challenges (SEEC-2017). 26 - 28 February, 2017, Mohali, India (P.No. - 157)

### Biography

Sandeep Kumar is Faculty in Dept. of Energy Science & Engg., Indian Institute of Technology (IIT) Bombay, India. He has his expertise in thermo-chemical conversion of biomass and use of alternate fuel in IC engine. His work involves both experimental work as well as CFD based models. He has his basic degree in Mechanical Engineering. His research interest also includes solid combustion, solid waste management and renewable system analysis.

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