भारतीय विज्ञान संस्थान

COMBUSTION GASIFICATION & PROPULSION LABORATORY (CGPL)

in association with

INTERDISCIPLINARY CENTRE FOR ENERGY RESEARCH (ICER) & CENTRE FOR SUSTAINABLE TECHNOLOGIES (CST), INDIAN INSTITUTE OF SCIENCE

NEWSLETTER

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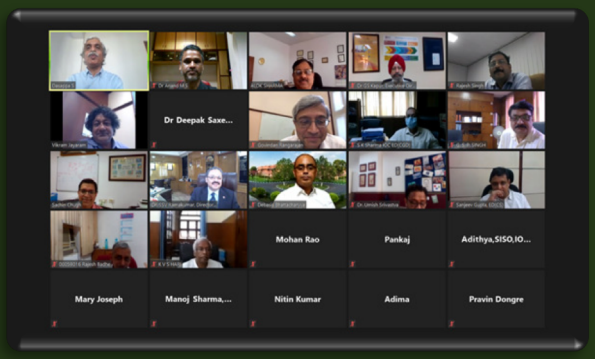
Virtual MoU Signing – IISc & Indian Oil R&D



Indian Institute of Science (IISc) and the R&D Centre of Indian Oil Corporation Limited (IOCL) signed an MoU to develop and demonstrate biomass gasification based hydrogen generation technology for producing fuel cell-grade hydrogen at an affordable price.

Under this agreement, IISc and IOCL will work jointly on the optimisation of both biomass gasification and hydrogen purification processes. The developed technology will be scaled up and demonstrated at IOCL's R&D Centre at Faridabad, IISc said in a release.

Dr. Ramakumar, Director (R&D), IOCL, said that hydrogen energy is an alternative to conventional fossil fuels, stressing that fuel cell vehicles when powered by hydrogen, emit only pure water as tailpipe emissions.

IISc's Director, Prof. G Rangarajan encouraged the academia-industry collaboration and highlighted contributions made by Prof. S. Dasappa at the Centre for Sustainable Technologies and currently the Chair at the Interdisciplinary Centre for Energy Research for utilising biomass, which would go a long way in meeting de-carbonisation needs.

Dr. Ramakumar Visit to CGPL on 19th Feb

Dr. Ramakumar, Director (R&D), IOCL, visited CGPL on 19 Feb. He was accompanied by other members from IOCL, Faridabad. A tour of the laboratory and the state-of-the-art technologies was given by Prof. Dasappa. It is a start to the numerous milestones that need to be conquered in our goal to achieve a low-carbon hydrogen economy.

S^3 - Medical Oxygen Generator, a COVID- 19 Innovation

To cater to the existing and anticipated requirement of medical oxygen for serious/critical COVID-19 cases, high purity, medical-grade oxygen generator was designed by CGPL. It works on Pressure Swing Adsorption (PSA) technology, with air as feed and zeolite molecular sieve as nitrogen adsorbent. Under normal temperature and low pressure, nitrogen gets separated and oxygen with purity levels of 93 ± 3 vol % is obtained. It can supply oxygen equivalent to 10 cylinders (6.9 m^3) per day, that can serve 10 – 20 hospital beds. Medical grade oxygen is achieved through different filters to remove dust, bacteria and, peculiar smell.

S^3 – Salient Features

- ✓ continuous process cycle with efficient feed cleaning, desorption and increased life of adsorbents
- ✓ product purity monitored using an online oxygen analyzer and alarms
- ✓ reliable and automatic unit with all safety features and provision for emergency stop
- ✓ product gas quality as per guidelines prescribed by Indian Pharmacopeia
- ✓ can be coupled to a diesel genset, renewable power as a decentralized system (for use in remote areas)
- ✓ bacterial filtration on the output line to meet medical standards
- ✓ a rugged system with ± 30% fluctuation in the input/feed flow rate allowed
- ✓ low system footprint (1.5 m × 2.5 m) with maximum delivery of 4 Nm^3/h at less than 1.5 kWh/Nm^3 power
- ✓ low noise levels (~65 dB).

Oxy-steam Gasification – Green Route For Hydrogen Generation

Oxy-steam gasification technology using oxygen and steam as the gasifying media, converts solid biomass to hydrogen-rich syngas (a mixture of H_2, CO, CH_4 and CO_2 gases). With surplus biomass from agro & forest residues (120 – 150 MMT) and municipal solid waste (62 Mt) generated annually, this technology holds great potential in meeting the no/low-carbon hydrogen demands of the future.

At CGPL, a pilot-scale facility has been established which generates hydrogen-rich syngas with a gas composition of about 50% H_2, 15% CO, 5% CH_4 and 30% CO_2 having a gas calorific value of about 10 MJ/kg. The gas is subjected to an in-house designed Vacuum Pressure Swing Adsorption system (VPSA) for the separation of hydrogen from the mixture of gases. A typical yield of 100 grams of hydrogen per kilogram of biomass has been realized with an overall energy efficiency of 40%. With extended research, the aim is to realize energy efficiencies close to conventional SMR-WGS route. The technology also draws strength from the fact of being an indigenous technology, promoting the Atmanirbhar approach of the Government of India.

The oxy-steam gasification system is fuel agnostic and can be exploited to generate high-purity H_2 from multiple sources. By partnering with key industrial player, IOCL, this technology can contribute towards green hydrogen and decarbonizing the industrial sector.

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