



## Council of Scientific & Industrial Research (CSIR)

### Some Key Achievements (over last one year)

- CSIR also made great headway in developing niche aerospace technologies. CSIR and the India Meteorological Department (IMD) are jointly producing the Drishti system, a visibility measuring system that provides information to pilots on visibility for safe landing and take-off operations, so as to enable the deployment of 70 such systems at Indian airports. The system has already been installed in 5 major Indian airports. CSIR-NAL has received the 'Make in India Excellence Award 2015' for Drishti under R&D category.

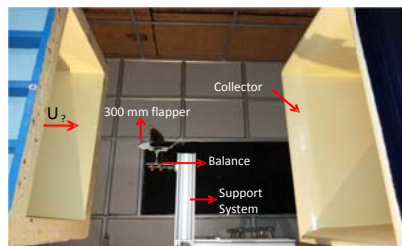


Drishti Transmissometer

- CSIR has set up a Micro Air Vehicle Aerodynamics Research Tunnel (MART) at the CSIR-National Aerospace Laboratories (CSIR-NAL) campus, Bengaluru. The tunnel, first of its kind in India, will be used to test the fixed-wing, flapping-wing and rotary-wing MAVs in the 500 mm wingspan category. The tunnel was set up under the National Programme on Micro Air Vehicles (NP-MICAV). The project is jointly coordinated by CSIR, the Defence Research & Development Organization (DRDO) and the Department of Science & Technology. The state-of-the-art tunnel would address all the aerodynamic, propulsion and aero-elastic issues related to MAVs.



Betz Chamber

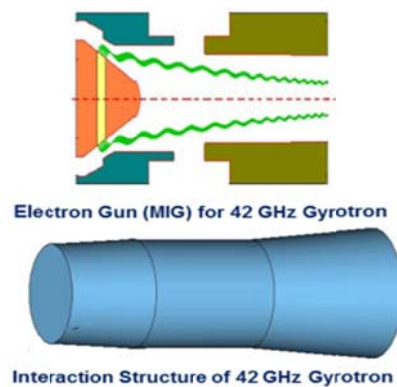


Flapper MAV test in Open Test Section



Gust Generator

- CSIR has been a consistent comrade of the ISRO and DAE. Its unstinting strong R&D support to the strategic sector has been most beneficial to the country. Gyrotron, a device used in nuclear fusion process, is currently imported in the country. Countries that manufacture gyrotrons namely the United States, Russia, Japan, and European Union do not disclose their designs and associated technology. Through focused efforts, CSIR with the Department of Science and Technology (DST) has developed the first Indian gyrotron which is ready to be tested at the Institute for Plasma Research (DAE), Gandhinagar, which is a partner institute on this project. CSIR has also been providing support in the development, production and supply of neodymium doped phosphate laser glass to the Raja Ramanna Centre for Advanced Technology (DAE). 'DHVANI', the Detection and Hit Visualization using Acoustic N-wave Identification system



developed by CSIR for perfecting marksmanship skills by accurately determining the location of bullet impact and providing real-time feedback, has been approved for induction into the Indian Army.



#### DHVANI - Detection and Hit Visualization using Acoustic N-wave Identification

- CSIR's endeavours in the domain of traditional knowledge for providing affordable healthcare have been praiseworthy. An anti-diabetic herbal formulation BGR-34, from a combination of natural extracts derived from six plant species mentioned in ancient Ayurveda texts has been developed. The drug which was approved by the Ministry of Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homoeopathy (AYUSH) is an adjuvant to existing diabetes treatment, to help maintain normal blood glucose levels and also in improving the immune system. The herbal drug has been launched by industry in parts of North India.



**Anti-diabetes Drug BGR-34**

- Further, a national cGMP facility for extraction, formulation and packaging of traditional herbal medicines has been set up at CSIR-Indian Institute of Integrative Medicine (CSIR-IIIM), Jammu. It has been created as per WHO guidelines. The facility will also be made available to R&D institutions and industry. The facility will target preparation of extracts and formulations for conducting clinical trials, process development, scale-up & optimization of lab- processes and converting them into commercially viable technologies besides generation of authentic and accurate clinically acceptable data. This facility will transform quality herbal drug production in India and its export to US and European markets.



**cGMP Pilot Plant at CSIR-IIIM**

(For Extraction, formulation and packaging of Traditional (ISM) Herbal Medicines)

- The farmers are the backbone of our country. CSIR has developed and released to farmers a new improved high yielding variety of Ashwagandha, NMITLI-101 which is rich in several bioactive compounds. The average root yield from NMITLI-101 crop is about 25 quintal/hectare and the seed production from the variety is up to 3 quintal/ha, under optimum conditions. The estimated economic return from cultivation of this variety is about Rs. 2.5 Lakh/hectare per crop.



**Ashwagandha, NMITLI-101**

- CSIR has also launched the JK Aroma Arogya Gram (JAAG) project which targets job and wealth creation through intensive cultivation of CSIR agri-technology of high value, low volume medicinal and aromatic crops. The benefits of the JAAG project include handholding of the farmers by CSIR for cultivation of medicinal plants, besides providing unemployed youth an opportunity to set up ventures in cultivation of medicinal plants. Awareness camps for farmers of the area besides demonstrations of Mobile Distillation Unit for extraction of essential oils are conducted. Started in July 2015, so far, seventy three farmers in 14 villages of Kathua district (J&K) have been distributed slips of lemongrass, Java citronella and vetiver for cultivation in 17.47 hectares area under the JAAG project.
- Also focusing at 'Reaching to the Unreached', CSIR's Centre for High Altitude Biology (CSIR-CeHAB) in Lahaul and Spiti is providing deployable knowledgebase to local communities for inclusive growth. The CSIR knowhow related to food & agri-processing was showcased at the Tribal Fair at Keylong for the benefit of the local farmers in making novel products from major crops of the region such as Buckwheat and also brining of the peas and cauliflower.



- CSIR has published whole genome sequence of *Ocimum sanctum*, the sacred plant of Hindu tradition. The nuclear genome of Holy basil is the smallest (386 Mb) in the family Lamiaceae while the chloroplast genome (142,245 bp) is the smallest in the order Lamiales. This is the first report of complete genome sequence of the holy basil, using a composite next generation sequencing technologies. The availability of the genome sequence opens the possibility to identify genes involved in producing therapeutic molecules and to produce them in vitro.
- As part of efforts towards developing sustainable energy solutions, CSIR under the CSIR-NMITLI, has successfully developed indigenous know-how to make technology components and the process for building Proton Exchange Membrane Fuel Cell (PEMFC) multi-cell stack of desired power output. CSIR has taken existing technology know-how from stack-to-system level higher by scaling-up the power produced to 3.5 kW and validating it for a commercial application such as telecom tower power backup. For this, a modular test bed has been designed, built and commissioned with in-house knowhow at Reliance Industries Ltd (RIL), Patalganga site. The fuel cell facility

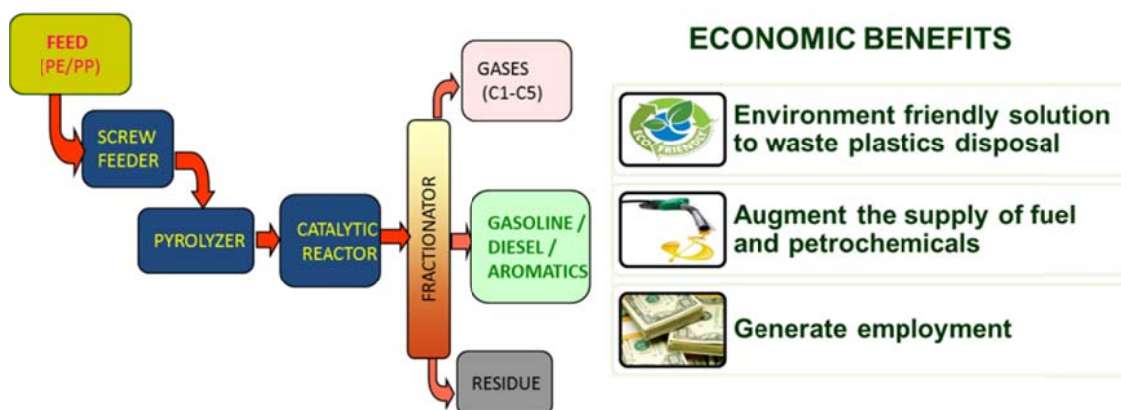


commissioned now, is expected to provide plenty of useful data for testing and developing indigenous fuel cells at low costs for commercial applications.



**Fuel Cell Test-bed**

- Plastics consumption in India is reported to be around ~10 MMT (2010) while plastic wastes in India are ~15,000 TPD amounting to high environmental pollution. As a potential solution to address the growing menace of plastic usage and the associated waste generation in the country, CSIR has developed a facile process for the conversion of waste plastics (polyolefins) to value added hydrocarbons e.g. gasoline, diesel and aromatics. The salient features of the technology are that the process provides for exclusive production of either gasoline or diesel or aromatics along with LPG from polyolefinic wastes (e.g. HDPE, LDPE, PP etc) and the liquid fuel meets Euro III specifications. Further, the process is simple, pollution free and environment friendly. The estimated payback period for a 30 TPD plant is about ~ 3 years.



**Waste Plastic to Petroleum Products**

- Application of biofuels for aviation is an effective means for the aviation industry to reduce its carbon footprint. CSIR has developed a process as well as a catalyst to produce jet fuel based on biomass-derived non-edible oils such as jatropha oil. The bio-jet fuel has been able to match all the major specifications for aviation fuels such as petroleum derived jet fuel. The process developed is very similar to refinery processes and hence can be integrated into the current refinery infrastructure.



**Pilot Plant Capacity: 100 kg feed/day**

- CSIR has conducted the analysis, designing and structural detailing of (G+1) reinforced concrete buildings using Expanded Polystyrene (EPS) Panels. The salient features of the technology are: faster mode of construction; ideal for mass production of houses; affordable; and disaster resistant - cyclone wind loads. The developed technology has been transferred to Consortium Transmission Systems Pvt. Ltd. (CTSPL), Hyderabad for 'Hudhud' cyclone victims' rehabilitation housing programme at Srikakulam, Andhra Pradesh. About 496 dwelling units are being constructed using the technology.
- A Mobile Pilot Plant for Toxic Emission Monitoring and Control has been developed by CSIR-NEERI, Nagpur for undertaking flue gas emission monitoring and control studies in various industries including Small and Medium Scale Industries (SMEs). Flue gas comprising of dust of different sizes and gases of varying concentrations representing different small scale industries such as ceramic kilns, hot mix plants, other small scale industries etc. will be monitored for its emission characterization. Part of the gas will be fed into the different control systems and their collection efficiencies will be measured with respect to time, temperature, flow etc. The performance in terms of techno-economic feasibility will be checked and a system for control of emissions will be provided in the pilot scale which can be scaled up for full scale installation.



**Mobile Air Pollution Monitoring Van**

- CSIR has developed new energy efficient, economically viable and more environment-friendly process technologies for preparation of various nano-catalysts, which are useful for several challenging catalysis reactions. The novel nano-catalysts have been found

effective in catalyzing reactions such as selective oxidation of benzene to phenol, propylene to propylene oxide, low temperature methane activation, and ethane to ethylene conversion in a continuous process at atmospheric pressure. These are industrially important chemicals/petrochemicals.

- CSIR has developed micro-channel reactors with stable catalyst coating formulations that are used to intensify the processes involving vegetable oils. These reactors have great impact on the product yield and conversion in hydro-processing of vegetable oils. The micro-channel reactors find immediate applications as a tool to intensify the process at places where there is inadequate supply of raw material such as biomass; and where transportation of feedstock, fossil fuels, is a problem. CSIR has used the micro-channel reactors to convert non-edible oil and biomass-derived oil (pyrolysis-oil), biomass-derived gases (syn-gas) and coal derived gasses (coal gasification to syn-gas) into second and third generation biofuel. Use of such reactors has resulted in improved reaction selectivity and throughput and thus higher product yield.
- Plasma gelsolin, a circulating actin-binding protein serving a protective role against tissue injuries is fast emerging as a health condition biomarker. Depletion of plasma gelsolin in systemic inflammation contributes to adverse outcomes. CSIR has developed two mass-production ready plate based kits to estimate plasma gelsolin levels in humans. While, most other labs including commercial set-ups are focusing on improving bulk production of this protein, CSIR has developed bonsai versions of this protein by structure-based insights and has successfully demonstrated the anti-sepsis properties of the miniaturized versions in LPS-induced sepsis model of mice. The kits thus developed will help in determining a quantitative measure of sepsis. The laboratory is also testing the kits viability in predicting cases of preterm birth.
- Under GUARDIAN, a one of its kind research programme, CSIR is focused at the development of genomics based diagnostic tools for understanding rare diseases. The programme with extensive collaboration between clinicians and researchers is targeted at better understanding the genetic basis and molecular mechanisms of rare genetic disorders using advanced genomic technology. The findings pave way to newer diagnostic methods such as exome sequencing based tools which could be an alternative to traditional gene sequencing approach to quickly identify the variations and be able to make an appropriate diagnosis in clinical settings.
- CSIR has played a major role in protecting India's rich traditional knowledge in healthcare by creating the TKDL. The TKDL involves documentation of the traditional knowledge available in public domain in the form of existing literature related to Ayurveda, Unani, Siddha and Yoga, in digitized format. The TKDL currently contains information concerning 2.93 lakh medicinal formulations in Ayurveda, Unani and Siddha in 5 international languages, i.e., English, Japanese, Spanish, French and German. Access to the TKDL is available to Patent Offices only under TKDL Access Agreement.

Recently, CSIR through the TKDL has successfully contested an attempt made by consumer goods giant M/s Colgate-Palmolive Company (United States of America) to patent a Mouth-wash formula containing herbal extract. Prior art evidences from TKDL provided that the claims made in the patent application filed by M/S Colgate-Palmolive

Company were not novel and the use of claimed constituents of the mouth wash under reference was already mentioned in India's traditional medical literature such as Ayurveda and Unani. Another important success was achieved when a leading UK-based Pangaea Laboratories Ltd.'s move to patent a medicinal composition containing turmeric, pine bark and green tea for treating hair loss was thwarted by the TKDL. The TKDL is proving to be an effective deterrent against bio-piracy and is being recognized as a global leader in the area of traditional knowledge protection.