

**GOVERNMENT OF INDIA  
MINISTRY OF SCIENCE AND TECHNOLOGY  
DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH  
LOK SABHA  
UNSTARRED QUESTION NO. 2396  
(TO BE ANSWERED ON 15.03.2023)**

**CSIR LABORATORIES**

**2396. SHRI SISIR KUMAR ADHIKARI:**

**Will the Minister of SCIENCE AND TECHNOLOGY be pleased to state:**

- (a) whether it is a fact that different Laboratories of CSIR are in constant innovation and development process in their fields and if so, the details thereof;**
- (b) whether it is also a fact that in many cases the innovations are not matured due to financial restrictions either from centre or other means thereby lacking in business marketing and if so, the details thereof; and**
- (c) whether the Government proposes to take the innovations under 'Make in India' scheme and take up marketing through different Government processes/schemes and if so, the details thereof?**

**ANSWER**

**HON'BLE MINISTER OF STATE (INDEPENDENT CHARGE) OF  
SCIENCE AND TECHNOLOGY & EARTH SCIENCES**

**(DR. JITENDRA SINGH)**

- (a) Yes, Sir. The constituent laboratories of Council of Scientific & Industrial Research (CSIR) have been pursuing cutting edge research innovations in advanced knowledge frontiers of science and technology which includes radio and space physics, oceanography, earth sciences, geophysics, chemicals, drugs, genomics, biotechnology and nanotechnology to mining, aeronautics, instrumentation, environmental engineering and information technology. It provides significant technological intervention in many areas with regard to societal efforts which include environment, health, drinking water, food, housing, energy, leather, affordable housing and agriculture sectors.**

**CSIR has published 5769 research papers during 2021 with Average Impact Factor as 5.401 and 5551 research papers in 2022 (as on January 2023) with Average Impact Factor as 5.295 SCI journals of repute. CSIR papers prominently published in Nature, Science, Chemical Society Reviews, Nature Genetics, Energy and Environmental Science and other globally reputed SCI Journals. The new knowledge generated from CSIR laboratories is reflected in terms of high average Impact Factor.**

**CSIR has filed 164 patent applications abroad and 230 patent applications in India during 2021-22, and it has been granted 165 patents abroad and 202 patents in India for the same tenure. CSIR has filed 119 patent applications abroad and 167 patent applications in India during 2022-23 (as on January, 2023), and it has been granted 70 patents abroad and 170 patents in India for the same tenure.**

**The significant achievements/ technologies developed by the constituent laboratories of CSIR is placed at Annexure-I.**

- (b) No, Sir. CSIR has been adequately funded to carry out research and development and leverages innovations for development of technologies/ products to benefit the masses and Indian industries.**
- (c) No, Sir. However, at internal level, each CSIR laboratory has its Project Monitoring and Evaluation (PME) unit/ Business Development Group (BDG) that undertakes necessary technology transfer and marketing activities. At CSIR Headquarters, the activities related to business development are primarily managed by Technology Management Directorate. Further, technologies / know-how / inventions / patents / processes emanating from various constituent laboratories of CSIR have also been promoted and commercialized through the National Research Development Corporation (NRDC).**

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**Details of significant achievement/ technologies developed by CSIR in recent past**

SNo.	Technology Name	Application/ Benefit of the Technology
1.	Distillery spent wash management technology	<ul style="list-style-type: none"> <li>Industrial grade salt with reduced iodide and bromide impurities</li> <li>High purity (edible grade salt and sodium sulphate)</li> <li>K-S fertilizer from spent wash ash, Eichhornia, tobacco waste, tapioca waste and temple flower</li> <li>Licensed to Aurangabad distilleries Ltd.</li> </ul>
2.	Indigenous pilot plant scale reactor with a capacity of producing 24lit/day of DME alongwith stable catalysts for conversion of methanol to DME and optimized process for catalytic conversion of Methanol to DME	<ul style="list-style-type: none"> <li>Conversion of methanol to DME</li> <li>Pilot plant has set up at CSIR-CIMFR, Dhanbad</li> </ul>
3.	Three Seaweed based animal feed additives were developed (AF-KWP, AFRD-5, AFRD-7)	<ul style="list-style-type: none"> <li>Cattle and poultry feed</li> <li>Licensed to M/S Aquagri Ltd.</li> </ul>
4.	Technology (knowhow) for indigenous fluorescent dyes and quenchers for gene based diagnostic assays	<ul style="list-style-type: none"> <li>These fluorescent dyes and quenchers are used in RT PCR for detection of COVID-19</li> <li>Licensed to Biotech Desk, Hyderabad</li> </ul>
5.	Technology for dental implants and its accessories	<ul style="list-style-type: none"> <li>In edentulous indications</li> <li>Licensed to Kamal Medtech; Commercialized in the name of "ifix"</li> </ul>
6.	A product for management of sepsis due to gram negative bacterial infections	<ul style="list-style-type: none"> <li>In sepsis indications due to Gram negative bacterial infections.</li> <li>Cadila Pharmaceuticals, Ahmedabad Commercialised as Sepsivac</li> </ul>
7.	FELUDA (FNCAS9 Editor-Linked Uniform Detection Assay)	<ul style="list-style-type: none"> <li>CRISPR Cas-9 based diagnostic tool for detection of SARS-CoV-2 (COVID-19 Diagnostics)</li> <li>Technology has been licensed to TATA Sons</li> </ul>
8.	10 kWe automotive grade Low Temperature-Proton Exchange Membrane (LT-PEM) Fuel Cell Stack	Automotive applications. Trial run of indigenously developed fuel cell stack-based vehicle was carried out in October 2020 on the platform of battery powered 5 seaters electric sedan car which was retrofitted with the CSIR's developed

		hydrogen fuel cell stack.
9.	Portable Personal Air Purifying Respiratory Device	Self-protection from COVID. Prototype developed.
10.	Solar Energy Based Cooking System (Solar Chulha)	Domestic uses for cooking. Licensed to 2 industries for production and commercialization.
11.	Mechanized Sewage Cleaning Prototypes developed	Sewage cleaning system. Licensed to 2 industries for production and commercialization.
12.	UV-C duct disinfection system	Mitigating the effect of Coronavirus in large buildings/halls etc. The technology transferred to ~30 companies.
13.	Low cost, high resolution and high end Raman Spectrometer with additional capabilities of carrying out photo-luminescence spectroscopy and optical emission spectroscopy	Useful for academic institutes and laboratories in India and industry related to Material Science, Geology and Mineralogy, Pharmaceuticals and Cosmetics, Carbon Materials, Semiconductors, Life-sciences, Polymers, Thin-Films, Forensics, Petrochemical, etc.  The prototype has been developed, tested, calibrated and demonstrated recently.
14.	Hansa-New Generation (NG) aircraft	2 seater aircraft useful for Flying Clubs. Hansa-NG aircraft has successfully made its maiden flight in September 2021. The aircraft took off from HAL airport and flew at an altitude of 4000 ft. and gained a speed of 80 knots before it made a successful landing after about 20 minutes.
15.	Oneer- An electronic device for the disinfection of drinking water	<ul style="list-style-type: none"> <li>On an average four persons/family require approximately 30-50 liters of potable drinking water/day</li> <li>A single unit of Oneer will cater to approximately 100-125 families or 400-500 people of a community. This could be expanded by deploying multiple units of the Oneer</li> <li>Domestic model of Oneer provides 10 Liters of safe water per batch suitable for house hold and small establishments and can also be operated on a solar powered battery.</li> <li>Community model of Oneer can continuously supply 450 Liters of water/ hour for communities.</li> </ul>
16.	Milk adulteration detection kit (Milk checker)	<ul style="list-style-type: none"> <li>The kit is useful for the detection of adulterants like Hydrogen peroxide, urea, Formalin, Ammonia &amp; Ammonium compounds, Dairy salt, Starch, boric acid, Neutralizers, Cellulose, Nitrates &amp; nitrites and detergent in adulterated</li> </ul>

		<p>milk.</p> <ul style="list-style-type: none"> <li>It has High sensitivity, cost effective and Serves as a handy tool for consumers/retailers</li> </ul>
17.	Emergency Retrieval System (ERS) For Power Lines:	<ul style="list-style-type: none"> <li>ERS an indigenously developed technology, modular aluminum towers used to quickly restore power on damaged power transmission lines with a minimal power interruption.</li> <li>These are temporary structures that can be deployed typically in 2-3 days, as against several weeks required for permanent restoration of the towers.</li> <li>During Power outage due to TL tower failure, the ERS will be used to restore power in short duration of time typically 2-3 days, which minimize loss of service to the society.</li> <li>This improves the quality of life in urban and rural areas with minimal interruption to the basic amenities/services like water supply, health care, waste management, communication, security, education, transport, etc.</li> </ul>
18.	Portable lightweight foldable module for make shift hospitals and other needs Poli Tal (M)	<ul style="list-style-type: none"> <li>Poli Tal (M) for constructing temporary shelters/structures during unforeseen situations/natural calamities in both urban and rural areas.</li> <li>The design utilizes optimum material, is extremely stable, can be erected very quickly and can be used as make-shift hospitals, emergency/temporary shelters, toilet units, etc.</li> <li>To support the effort of the Government in tackling the emergency condition that arisen due to the spread of COVID-19 pandemic, CSIR using the Poli-Tal technology, constructed 10-bedded portable and lightweight transit hospital structure at NDRF, Arakkonam.</li> </ul>
19.	Anaerobic Gas lift Reactor (AGR) for the treatment of organic solid waste	<ul style="list-style-type: none"> <li>Treatment of organic solid waste for the generation of biogas and bio manure</li> <li>Scale operation: 500 kg to 10 tons per day</li> <li>Plants with the capacity of 1 ton per day and below deployed at 22 locations</li> <li>Plants with the capacity of above 1 ton per day but below 10 ton per day deployed at 4 locations</li> </ul> <p><i>Plants based on Substrates</i></p> <ul style="list-style-type: none"> <li>Food Waste: 15 locations</li> <li>Market and vegetable waste: 7 locations</li> <li>Poultry litter: 2 locations</li> </ul>

		<ul style="list-style-type: none"> <li>• Organic fraction of MSW and leachate: 1 location</li> <li>• Mulberry waste: 1 location</li> <li>• AGR technology has been commercialized and licensed to many companies on non-exclusive basis</li> </ul>
20.	Accelerated Anaerobic Composting (AAC) of Organic Waste	<ul style="list-style-type: none"> <li>• Most of the lakes in India are polluted due to the discharge of untreated industrial wastewater and sewage resulting in eutrophication. Water hyacinth is a noxious weed which grows uncontrollably in these lakes due to eutrophication.</li> <li>• A pilot project for the conversion of water hyacinth filled in Kapra lake in Hyderabad to soil conditioner has been successfully demonstrated.</li> <li>• Two full scale plants are under installation at Nizam and Rajeev Gandhi Lake</li> <li>• About 47 composting units of 250 – 300 kg/day capacity for the conversion of market vegetable waste to soil conditioner is in progress in Telangana State</li> </ul>
21.	Design of highly compact vertical modular nanofiltration system for purification of ground and surface water	<ul style="list-style-type: none"> <li>• Environmentally safe process</li> <li>• The NF plant is successfully commissioned at Mogallu Village in West Godavari District of Andhra Pradesh for surface water purification. A similar pilot plant was also installed at CSIR-IICT for providing drinking water to IICT staff and students and for cooking purpose at IICT canteen.</li> <li>• The NF plant has also been installed at annual Hyderabad Industrial Exhibition, Nampally to provide safe drinking water free of cost to the general public.</li> </ul>
22.	Compact Membrane Unit for Fluoride Removal from groundwater	<ul style="list-style-type: none"> <li>• Effective fluoride reject treatment procedures are being developed</li> <li>• The developed defluoridation membrane technology is deployed at both rural and urban areas in schools, hospitals, hostels and small hamlets.</li> <li>• More than 20 such compact systems have been installed successfully in several schools and fluoride worst hit villages of Telangana; on charity basis funded by CSIR-IICT for production of safe drinking water.</li> <li>• All the units are running successfully from past few years.</li> </ul>

23.	<b>High Resolution Heliborne Aquifer Mapping &amp; Management</b>	<ul style="list-style-type: none"> <li>• This technique will provide very precise information on groundwater potential zones in the problematic areas and water stressed regions of the country</li> <li>• Through this technique high resolution 3-D image of the sub-surface will be generated based on the response of the various lithologies, structures and structural discontinuities up to a depth of 500 meters below the surface.</li> <li>• This technique has been successfully implemented in various parts of the country and recently CSIR-NGRI successfully completed a mega project in Rajasthan and Gujarat in collaboration with Central Ground Water Board (CGWB); Ministry of Jal Shakti, Govt, of India.</li> </ul>
24.	<b>Herbal Incense Cones from flowers</b>	<ul style="list-style-type: none"> <li>• Technology transferred to Temple Trust, Dist. Sirmour (H.P.) and Jagriti NGO, Baijnath</li> <li>• Employment to more than 50 people was provided through technology deployment</li> </ul>
25.	<b>Compost booster for cold regions</b>	<ul style="list-style-type: none"> <li>• Technology transferred to NGO's, Panchayat level, Army headquarters for the deployment of technology in high altitude areas</li> <li>• Technology deployed in two Cluster; one in Sikkim and One in Himachal Pradesh</li> <li>• Improved income for families of selected 400 beneficiaries through SFURTI scheme of MoSME. Farmers can earn additional income Rs. 30,000/ year by selling enriched compost</li> </ul>
26.	<b>Shiitake mushroom: vitamin D2 enriched</b>	<ul style="list-style-type: none"> <li>• Technology transferred through MSME's to clusters in Sikkim for famers livelihood promotions</li> <li>• Technology deployed in three clusters and six entrepreneurs</li> <li>• Improved income for families of selected 750 beneficiaries through SFURTI scheme of MSME. Farmers can earn additional income Rs. 50,000/ year by selling fresh and dry shiitake</li> </ul>
27.	<b>Iron and zinc enriched spirulina-based bars</b>	<ul style="list-style-type: none"> <li>• Technology deployment through integration of products to POSHAN Abhiyaan and Integrated Child Development Services (ICDS)</li> <li>• Technology transferred to five entrepreneurs</li> <li>• A total of 100 malnourished children and 60 pregnant and lactating women</li> </ul>
28.	<b>Multigrain high protein mix</b>	
29.	<b>Protein &amp; fibre enriched cereal bars</b>	
30.	<b>Iron enriched fruit bars and</b>	

	candies	benefitted by technology deployment through Poshan Abhiyan
31.	Canning technology for ready to eat (RTE) foods	<ul style="list-style-type: none"> <li>Technology deployment through the ones affected by Cyclone Amphan in Orissa/Kolkata under the National Disaster Response Force (NDRF) supply and Making available food during Lockdown; COVID-19-related public lockdown led to the limited supply of food products wherein the migrant laborers were seriously affected</li> <li>Technology transferred to Three entrepreneurs</li> <li>5,28,000 (220 tons) packs of RTE Tinned Food during COVID and Orissa disasters: 3,00,000 packs during Cyclone Amphan in Orissa/ Kolkata under NDRF supply; 1,00,000 packs in Odisha during Cyclone Fani; 68,000 packs supplied during COVID Pandemic in Orissa, H.P.,</li> </ul>
32.	Damask rose ( <i>Rosa damascena</i> ): agro-and processing technology	<ul style="list-style-type: none"> <li>Under "CSIR Aroma Mission" 2816 hectare brought under cultivation in 11 states and two UT, generating revenue of Rs. 31.27 crores.</li> <li>1<sup>st</sup> time large scale cultivation of Saffron in H.P. Lauded by Hon'ble C.M., H.P. Capacity building for 189 farmers.</li> </ul>
33.	Wild marigold ( <i>Tagetes Minuta</i> ): agro-and processing technology	
34.	Lavender ( <i>Lavandula officinalis</i> ): agro- and processing technology	
35.	Rosemary ( <i>Rosmarinus officinalis</i> ): agro and processing technology	
36.	Agro-technology for mass production of saffron ( <i>Crocus sativus</i> L.)	
37.	German chamomile ( <i>Matricaria chamomilla</i> ): agro and process technology	<ul style="list-style-type: none"> <li>Technology deployment through clusters for integration of apiculture in floriculture through "CSIR Floriculture Mission</li> <li>Eleven bee keeping clusters (20 famers in 10 clusters and 10 farmers in 1 cluster) were formed in Himachal Pradesh and Uttarakhand</li> </ul>
38.	Improved bee hive for quality and hygienic extraction of honey	
39.	Lilium: agrotechnology	
40.	Calla lily: agrotechnology	<ul style="list-style-type: none"> <li>Planting material is provided to farmers, NGOs, Government schools, colleges,</li> </ul>

41.	Gerbera: agrotechnology	<p>hospitals and other offices for technology deployment and awareness</p> <ul style="list-style-type: none"> <li>• "Under Floriculture Mission" 250-hectare area brought under cultivation of floriculture crops benefitting 1004 farmers.</li> </ul>
42.	Agro-technology of carnations	
43.	Alstroemeria: agrotechnology	
44.	Cut-roses: agrotechnology	
45.	Chrysanthemum: agrotechnology	
46.	Desktop Autoclave for R&D Institutions:	<ul style="list-style-type: none"> <li>• The desktop autoclave was developed to meet the expectations of academia and research institutions in establishing an affordable, low energy consuming, aerospace grade autoclave.</li> <li>• The Desktop autoclave have been supplied to IIT Madras, IIT-Delhi, IIT-Guwahati, MIT-Manipal, and IIT-Hyderabad and the academic institutions in the country earlier dependent on imports of the system for carrying out research.</li> <li>• The indigenous technology has helped Indian students in composite research to great extent in their academic R&amp;D</li> </ul>
47.	Wind Solar Hybrid System:	<ul style="list-style-type: none"> <li>• Deployed 1 kW Wind Solar Hybrid (WiSH) system at various science and technology educational institutions in Bangalore, Odisha and at CSIR laboratories like CSIR-IMMT, CSIR-SERC &amp; CSIR-CBRI.</li> <li>• CSIR-NAL's renewable energy activity has resulted in the successful design and development of Wind Solar Hybrid system capable of generating power of 1 kW to 10 kW.</li> <li>• The developed WiSH system are suitable for powering agri pumps and off-grid remote rural applications.</li> </ul>
48.	Airboat for Cleaning Lakes - JALDOST:	<ul style="list-style-type: none"> <li>• JALDOST is an Aerospace technology-based spin off societal product for cleaning waterbodies</li> <li>• CSIR-NAL is in talks with BBMP Lakes Authority for deployment and successful commercialization through industry partner</li> </ul>
49.	PPE & SwasthVayu BiPAP Ventilator for Covid-19	<ul style="list-style-type: none"> <li>• CSIR-NAL has made significant contributions in the area of Health and Societal Mission for the COVID-19 mitigation in service of the nation</li> <li>• Both the technologies have been transferred to industries for commercial</li> </ul>

		<p>production which has resulted in quick deployment of about 1500 SwasthVayu units to hospitals of NCT- Delhi, Ramgarh &amp; Chatra- Jharkhand, Bhopal-Madhya Pradesh, Mysore, Hyderabad and more than 2 lakhs units of PPE coverall to Hindustan Latex Limited (HLL), Jaslok Hospitals etc. during covid-19.</p>
50.	Octa-Copter Drone for Agri	<ul style="list-style-type: none"> <li>• NAL has developed a modular Oct-Copter UAV system that can carry a maximum payload of 20 Kg and fly for the endurance of around 20-min.</li> <li>• <i>Agri Application:</i> NAL has developed a modular Oct-Copter UAV system that can carry a maximum payload of 20 Kg and fly for the endurance of around 20 min. The Oct-Copter has a provision to house either a hyperspectral camera for crop health monitoring or a fertilizer. First field demonstration of NAL's Oct-Copter has been carried out for the farmers of Alur APMC, Bangalore.</li> <li>• <i>Medical Applications @ Bengaluru:</i> CSIR-NAL has teamed with Department of Health &amp; Family Welfare, Govt. of Karnataka for aerial delivery of covid-19 vaccine's in remote area. The Octacopter has successfully delivered 50 vials of Covid-19 vaccines along with syringes in a special container from Chandapura PHC to Haragadde PHC on 13th November 2021.</li> <li>• <i>Medical Applications @ Jammu:</i> CSIR-NAL has teamed with CSIR-IIIM, Jammu and Department of Health &amp; Family Welfare, Govt. of Jammu for aerial delivery of covid-19 vaccine's in remote border area. The Octacopter has successfully delivered 50 vials of Covid-19 vaccines along with syringes in a special container from IIIM-Jammu to Sub-District Hospital, March on 27th November 2021.</li> </ul>
51.	System for Monitoring of Adulteration in Milk Supply Chain	<ul style="list-style-type: none"> <li>• This technology ensures the supply of adulteration-free, healthy Milk to people.</li> <li>• Qboid (Licensee) has deployed 36 units till now and executing the order of 140 units to generate a royalty of ~8.80 Lakhs.</li> </ul>
52.	Rapid Milk Analyser	<ul style="list-style-type: none"> <li>• This technology supports the Quality assurance of Milk.</li> <li>• This StartUp plans to deploy on a subscription basis. Actual deployment</li> </ul>

		details are awaited.
53.	Rapid Ksheer Scanner	<ul style="list-style-type: none"> <li>This technology ensures the supply of adulteration-free, for consumption by people.</li> <li>REIL has sold 552 units till 31-03-2021 and Royalty of 28.48 Lakhs has been generated.</li> </ul>
54.	Smart Watch for Vital Health Parameter	<ul style="list-style-type: none"> <li>This technology supports the development of healthcare reporting and enables the self-sufficiency of Startups.</li> <li>This startup has a target of deploying 10,000 units based on this Technology by FY 23-24.</li> </ul>
55.	IoT enabled Smartphone based Colposcope for Cervical Cancer Examination	<ul style="list-style-type: none"> <li>This technology supports the development of healthcare diagnostics by Indian startups.</li> <li>In production and executing orders of 100 pieces generation</li> </ul>
56.	Aromatic crops	<ul style="list-style-type: none"> <li>Area Covered under cultivation of aroma crops: ~27,000 hectares</li> <li>States covered: 29</li> <li>Tribal Clusters developed: 20</li> <li>On the farm processing/distillation units: 300</li> <li>Training/awareness/skill development programmers organized: 1124</li> <li>Farmers benefitted: ~65,000</li> <li>Rural employment generated: 12 lakh man days</li> <li>Farmers income enhancement: Rs 30,000 – 70,000/- per hectare per year</li> <li>Purple Revolution by catalysing Lavender Cultivation in J&amp;K, which is a high value commodity: cultivation in 10 districts of J&amp;K, Increase in the farmer's income from Rs. 20,000/- to Rs. 200,000/- per acre per year.</li> <li>Atmanirbharata in Lemongrass essential oil: From being one of the importers of Lemongrass essential oil a few years back, India has now become one of the largest exporters in the world with annual export of 300-400 tonnes Lemongrass essential oil worth Rs. 35-40 crore. Farmers are earning the income of Rs. 30,000/- to 70,000/- per hectare per year depending upon the water availability and environmental conditions</li> <li>Golden revolution in Himachal Pradesh: Introduction of improved varieties 'HIMGOLD' and 'HIM SWARNIMA' of wild Marigold (<i>Tagetes minuta</i> L.) yielding</li> </ul>

		high grade aromatic oil. Total essential oil production in the country is 6.5 tonnes, which has enhanced the farmers' income 2.5 times over traditional crop
57.	Floriculture crops	<ul style="list-style-type: none"> <li>• Area brought under cultivation of Floriculture crops: 750 hectares</li> <li>• State covered: 21</li> <li>• Indigenous development of Tulip bulb production initiated in Lahaul &amp; Spiti has helped reduce the import of quality planting material.</li> <li>• Apiculture integration with Floriculture in collaboration with KVIC: 49 clusters established</li> </ul>
58.	Dry Swab Technology for the detection of SARS-CoV-2	<ul style="list-style-type: none"> <li>• The Dry Swab Technology for the detection of SARS-CoV-2 was a huge success and was widely used in testing laboratories across our Country during the Covid19 pandemic era; considerably making affordable diagnostics available.</li> </ul>
59.	Improved Samba Mahsuri (RP BIO 226): a bacterial blight disease resistant and low GI (diabetic friendly) rice variety	<ul style="list-style-type: none"> <li>• Similarly, ISM Rice variety has influenced the lives of farmers across our country uniformly at all such places where bacterial blight has been a serious threat to paddy cultivation</li> </ul>
60.	Paper-based affordable micro fluidic kit for early pregnancy detection in cattle and buffaloes	<ul style="list-style-type: none"> <li>• The Cattle Pregnancy technology developed by us is currently being co-developed further for making it suitable for the usage at field level.</li> </ul>
61.	Modular Ceramic Membrane based plant of capacity upto 2m3/hour for water purification	<ul style="list-style-type: none"> <li>• Deployments are in the states of West Bengal and Bihar for Iron and Arsenic removal plants. Iron removal plants are deployed in West Bengal and north eastern states.</li> <li>• More than 115 plants are deployed. Estimated daily production capacity is 11 lakh litre which caters to the need of more than 11000 families. All these plants altogether use ceramic membranes, which has led to investment on equipment by ceramic industry for fabrication of membrane.</li> <li>• More than 1000 rural potters are trained under various training programs.</li> </ul>
62.	Mobile cold Mixer cum Paver (MCMP)	
63.	Development of Rejuvenator for Recycling of Asphalt Pavement material for Hot-in-Plant and Hot-in situ	

	<b>Recycling of Bituminous Pavement</b>	
64.	<b>Macro surfacing Technology: Thin Surfacing for Cement Concrete Pavement</b>	<ul style="list-style-type: none"> <li>Technologies are useful for the common man by reducing the fuel consumption (improving fuel efficiency), traffic congestions, pollution and improving riding quality of roads and time saving.</li> </ul>
65.	<b>Process for construction of shallow multidirectional underpass intersection by box jacking and soil nailing without effect existing traffic</b>	
66.	<b>Method for instant improvement of foundation soil during box jacking operation without affecting the live rail/road traffic thereof</b>	
67.	<b>Herbal Gulal from Floral Temple Waste</b>	<ul style="list-style-type: none"> <li>The majorly offered flowers in temples are marigold rose, jasmine, chrysanthemum, Hibiscus, etc. Such floral waste can be utilized indifferent ways to produce valuable products for economic upliftment of the weaker sections and can also help to save environment from pollution caused due to improper disposal of flower waste.</li> <li>Local, villages around famous temple can be deployed for collection, sorting and primary processing. Small scale processing unit can be set up in the village or nearby town.</li> </ul>
68.	<b>Herbal Floor Disinfectant and Cleaner (Floor Mop)</b>	<ul style="list-style-type: none"> <li>It is a good alternative to chemical-based floor cleaners which contain laurel sulphate, acetic acid and other chemical preservatives; it is skin and eco-friendly. This technology is useful in job creation and income generation for small scale Entrepreneurs.</li> </ul>
69.	<b>Alcohol Based Liquid Herbal Hand Sanitizer</b>	<ul style="list-style-type: none"> <li>It's a scientifically validated and cost-effective product that is suitable for regular use. Useful for MSME and Pharma industries.</li> <li>Small-scale processing unit can be set up in the village or nearby town which may prove as an income generation tool to provide supplementary income to the villages.</li> </ul>
70.	<b>Recycling of plastic waste</b>	

	into tiles for Structure Designing for societal usage	<ul style="list-style-type: none"> <li>Technology has been transferred to many industries for deployment</li> </ul>
71.	Noise Absorptive barrier for Metro/ Railway/ Highway/ Airport Noise Abatement	
72.	Process for production of Biodegradable table wares and cutleries from agricultural wastes	<ul style="list-style-type: none"> <li>India being an agricultural country, a huge volume of agro-wastes is produced. NIIST technology for making biodegradable cutleries utilizes this agri-waste and helps farmers in enhancing their earnings through selling of plates or cutleries, which are alternatives to single-use plastics.</li> <li>Ayurvedic formulation trikatu syrup, automatics hand sanitizers, Air sanitizer and the SFM face masks were developed during the times of Covid-19 pandemic and these technologies were need of the hour.</li> <li>It all came out as a boon to the common man and protected them from severe infections.</li> </ul>
73.	Trikatu syrup Preparation	
74.	Automatic Hand Sanitizer Dispenser	
75.	Air Sanitizer	
76.	Reusable Stopgap Face Mask	
77.	Novel Cow and Fuel Ball Bio-Methane Reactor	<ul style="list-style-type: none"> <li>The sustainable development initiative by CSIR CIMFR helps replaces burning of coal for cooking to renewable energy such as biogas from coal washery effluent with biomass blend, plantation of trees per family/per tree</li> </ul>
78.	Developed certain varieties of crops in of Lemon grass ( <i>Cymbopogon khasianus</i> x <i>C. pendulus</i> , Poaceae) [CKP-25], Kalam, Rosagrass ( <i>Cymbopogon nardus/khasianus</i> ) RRL (J)CN- 5 & IIIM (J)CK- 10, Mentha spp. ( <i>M. longifolia</i> , <i>M. Piperata</i> , <i>M. spicata</i> , <i>M. Arvensis</i> ), Jammu Monarda ( <i>Monarda citriodora</i> ) Var. IIIM (J) MC02, Ocimum species (Var. Og 14 & Ob 15).	<ul style="list-style-type: none"> <li>Several varieties of aromatic crops developed by Institute have been extended to farmers in different parts of country under Aroma Mission enhancing the income of farmers.</li> </ul>
79.	Energy Efficient Brass Melting Furnace for Artisans	<ul style="list-style-type: none"> <li>The energy efficient furnace has enabled the brassware artisans in some areas to improve their product efficiency, product quality. In this regard, the technology transferred to:</li> <li>Moradabad Industrial Development company, Moradabad, UP in 2013</li> <li>Technical Training Institute (TTI),</li> </ul>

		<p>Balasore, Odisha, in 2014</p> <ul style="list-style-type: none"> <li>• Khadi &amp; Village Industries Board, MSME &amp; T Dept. Govt. of W.B, in 2017</li> <li>• Yugantar Bharati, Ranchi, Jharkhand, in the year 2016</li> <li>• Moradabad Industrial Development company, UP installed CSIR-NML's energy-efficient furnace at Kutch, Gujarat in the year 2017. CSIR-NML so far Trained ~ 450 artisans- entrepreneur at NML, Demonstration given to ~ 700 artisan across the country, installed the furnaces at 7 different places.</li> <li>• CSIR-NML is actively involved to uplift the utensils, artifacts, and jewelry cluster by technological intervention and prepared detailed project report in five different clusters of West Bengal during the year 2018 to 2022 where a large number of common people are involved.</li> </ul>
80.	Anti-tarnishing lacquer	<ul style="list-style-type: none"> <li>• The lacquer has enabled the brass artisans of brass clusters of India to improve their product quality and increase the sales. For example, brass artisans of Bankura, West Bengal are using the lacquer to produce better quality "dokra" handicrafts, improving its sales and hence their earnings.</li> <li>• The lacquer has also enabled SMEs involved in manufacturing of brass handicrafts and hardware items to produce better quality products and compete in the market with the international products.</li> </ul>
81.	Portable NPK soil analysis	<ul style="list-style-type: none"> <li>• It helps farmers to improve productivity</li> </ul>
82.	interventions for leather making through WCTT, ZLD	<ul style="list-style-type: none"> <li>• Empowered the industry to address the environmental pollution as well as health hazards through techno-enabled economical solutions.</li> <li>• Interventions from CSIR-CLRI have resulted in productivity enhancement with time economy, without sacrificing the quality.</li> <li>• Technological options have emerged to ensure wealth from waste whereby value-added products are produced for consumer applications, such as gelatine from raw hide/skin trimmings, leather like sheet from agro- and leather industry wastes, etc., thereby invoking the concept of circular economy.</li> <li>• Generation of more employment has</li> </ul>

		been facilitated.
83.	Improved Jaggery Making Plant	<ul style="list-style-type: none"> <li>Common men have certain basic needs. To name a few, the major challenges that India faces revolve around: Poverty, Pollution, Unemployment, etc.; The technologies developed by CSIR-IIP have been able to ameliorate for the common men of India addressing some of their basic needs.</li> </ul>
84.	Production of Liquid seaweed plant bio stimulants from Sargassum spp. IN 201811029622	<ul style="list-style-type: none"> <li>India being agriculture country, there is considerable demand for developing low cost bio fertilizer that can be affordable even by marginal farmers for enhancement of crop yields &amp; quality.</li> </ul>
85.	Zero Liquid Discharge Process for the production of alginic acid and its derivatives from alginophytes. IN 201711025753	<ul style="list-style-type: none"> <li>The residue generated while producing liquid fertilizer can be used as a feedstock for making a commercially important product such as cellulose, carbon materials, for desired applications etc.</li> </ul>
86.	Kappaphycus alvarezii and Red Seaweed Based Formulations for Improving Productivity and Health of Dairy and Poultry Animals.	<ul style="list-style-type: none"> <li>It is tested for enhancing the crop yield &amp; quality. Liquid seaweed plant bio stimulants from Sargassum and its solid formulations shows excellent enhancement in crop yields from 13 to 28%.</li> </ul>
87.	Production of Sap from Kappaphycusalvarezii and its application.	<ul style="list-style-type: none"> <li>The fresh/dry seaweed biomass is liquefied to produce a seaweed liquid fertilizer which proven to be a promising low-cost bio fertilizer (foliar spray as well as soil applications) and residue processed for recovery of cellulosic and carbon materials which may be used for suitable applications. Raw material (brown seaweeds) used are abundant in nature and easy to harvest.</li> <li>India import large quantity of seaweed fertilizer that involves high foreign exchange exchequer (tentatively estimated at ₹800-1000 crore). The technology has already been transferred to 10 industries for commercial production in India &amp; revenue opportunity potential of licensee (in the near term) is ~₹20 crore.</li> <li>Similarly, Animal feed additive Market – By 2022 is projected at USD 1.853 billion and growing CAGR@ 8.1 %, and thus offers tremendous scope. The formulations have been tested and validated by different ICAR institutes working on animals (IVRI, NDRI) and poultry (CARI) Toxicology studies of</li> </ul>

		<p>specific formulation are available.</p> <ul style="list-style-type: none"> <li>• It has shown improved performance of poultry and cattle, better immuno-responsiveness (cellular mediated and HA titer) in poultry and cattle, gut health (microbial &amp; structural) in poultry, higher egg production and advancement in egg laying age, higher calcium and iron content in milk, reduced methane emission and higher energy use efficiency, higher daily growth rate in cross bred calves.</li> <li>• Low energy requirement, raw materials indigenously available, competitive cost, idea of toxicological profile and active constituents, palatable to animals, can be offered as feed additive to animals in different forms including powder and cattle lick.</li> </ul>
88.	Medical oxygen (MO2) plant	<ul style="list-style-type: none"> <li>• CSIR-NCL has developed indigenous technology for the manufacturing of Lithium zeolite for oxygen concentration. The zeolite provides 93% O2 concentration, which is approved for medical usage in ICUs. CSIR-NCL also commissioned an oxygen concentration plant developed by CSIR-IIP at Aundh Government hospital.</li> <li>• The plant was at its fullest operation during the peak Covid period and many Covid patients were benefitted due to its 24x7 operation.</li> </ul>
89.	Oxygen Enrichment Unit:	<ul style="list-style-type: none"> <li>• The Oxygen Enrichment Unit (OEU) developed by CSIR-NCL team is efficient in providing 35-40% oxygen concentration from air with an adjustable flow rate of 0.5-15 lit/min. The technology was licensed to NCL start-up, GENrich Membranes. About 50 units were assembled and demonstrated in various forums, hospitals and primary health centres.</li> </ul>
90.	Environmental surveillance of SARS-CoV2 in Pune:	<ul style="list-style-type: none"> <li>• Testing waste water can serve as a cost-effective early warning system and help officials keep track of coronavirus at an early stage even among asymptomatic persons. Pune Municipal Corporation (PMC) along with scientists of CSIR-National Chemical Laboratory (CSIR-NCL) conducted a pilot project that has shown traces of the virus causing Covid 19 in</li> </ul>

		the sewage.
91.	Recycling of decontaminated COVID PPE waste	<ul style="list-style-type: none"> <li>Standardized a protocol to decontaminate the biomedical waste and recycle them into valuable products. CSIR-NCL team has developed the know-how to recycle used efficiently/contaminated PPE - especially overalls and gowns.</li> <li>Demonstrated that decontaminated, shredded, and agglomerated PPE material can be used as feed-in polymer melt processing operations such as injection molding.</li> </ul>
92.	Eco-friendly Ganesh Immersion	<ul style="list-style-type: none"> <li>CSIR-NCL and Pune Municipal Corporation (PMC) are jointly supporting the activity of Eco-friendly Ganesh Immersion and providing free Ammonium Bicarbonate (ABC) along with technical help for safe implementation of eco-friendly process.</li> <li>This method is very easy to implement at home and takes about 48 hours to dissolve the idol completely. The initiative has been widely accepted.</li> <li>A Mobile van was also launched for the collection of Ganesh idols from Pune for eco-friendly immersion using the CSIR-NCL technology in association with Ujjivan Small Finance Bank.</li> </ul>
93.	Development of hydrogen fuel cell technologies to reduce on-road pollution by diesel driven heavy vehicles	<ul style="list-style-type: none"> <li>India's first Hydrogen Fuel Cell (HFC) prototype car running on an indigenously developed fuel cell stack was demonstrated at CSIR-NCL, Pune in 2020.</li> <li>CSIR-NCL and CSIR-CECRI partnered with KPIT for the development of an automotive grade PEM Fuel Cell technology.</li> </ul>
94.	SWASTIIK- Disinfection of Water using Cavitation Technology and Natural Oils:	<ul style="list-style-type: none"> <li>CSIR-National Chemical Laboratory (CSIR-NCL), Pune has combined the Modern technology and Indian traditional knowledge of Ayurveda finding out a solution to disinfect water completely and offer possible health benefits of natural oils like lemongrass oil, clove oil, eucalyptus oil, etc.</li> </ul>
95.	Development of manufacturing technologies for bulk drugs like paracetamol	<ul style="list-style-type: none"> <li>CSIR-NCL has developed a superior and cheaper process for the manufacture of the widely used drug, paracetamol.</li> <li>This process has been developed under CSIR Mission Mode Project "Innovative</li> </ul>

		<b>Processes and Technologies for Indian Pharmaceuticals and Agrochemical Sector Industries (INPROTICS)".</b>
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