

# CSIR in Media



*75 Years of*

**CSIR Touching Lives**

**News Bulletin**

**21<sup>st</sup> to 28<sup>th</sup> August 2018**





## SpiceJet operates country's first biojet fuel flight

CSIR-IIP

28<sup>th</sup> August, 2018



**The flight was powered by a blend of 75% air turbine fuel and 25% biojet fuel.**

A blend of oil from jatropha seeds and aviation turbine fuel propelled the country's first ever bio-jet fuel powered flight on Monday between Dehradun and Delhi. The 43 minute flight was operated by SpiceJet's Bombardier Q-400 aircraft with 20 officials and five crew members onboard. A blend of 25% of bio jet fuel and 75% of aviation turbine fuel (ATF) was carried in one of the two engines of the plane, while the other engine carried only ATF. International standards permit

blend rate of upto 50% bio fuel with ATF. "Today's flight was a technological demonstration that bio jet fuel can be used in flights. It has the potential to reduce fuel costs by 15-20%," SpiceJet Chairman and Managing Director, Ajay Singh said after the flight landed at Delhi's Indira Gandhi International airport. Minister for Road Transport and Highways, Nitin Gadkari said, "A policy will soon be framed on bio jet fuel for aviation industry and placed before the Cabinet." Inedible oil seeds like jatropha have low per acre productivity and there is a need to use biotechnology to enhance yields, he added. The indigenously developed fuel has been nearly eight years in the making by the Council for Scientific and Industrial Research based in Dehradun along with Indian Institute of Petroleum (IIP). The institute started its experiment on bio-fuel soon after Virgin Atlantic carried out the first test flight globally in 2008. By 2010, the Indian institute starting producing few litres of bio fuel per month in its laboratory.

a.



The fuel was recognised by American Standard for Testing and Material and received a patent by 2011. By 2013, it was tested in a Pratt and Whitney engine in Canada. “We produced 430 litres of HEFA bio jet fuel in four days and took a month to test it for today’s flight. We have the requisite technology, which is ready to be transferred for use by oil refineries for mass scale production,” said Anjan Ray, Director, Institute of Petroleum,.

He explained that bio jet fuel can be produced from animal fat, used cooking oil, waste dairy fat, sewage sludge, etc. The oil needs to have a freezing point below -47 degrees so it doesn’t freeze at altitudes at which planes fly, should not catch fire on ground when being transferred into a plane, must have the same density as ATF, have a certain calorific value and should not choke the filters.

Dr. Ray says that 70% of the cost of the bio fuel constitutes the feed cost and therefore if the production of these crops can be scaled up, the oil produced can be cost competitive. It is also 1.8% more energy dense as compared to ATF and is, therefore, more efficient. A lower sulphur content also means that it causes less wear and tear.

The US Grains Council, a global biofuel promoting organisation, dubbed today’s test flight as a significant breakthrough

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[Business Today](#), [Live Mint](#), [The Quint](#)



विदेश में हुए प्रयोग से ज्यादा सफल रही भारत की बायोफ्यूल उड़ान

# ऑस्ट्रेलिया ने 10 फीसदी सरसों से, हमने 25% जट्रोफा से उड़ाया प्लेन

■ एनबीटी, नई दिल्ली

पहली बार बायोफ्यूल से प्लेन उड़ाकर भारत ने एविएशन इंडस्ट्री में नया मुकाम हासिल कर लिया है। सोमवार को स्पाइजेट ने बॉम्बार्डियर क्यू 400 से देहरादून-दिल्ली के बीच इस उड़ान का सफल टेस्ट किया। इसके साथ ही भारत उन खास देशों में शामिल हो गया, जिन्होंने बायोफ्यूल से किसी प्लेन को उड़ाया है। पहला बायोफ्यूल प्लेन ऑस्ट्रेलिया की क्वांटस एयरलाइंस ने इसी साल 29 जनवरी को उड़ाया था। इसके बाद कनाडा और अमेरिका ने भी ऐसा टेस्ट किया। लेकिन भारत का टेस्ट ऑस्ट्रेलिया में किए गए टेस्ट से इस मामले में बेहतर है कि क्योंकि इसमें बायोफ्यूल की मात्रा ज्यादा है। साथ ही यह प्रदूषण भी कम करता है। ऑस्ट्रेलिया ने अपनी फ्लाइट में 90 फीसदी एविएशन टर्बाइन फ्यूल (एटीएफ) और 10 फीसदी सरसों के तेल का इस्तेमाल किया था। जबकि भारतीय उड़ान में 75 फीसदी एविएशन टर्बाइन फ्यूल (एटीएफ) और 25 फीसदी जट्रोफा के तेल का इस्तेमाल हुआ। यानी ऑस्ट्रेलिया के टेस्ट की तुलना भारतीय फ्लाइट कम प्रदूषण फैलाएगी। हालांकि ऑस्ट्रेलियाई टेस्ट फ्लाइट की समय अवधि को लेकर आगे है। उसकी बायोफ्यूल फ्लाइट 15 घंटे की थी। वहीं, हमारी फ्लाइट देहरादून से दिल्ली तक थी। जिसमें मात्र 45 मिनट लगे। रिसर्चर्स के मुताबिक ऑस्ट्रेलिया फ्लाइट ने अपने टेस्ट में पहले की तुलना 7 फीसदी कम प्रदूषण फैलाया। वहीं भारतीय फ्लाइट 12 फीसदी प्रदूषण कम होने का अनुमान है।

भारतीय उड़ान से प्रदूषण कम होगा, पारंपरिक फ्यूल पर निर्भरता कम करने के लिहाज से भी अच्छा



12 हजार करोड़ बच सकते हैं सालाना

- बायोफ्यूल से प्लेन उड़ाने वाला भारत पहला विकासशील देश है। इससे पहले कनाडा, ऑस्ट्रेलिया और अमेरिका जैसे विकसित देश ही यह कारनामा कर पाए।
- स्पाइजेट ने अपनी उड़ान के लिए इस्तेमाल ईंधन 75 प्रतिशत एविएशन टर्बाइन फ्यूल (एटीएफ) और 25 प्रतिशत बायोफ्यूल का मिश्रण था।
- बायोफ्यूल से प्लेन उड़ाना सस्ता बैठता है। एक स्टडी के मुताबिक उड़ान की लागत 20% तक कम हो जाती है। यानी प्लेन का किराया सस्ता होगा।
- अगर भारत इस तकनीक में परफेक्ट हो जाता है, तो तेल आयात पर निर्भरता कम होगी, सालाना 12 हजार करोड़ रुपये तक बच सकते हैं।
- छत्तीसगढ़ के 500 किसान परिवार जट्रोफा के उत्पादन में शामिल थे। उन्हीं के द्वारा रिफाइन किए गए बायोफ्यूल का फ्लाइट में इस्तेमाल हुआ।

80% कम हो सकता है कार्बन उत्सर्जन

- अगर पूरी दुनिया के सभी प्लेन बायोफ्यूल से उड़ाए जाएं तो एविएशन क्षेत्र में उत्सर्जित होनेवाले कार्बन को 80 प्रतिशत तक कम किया जा सकता है।
- पीएम मोदी ने हाल में 'नेशनल पॉलिसी फॉर बायोफ्यूल 2018' जारी की थी। 4 सालों में एथेनॉल के प्रोडक्शन को 3 गुना बढ़ाने का लक्ष्य है।
- बायोफ्यूल सब्जी के तेलों, रिसाइकल ग्रीस, काई, जानवरों के फैंट आदि से बनता है। ईंधन की जगह इसका इस्तेमाल किया जा सकता है।

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Amar Ujala, Page no. 1  
Dainik Jagran, Page no. 14



## Close watch on climate change

CSIR-NISCAIR

28<sup>th</sup> August, 2018

### MoES to consider Rs. 79-crore project to study climate change in State

The Ministry of Earth Sciences (MoES) is considering a Rs. 79-crore proposal to study the impact of climate change on Kerala. The project has been proposed by the National Institute of Science Communication and Information Resources (NISCAIR) under the Council of Scientific Industrial Research (CSIR). “The project involves experts from various scientific institutions across the country. It consists of 25 work packages and covers all the aspects of climate change adaptations for Kerala,” J. Sundaresan Pillai, Head of Climate Change Informatics, CSIR-NISCAIR and Principal Investigator of the project, told The Hindu in a telephonic interview from New Delhi.

### Ambitious project

The ambitious project, spread over a period of three years, will assess the impact of climate change on agriculture (including plantation crops and spices); fisheries (marine and inland); industries; health; transport — vehicular and inland water transports; tourism; biodiversity; forestry; and landslips. It assumes significance in the wake of devastating floods that ravaged many parts of the State as the research initiative will specifically assess the dynamics of riverine discharge and saline water incursion under the climate change scenario. The experts will study the spatial and temporal changes in water resources (surface and groundwater — quantity and quality).

Dr. Sundaresan Pillai said that CSIR-NISCAIR was the nodal institute to develop climate change adaptation programmes for islands and coastal ecosystems as part of the 12th Five Year Plan programme approved by the CSIR.



## **Climatic elements**

“The Kerala project will analyse the trends in climatic elements, their spatial pattern and its relationship with extreme events such as El Nino, cyclones etc. “It is part of the vulnerability assessment and development of adaptation strategies for climate change impact with special reference to coasts and island ecosystems of India project launched by CSIR-NISCAIR in 2015,” he said. Researchers associated with the project will assess the monsoonal variations and its impact, besides looking at the climate change scenario on the islets of Kerala.

## **Framework tool**

Dr. Sundaresan said that the objective of the project was to develop a framework and decision support tool to assess the climate change impact on livelihood and developmental processes. “We have plans to evolve region-wise/localised specific adaptive measures for the State. The study will look into suitable sectoral mitigation options under changing climate scenarios and assess the carbon sequestration potential of Kerala,” he said.

## **Atmospheric chemistry**

The project proposal stated that researchers will study the atmospheric chemistry related to climate change and monsoonal variations from Kerala’s perspective and develop large-scale forecasting and modelling of the various parameters using high-power computer simulation tools.

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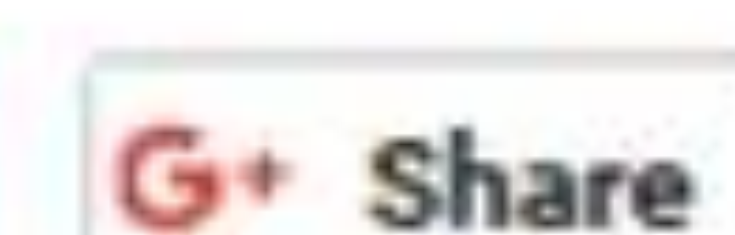
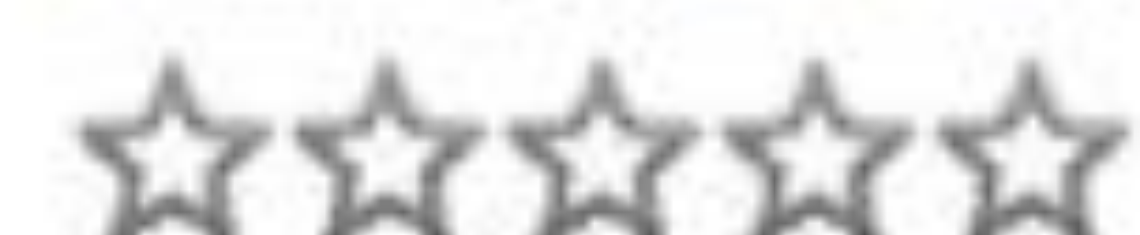


CSIR-NML

25<sup>th</sup> August, 2018

## LOYOLA SCHOOL WINS PROF SN SINHA MATERIALS & METALLURGY QUIZ

Saturday, 25 August 2018 | PNS | Jamshedpur | in Ranchi



The Indian Institute of Metals (IIM), Jamshedpur Chapter, organised the 6th "Professor S. N. Sinha Memorial Materials and Metallurgy Quiz 2018 (SNSM3Q-2018)" for standard XI and XII students at CSIR-NML's Auditorium, Burmamines. Dr Indranil Chatteraj, director, CSIR-NML, Jamshedpur formally inaugurated the programme.

The event is dedicated to the memory of Late Prof. S N Sinha, an eminent educationist and past president of the IIM Jamshedpur Chapter.

Six teams qualified in the screening round out of 29 teams, representing from five schools, namely - Loyola School Jamshedpur (two teams), Vidya Bharati Chinmaya Vidyalaya, Sacred Heart Convent school, Baldwin Farm Area High School and JUSCO School Kadma. After series of interesting rounds, Shivam Singh and Harshit Singh of Loyola School Jamshedpur were declared champions.

Debanshu Sen and Ujjal Ghosh of Baldwin Farm Area High School got Second prize. Adrija Roy and Mini Shail Chhabra of Sacred Heart Convent school stood .

The two winning team will get opportunities to participate in Professor Brahm Prakash Memorial Materials Quiz - 2018 to be held at Kalpakkam in September.

Over the years, this Quiz Competition has attracted appreciation from educationalist, researchers & industrialists and is considered a prestigious annual event of the Kalpakkam Chapter and the IIM. The National Level "Prof. Brahm Prakash Memorial Materials Quiz" has gained wide popularity within student community. More than 50 teams comprising 100 students from all around the country participate every year.

This programme was initiated as an effort to create awareness among the students about the role of materials science and metallurgy in industrial and technological developments. In the year 1993, this event was named after Prof. Brahm Prakash, an eminent metallurgist of India.

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The Pioneer



## Bus from Gujrat will purify drinking water in flood-hit Kerala

CSIR-CSMCRI

25<sup>th</sup> August, 2018



**The bus, which started from the coastal town of Bhavnagar, has the capacity to purify 3,000 litres of water per hour.**

A bus having on-board water purification system and the capacity to purify 3,000 litres of water per hour, reached flood-affected Kerala on Friday. It will be used to provide safe drinking water to the people of the state. The 40-foot long bus, which started from the coastal town of Bhavnagar in Gujarat, needs four people to handle its water purifying and desalination plant. It has been indigenously developed by scientists at the Central Salt and

Marine Chemicals Research Institute (CSMCRI), Bhavnagar, a place which is famous for housing the “Sheth Brothers” which manufactures ayurvedic medicines, including the popular Kayam Churna. The CSMCRI is a laboratory of the Council of Scientific and Industrial Research (CSIR) and was inaugurated by former Prime Minister Jawaharlal Nehru in 1954. Speaking to *The Sunday Guardian*, senior scientist at CSMCRI, Dr Sanjay Patil said that the mobile desalination and purification plant, developed in 2008 by scientists at CSMCRI, was first used in 2009 in Uttarakhand. “The bus will be very useful for those who have been hit by the floods. It has been successfully operationalised in various places like North 24 Parganas during the Aila cyclone in West Bengal, and also in Karnataka, Odisha and Uttarakhand. It needs four people to operate it, apart from one driver to drive it around. It also has a built-in generator to meet power demands and the energy required to desalinate the



water. As of now, the bus will be stationed at the National Institute for Interdisciplinary Science and Technology, Thiruvananthapuram, and from there we will move it around the state as per requirements and demand,” Patil told *The Sunday Guardian*. Patil and his colleagues, have reached Thiruvananthapuram and they will be travelling with the bus to make sure that everything works out smoothly. Every day, the bus will purify close to 40,000 litres of drinking water that matches the drinking water standards stipulated by WHO.

“The bus can purify any contaminated water, sea water through the onboard RO and ultra-filtration plant that it carries. We have installed solar panels on top of it so that the bus can use solar power to meet its basic needs,” Patil added. Residents of Kerala, especially those living in rural and coastal areas, are facing a massive drinking water crisis due to the contamination of wells and damage to pumping stations in the flood-hit areas.

A large section of coastal and low lying regions of the state was entirely submerged during the floods due to which flood water entered the wells, rendering them unsafe for drinking. Power plants and electricity poles have been damaged extensively, due to which the filtering plants are facing problems.

**Published in:**  
[Sunday Guardian](#)



## CSIR tech to make combat aircraft Tejas 20% lighter

CSIR-NAL

24<sup>th</sup> August, 2018



Technology indigenously developed by a government laboratory for manufacturing carbon components will make India's light combat aircrafts 20% lighter. The technology developed by the Council of Scientific and Industrial Research - National Aerospace Laboratory (CSIR-NAL) uses indigenously developed carbon fibre, which is pre-impregnated with the organic polymer 'resin', to make complex parts like fin, rudder, wing spars and fairings in a single mould. "For making the composite material, this pre-impregnated carbon fibre is autoclaved or treated under extreme heat and temperature. The autoclaving technology has also developed

by our lab," said Jitendra Jadhav, director of CSIR-NAL. "The material is then moulded into complex components of the aircraft. This reduces the number of parts used in the aircraft as well as the number of fasteners needed to assemble it," he said. The use of the complete home-grown technology will reduce the number of parts of the light combat aircraft by 40%, the number of fasteners by 50%, and the time on the assembly line by 30%. The composite technology is critical of the fourth generation fighter aircraft. "The composite material is sturdier than aluminium, more heat resistant, the wear and tear is less and corrosion," said Jadhav. The laboratory has received an order for 20 sets of parts for the aircrafts worth more than ~100 crore from the government owned aerospace company Hindustan Aeronautics Limited (HAL). CSIR-NAL has now transferred the technology to manufacturing partner Tata Advanced Materials Limited (TAML), Bengaluru. The project began with two of



CSIR. technology demonstrator aircrafts and then five prototype aircrafts. “It is a matter of pride that India’s light combat aircraft – Tejas – has one of the highest percentage deployment of composites among contemporary aircrafts of its class anywhere.

And, this project is a major achievement of CSIR and highlights its commitment towards ‘Make in India’ initiative,” said Dr Girish Sahni, director general

**Published in:**  
[Hindustan Times](#)



# सीएसआईआर तेजस के पुर्जे बनाएगा

नई दिल्ली | विशेष संवाददाता

## भारत संग विमान बनाएगा रूस!

वैज्ञानिक एवं औद्योगिक अनुसंधान परिषद (सीएसआईआर) की बेंगलुरु स्थित प्रयोगशाला नेशनल एयरोस्पेस लैबोरेटरी (एनएएल) को तेजस के उपकरण बनाने का बड़ा काम मिला है। प्रयोगशाला को मिला कार्य सौ करोड़ रुपये से भी अधिक का है।

सीएसआईआर ने यहां जारी एक बयान में कहा कि एचएएल ने हल्के लड़ाकू विमान तेजस के लिए उपकरण की आपूर्ति को लेकर नेशनल एयरोस्पेस लैबोरेटरी (एनएएल) को 100 करोड़ से अधिक का ठेका दिया है।

सीएसआईआर के अधीन आने वाले एनएएल ने प्रौद्योगिकी विकसित की है, जिसका उपयोग एलसीए तेजस के प्राथमिक एयरफ्रेम उपकरणों में किया जाता है। सीएसआईआर के महानिदेशक डॉ. गिरीश साहनी ने कहा कि कंपोजिट प्रौद्योगिकी महत्वपूर्ण

नई दिल्ली | हिटी

अत्याधुनिक लड़ाकू विमानों के इंजन बनाने वाली रूसी कंपनी यूनाइटेड इंजन कॉर्पोरेशन (यूईसी) भारत के साथ मिलकर उन्नत स्टील्थ विमान बनाना चाहती है। कंपनी ने कहा है कि वह एसयू-57 स्टील्थ फाइटरप्लेन के लिए दूसरी पीढ़ी का इंजन बनाने की दिशा में बढ़ रही है। यह इंजन सुपरक्रूज फीचर वाला होगा, जिससे यह किसी भी राडार की पकड़ में नहीं आएगा। इस परियोजना में विलंब की वजह को स्पष्ट

प्रौद्योगिकी में से एक है, जो एलसीए को चौथी पीढ़ी के लड़ाकू विमान बनाती है। अन्य देशों द्वारा जरूरी प्रौद्योगिकी देने से इनकार के दौरान देश में जटिल कल-पुर्जे बनाने की चुनौती थी। साहनी ने कहा कि कंपोजिट प्रौद्योगिकी के उपयोग

करते हुए कंपनी ने कहा कि पांचवीं पीढ़ी के लड़ाकू विमान के विकास से भारत के पीछे हटने के बाद ऐसा हुआ है। हालांकि कंपनी इस परियोजना में भारत को शामिल करने का प्रयास कर रही है। पहले भारत भी रूस के साथ मिलकर पांचवीं पीढ़ी के अत्याधुनिक लड़ाकू विमान विकसित करने की परियोजना पर काम कर रहा था लेकिन हाल ही में उसने इस परियोजना से पीछे हटने का फैसला किया।

hindustantimes

से एयरफ्रेम के वजन में 20 प्रतिशत की कमी आई है। तेजस एलसीए सुपरसोनिक एकल सरट, एकल इंजन बहु-भूमिका वाला हल्का लड़ाकू विमान है। इसका विनिर्माण हिन्दुस्तान एयरोनोटिक्स लिमिटेड ने किया है।

**Published in:**

Hindustan, Page no. 9



## Huge demand for CECRI's lithium-ion cells

CSIR-CECRI

24<sup>th</sup> August, 2018

**Lithium-ion cells developed by the Central Electro-Chemical Research Institute (CECRI) have attracted considerable demand from the Indian users and industry.**

Indian Railways and the Defence have shown interest in buying the cells. “We have enquiries worth ₹3,000 crore, including ₹1,000 crore from the Railways alone,” says S Gopukumar, a Chief Scientist with CECRI, who has been involved with the development of Lithium-ion cells for over fifteen years. Some private sector companies, including Tata Chemicals and Carborundum Universal of the Chennai-based Murugappa group, are in talks with CECRI for licensing technology for producing the cells. Karaikudi, Tamil Nadu-headquartered CECRI is one of the 38 labs under the control of the government of India owned Council for Scientific and Industrial Research (CSIR). Li-ion cells have become the first choice for energy storage and are used everywhere from mobile phones to electric vehicles to large energy storage batteries meant to soak up surplus power from (say) wind and solar plants. India today imports between 8 and 10 million cells every month and the import-dependence is a cause of worry for policy makers.

**Indigenisation** Against this backdrop, there is a quest for indigenously produced Li-ion cells, so that India does not miss the bus in local manufacture — as it happened in the case of solar cells, where the country's needs are almost entirely met by imports. Though the science behind any electro-chemical cell is nothing new, the chemical composition of key elements such as cathode, anode and electrolyte is proprietary, as is the manufacturing process. While many are working towards developing Li-ion cells, by far only two Indian entities have the technology — CECRI and ISRO. CECRI has a small production unit at its Chennai unit, which is more a demonstration facility. At present, under a recent agreement with the Raasi group of companies, CECRI is making the cells for Raasi. However, Raasi has said it



would set up a cell making factory at Krishnagiri. Competitive pricing If mass-produced, cells made with CECRI's technology can be sold cheaper than those imported from China, Gopukumar told this correspondent at Karaikudi on Thursday. Today the cells sell in the market for \$250 a kWhr; CECRI can make cells for \$200. Sixty per cent of the cost of the cell is the cathode material, he said. Roughly, a plant that can produce 3 million cells a month can be set up with an investment of ₹1,000 crore. The investment can be paid back in three years, said Gopukumar, who is also the National Co-ordinator for Lithium-ion cell related work done by all the CSIR labs. (While the technology has been developed by CECRI, different labs make components for the cell. The cathode, which is the heart of the technology, is produced by CECRI, the anode is made by the National Physical Laboratory, electrolyte by the Indian Institute of Chemical Technology, Hyderabad and the 'separator' by the Central Glass and Ceramic Research Institute, Kolkata.) CECRI has technologies for Li-ion cells of two "chemistries". One, Lithium Cobalt Oxide double-doped with Copper and Magnesium. Basically, this means that the cathode is made with this special alloy, so that it can pack more current — 225 milli ampere per gram. This voltage of this cell can go up to 4.6V. The other cell is 'Lithium Manganese Phosphate', with energy density of 150 ma/gm, of potential of 4.4V. This is type of cell that can be used in EVs, and the one that Raasi intends to produce. (Voltage multiplied by current gives Watt, a measure of power. Therefore, higher the voltage (V) and/or the current (amp), the higher the power.) Gopukumar said that India has Lithium availability in India is not as big a problem as is thought to be because there are deposits in Rajasthan and the metal could also be extracted from sea water.

**Sodium ion** Meanwhile, CECRI scientists, AS Prakash and K Ramesha, have developed a Sodium-ion cell. This cell is yet to be perfected but when it is done, it would be a lot cheaper than Lithium-ion cell because Sodium is far more abundantly available. On the flipside Sodium is difficult to handle. Likewise, CECRI scientists are also working on Lithium-air, Lithium Titanium Oxide and Sodium-air cells, all of which are cutting edge technology.

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## CFTRI to supply 50,000 meals to Kerala, Kodagu

CSIR-CFTRI

21<sup>st</sup> August, 2018

The Central Food Technological Research Institute (CFTRI), which joined Defence Food Research Laboratory (DFRL) in supplying flood-relief food to Kerala and Kodagu, plans to distribute 50,000 meals in the flood-hit regions over the next three to four days. Relief food material prepared at the CFTRI's pilot plants as well as manufacturing facilities of local industries, which had taken Institute's technologies, were sent to Kerala and Kodagu on Sunday and Monday. After supplying 50,000 meals over three-four days, CFTRI will review its operations in terms of supply and product mix, a statement from the Institute said.

The consignments by the CFTRI included rehydrate and consume wheat rava upma and imli poha, chapattis, high-protein biscuits, tomato curry, pickles, jam and chutney, besides water bottles. All the food products are highly nutritious with a reasonable shelf-life, according to the statement. While the first consignment of 14,500 meals including 3,000 for air-dropping over central Kerala was sent on Sunday, the second consignment was sent on Monday afternoon. While the food items meant for distribution in Ernakulam/Thiruvananthapuram region of Kerala was airlifted from Mysuru airport in an IAF aircraft along with relief food prepared by DFRL, the food items for Wayanad region in Kerala and Kodagu left by road in separate trucks. Commissioner of Food Safety, Government of Karnataka, Pankaj Kumar Pandey, and the office of Mysuru MP Pratap Simha had contacted the CFTRI with a request to send relief supplies to the flood-hit regions. It may be mentioned here that DFRL is also dispatching ready to eat food packets to flood-hit regions of Kerala and Kodagu.

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