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समाचार पत्रों के चयनित अंश
Newspapers Clippings

डीआरडीओ समुदाय को डीआरडीओ प्रौद्योगिकियों, रक्षा प्रौद्योगिकियों, रक्षा नीतियों, अंतर्राष्ट्रीय संबंधों और विज्ञान एवं प्रौद्योगिकी की नूतन जानकारी से अवगत कराने हेतु दैनिक सेवा

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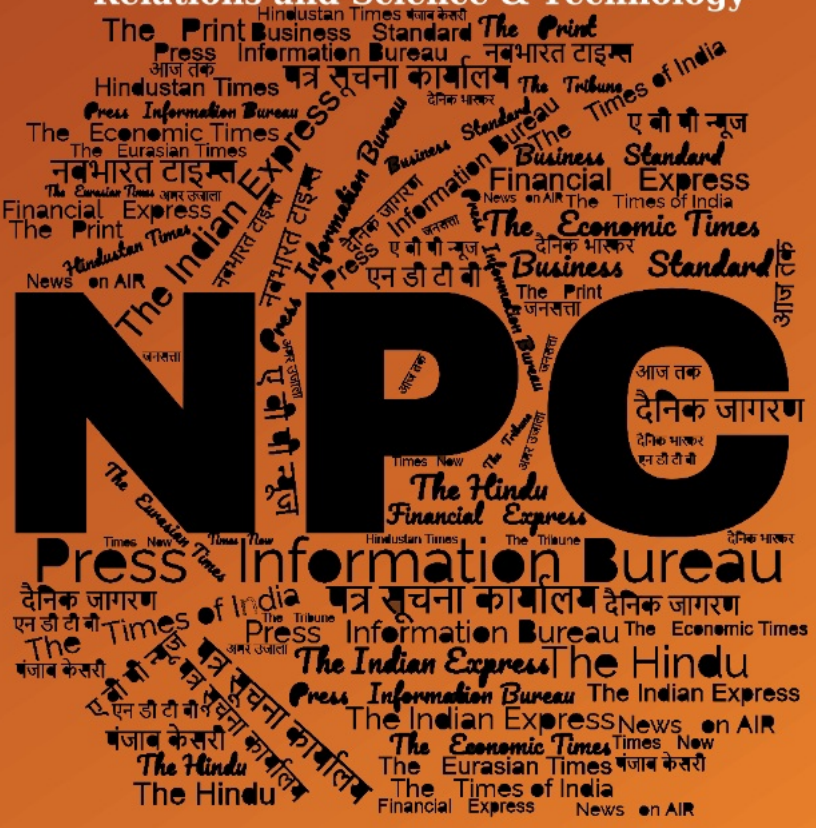

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DRDO News

Hindustan Times

Wed, 19 Nov 2024

India successfully test fires long-range hypersonic missile, joins select club

The Defence Research and Development Organisation (DRDO) on Saturday conducted a successful flight test of long range hypersonic missile from the Dr APJ Abdul Kalam Island off the Odisha coast in what was termed as a 'major milestone' by Defence Minister Rajnath Singh.

Rajnath Singh called he successful flight test of the long range hypersonic missile a historic moment which put India in the group of select nations having capabilities of such critical and advanced military technologies.

"India has achieved a major milestone by successfully conducting flight trial of long range hypersonic missile from Dr APJ Abdul Kalam Island, off-the-coast of Odisha. This is a historic moment and this significant achievement has put our country in the group of select nations having capabilities of such critical and advanced military technologies," Singh said in a post on X on Sunday, congratulating DRDO and the armed forces.

This hypersonic missile can reportedly carry various payloads for ranges over 1500km for all the Services of the Indian Armed Forces.Indigenously developed by the laboratories of Dr APJ Abdul Kalam Missile Complex, Hyderabad along with various other DRDO laboratories and Industry

Partners, the flight trial of this was carried out in the presence of senior scientists of DRDO and the Armed Forces.

Hypersonic weapons are those which are travel at hypersonic speed, defined as between 5 and 25 times the speed of sound or about 1 to 5 miles per second. On November 12, DRDO conducted the maiden flight-test of Long Range Land Attack Cruise Missile (LRLACM) from the Integrated Test Range (ITR) in Chandipur off the coast of Odisha from a mobile articulated launcher.

During this test, all sub-systems performed as per expectation and met the primary mission objectives, a PIB release said, adding that the missile performance was monitored by several range sensors like Radar, Electro Optical Tracking System and telemetry deployed by ITR at different locations to ensure complete coverage of the flight path.

The missile demonstrated its capability to perform various manoeuvres while flying at various altitudes and speeds. The missile is also equipped with advanced avionics and software to ensure better and reliable performance, the release said.

https://www.hindustantimes.com/india-news/long-range-hypersonic-missile-major-milestone-rajnath-singh-odisha-drdo-101731814001473.html

Defence News

Defence Strategic: National/International

Press Information Bureau
Government of India

Ministry of Defence

Mon, 18 Nov 2024

Raksha Mantri Shri Rajnath Singh to attend 11th ASEAN Defence Ministers' Meeting Plus in Lao PDR

Raksha Mantri Shri Rajnath Singh will pay an official visit to Vientiane, Lao PDR from November 20-22, 2024 to attend the ASEAN Defence Ministers' Meeting Plus (ADMM-Plus). He will address the forum on Regional and International Security Issues during the meeting.

On the sidelines of 11th ADMM-Plus meeting, Raksha Mantri is expected to hold bilateral meetings with participating counterparts from Australia, China, Japan, Lao PDR, Malaysia, New Zealand, Philippines, Republic of Korea and USA. These meetings are aimed at further enhancing bilateral defence cooperation with these countries.

ADMM is the highest defence consultative and cooperative mechanism in ASEAN. ADMM-Plus is a platform for ASEAN member states (Brunei, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand, Vietnam) and its eight Dialogue Partners (India, US, China, Russia, Japan, South Korea, Australia and New Zealand) to strengthen security and defence cooperation.

India became the dialogue partner of ASEAN in 1992 and the inaugural ADMM-Plus was convened in Hanoi, Vietnam on October 12, 2010. Since 2017, ADMM-Plus Ministers have been meeting annually to bolster the cooperation amongst ASEAN and the Plus countries. Lao PDR is the chair and host of 11th ADMM-Plus.

https://pib.gov.in/PressReleasePage.aspx?PRID=2074309

THE ECONOMIC TIMES

Mon, 18 Nov 2024

Southern Naval Command set for ''Sea Vigil 2024''

As part of the nation-wide Coastal Defence Exercise 'Sea Vigil 2024, the Southern Naval Command will coordinate the exercise in Kerala and Lakshadweep this week, Navy officials said on Monday. The fourth edition of the exercise in Kerala and Lakshadweep will be overseen by Vice Admiral V. Srinivas, Flag Officer Commanding-in-Chief of the Southern Naval Command and Commander-inChief of Coastal Defence (South), Navy officials said.

The exercise will be conducted by the Indian Navy with the participation and support of 16 Central and State agencies, including the Coast Guard, Kerala Police, Marine Enforcement Wing of the Fisheries Department, Department of Shipping, Ports and Waterways, CISF, BSF, DGLL (Directorate General of Lighthouses and Lightships), Customs, Intelligence Bureau, NCC, and others, they said. Notably, the NCC is participating in the exercise for the first time, they said

The biennial exercise, which began in 2009 in the aftermath of the 26/11 Mumbai terror attacks, aims to validate the efficacy of the coastal defence response across the Indian coastline against threats arising from the sea, the officers told reporters.

The exercise will focus on strengthening the security of coastal assets, such as ports, oil rigs, single point moorings, cable landing points, and critical coastal infrastructure, including the safety of coastal populations, they said.

https://economictimes.indiatimes.com/news/defence/southern-naval-command-set-for-sea-vigil-2024/articleshow/115418799.cms

Press Information Bureau
Government of India

Ministry of Defence

Tue,19 Nov 2024

Coast Guard rescues 7 Indian fishermen from Pakistan Maritime Security Agency vessel

The Coast Guard has rescued seven Indian fishermen who were apprehended by the Pakistan Maritime Security Agency (PMSA) in the mid-sea off the Gujarat coast and kept on their ship near

the maritime boundary between the two countries, officials said on Monday. The incident took place on Sunday when the Coast Guard received a distress signal from an Indian fishing boat (IFB) operating near the No-Fishing Zone (NFZ) in the afternoon, said an ICG release.

At approximately 15:30 pm, an ICG ship on patrol received a distress call from an Indian fishing boat operating near the NFZ. The call reported that another Indian fishing boat, Kal Bhairav, had been intercepted by a PMSA vessel, and seven Indian crew members on board had been apprehended," said the release. The Coast Guard immediately swung into action and sent its ship to the location near the India-Pakistan Maritime Boundary (IMBL).

Despite efforts by the PMSA ship to retreat, the ICG ship eventually intercepted the vessel from the neighbouring country and persuaded personnel on board to release the seven Indian fishermen they had apprehended, it said.

"The ICG ship was able to retrieve the seven fishermen safely, who were all found to be in stable medical condition. Unfortunately, the Indian fishing boat, Kal Bhairav, was reported to have been damaged and sunk during the incident," the release added.

The Indian ship returned to the Okha harbour on Monday where a joint investigation involving the ICG, the Gujarat police, intelligence agencies, and fisheries department was undertaken to probe the circumstances leading to the collision (between PMSA vessel and IFB Kal Bhairav), and the subsequent rescue operation, said the release.

https://economictimes.indiatimes.com/news/defence/coast-guard-rescues-7-indian-fishermen-from-pakistan-maritime-security-agency-vessel/articleshow/115423128.cms

THE WEEK

Wed, 19 Nov 2024

Kepang La Day celebrated: Indian Army remembers fallen heroes, support of villagers during 1962 Indo-China War

The Spear Corps of the Indian Army, on Sunday, celebrated the Kepang La Day at Gelling in Arunachal Pradesh's Upper Siang district to pay tribute to the soldiers who sacrificed their lives during the 1962 Indo-China War.

According to a defence communique, the resilience of the villagers who supported the Indian Army during the war was also celebrated during the day.

A ceremony was held at the Kepang La Chorten. This was followed by a wreath-laying ceremony and a Guard of Honour to pay tribute to the martyrs.Prayers were also offered at the Gelling

Monastery. The Army also paid tribute to the villagers who supported the Army during the war by recognizing and expressing their acknowledgment of the courage and unity of their ancestors.

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Kepang La Pass in Siang Valley is an inseparable part of India's heritage, symbolising the sacrifices made by soldiers and villagers. The Day is being observed to honour those heroes, whose steadfast legacy at the borders is a reminder of the valour and unity at the heart of national identity, the communique said.

Kepang La is a significant mountain pass on the Indo-Tibetan border along the Line of Actual Control (LAC). This strategic location is situated near the course of the Yarlung Tsangpo, known as Brahmaputra River in Assam and Siang in Arunachal Pradesh.

The bravery of the Siang Valley people and soldiers was put to the ultimate test during the 1962 India-China war. When villagers from Gelling noticed Chinese PLA footprints near the Nyugong Ri stream, Indian forces quickly responded, engaging the enemy in fierce gunfire. For eight hours, Indian soldiers defended their positions with remarkable valour, sacrificing their lives to protect the valley.

Among those who were martyred were 2 Madras Regiment's subedar Sheikh Subani, havildar B Ramalinga G, sepoys Murri Raja, Appa Rao and Ellias.

https://www.theweek.in/news/defence/2024/11/18/kepang-la-day-celebrated-indian-army-remembers-fallen-heroes-support-of-villagers-during-1962-indo-china-war.html

#SWARAJYA

Mon, 18 Nov 2024

India, Japan Ink Pact To Jointly Develop Stealth-Enhancing UNICORN Mast For Indian Navy Ships

India and Japan have signed a Memorandum of Implementation (MoI) for the joint development and production of the Unified Complex Radio Antenna (UNICORN) mast, a state-of-the-art integrated communication system.

The MoI was formally signed and exchanged in Tokyo on Friday (15 November) during a ceremony attended by Sibi George, India's Ambassador to Japan, and Ishikawa Takeshi, Commissioner of Acquisition Technology and Logistics Agency under the Japanese Ministry of Defence (MoD).

The UNICORN mast is a next-generation naval mast system that integrates multiple communication systems and enhances the stealth characteristics of naval platforms by reducing the radar cross-section (RCS) of antennas.By stacking antennas and enclosing them within a radome, the system makes naval vessels more difficult to detect, improving their operational effectiveness in sensitive environments.

"The Indian Navy is pursuing the induction of these advanced systems which will be co-developed by Bharat Electronics Limited in India with Japanese collaboration," the Navy said in a statement.It also highlighted that this project marks the first-ever case of co-development and co-production of defence equipment between the two nations.

The technology was previously discussed during the India-Japan 2+2 dialogue in August 2024, where both nations appreciated the progress made for the transfer of UNICORN and related technologies and early signing of related arrangements.Although Japan has sought to boost defence exports in recent years, strict conditions under its pacifist constitution have often posed challenges.

This agreement could pave the way for the first export of Japanese defence technology under the 2015 bilateral agreement on defence equipment and technology transfer.Earlier negotiations between India and Japan for the procurement of amphibious planes for the Indian Navy stalled due to high costs and other priorities.However, the UNICORN project signals renewed momentum in defence collaboration between the two nations.

https://swarajyamag.com/news-brief/india-japan-ink-pact-to-jointly-develop-stealth-enhancing-unicorn-mast-for-indian-navy-ships

Science & Technology News

Press Information Bureau
Government of India

Ministry of Science & Technology

Mon, 18 Nov 2024

‘One Day One Genome’ initiative to harness the microbial potential of India

The Department of Biotechnology (DBT) and Biotechnology Research and Innovation Council (BRIC) introducesthe 'One Day One Genome' initiative to showcase the enormous microbial potentialof India. Shri.Amitabh Kant, India’s G-20 Sherpa and Former CEO NITI announced the launch of ‘One Day One Genome Initiative’ on the 1st foundation day of BRIC held in National Institute of Immunology (NII), New Delhi on 9th November 2024

'One Day One Genome’ initiative will highlight the unique bacterial species found in our country and emphasize their critical roles in environment, agriculture and the human health.Microorganisms are crucial for our ecosystem. They play an important role in all biogeochemical cycles, soil formation, mineral purification, degradation of organic wastes and toxic pollutants along with methane production. Cumulatively they help to maintain the homeostasis in our planet. In agriculture, they help in nutrient cycling, nitrogen fixation, maintaining soil fertility, controlling pest and weeds and stress responses. Microorganisms symbiotically associate with plants and help them in nutrient and water uptake. They are indispensable part of human body. There are much more microbial cells than the number of human cells in a human body. They are essential for our digestion, immunity and even mental health. All infectious diseases are mainly caused by pathogenic microorganisms on the other hand non-pathogenic microorganisms are indispensable for our defense against infectious diseases.

Genome sequencing will allow the visualization of the hidden potential of the microbial world to the community at large. Sequencing data can be analyzed to identify the genome encoded capacities for various important enzymes, antimicrobial resistance, bio active compounds etc. Research in this field will lead to the benefit of better protection and management of our environment, development in agriculture and improvement in human health.

This initiative coordinated by Biotechnology Research and Innovation Council-National Institute of Biomedical Genomics (BRIC-NIBMG) an institute of the Department of Biotechnology.This initiative aims a release a fully annotated bacteriological genome isolated in the country freely available to the public. This will be complemented with a detailed graphical summary, infographics and genome assembly/annotation details. These documents will thus give an idea about the scientific and industrial use of these microbes. Consequently, microbial genomics data will become more accessible to the general public, scientific researchers and thereby stimulate discussions; innovations directly benefit the entire community and ecosystem.

https://pib.gov.in/PressReleasePage.aspx?PRID=2074247

Press Information Bureau
Government of India

Ministry of Science & Technology

Mon, 18 Nov 2024

Architect of Pollen development & Seed formation identified

Scientists have identified a novel gene that plays a crucial role in the development of stamens (male reproductive structure) including pollen grain and seed formation, in Arabidopsis flowering plants related to cabbage and mustard. The study opens up new possibilities for improving crop fertility and seed production.

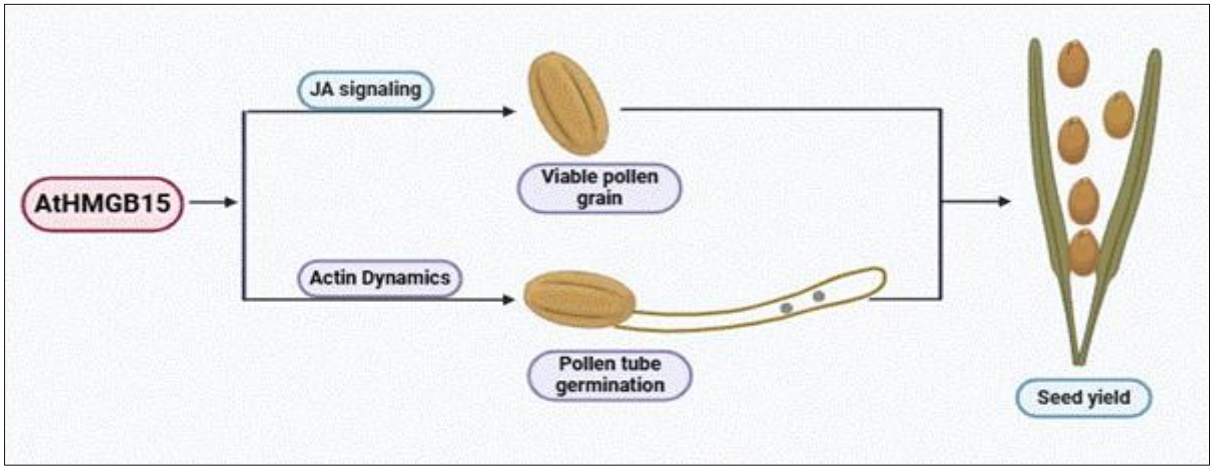
Pollen formation represents a very important developmental stage in plant life cycle. It represents the male gametophyte and its role is to deliver the genetic material to the embryo sac. The production and transfer of viable pollen grains to the stigma, germination of the pollen grains, growth of the pollen tubes down the style, and effective fertilization are necessary for the formation of a successful seed set. Thus, understanding the pollen development process not only elucidate the basic mechanism of sexual reproduction of flowering plants but also add valuable information for subsequent manipulation in crop production.

“Pollen germination speed” and “pollen tube growth” are the two important characteristic features of healthy pollens that have evolved with the evolution in flowering plants (Angiosperms). The rapid growth of the pollen tube through the style to reach ovary, is a pre-requisite for fertilization in flowering plants. Since many pollen tubes grow through the style, the reproductive success of a pollen grain is determined by its rate of pollen tube elongation.

It has been shown that maturation of pollen grain with proper structure and composition of cell wall determines its interaction with the stigma as well as its germination ability for successful fertilization. Thus, it is important to understand the molecular mechanisms responsible for pollen development, pollen hydration and pollen germination- factors that are responsible for the formation of a mature viable pollen grains.

Recent investigations on pollen development by Prof. Shubho Chaudhuri’s lab at Bose Institute, Kolkata, an autonomous institution of Department of Science and Technology, identified a novel gene named HMGB15, a non-histone protein that restructures chromatin, plays a crucial role in the development of stamens (male reproductive structure) in Arabidopsis.

A mutation in this gene, causes partial male sterility in plants. The mutant plants exhibit low pollen grain viability, defective pollen wall patterning, retarded pollen tube germination rate, shorter filaments that are unable to reach the stigma resulting in reduced seed production. The abnormalities in the mutants are due to the disruption in gene regulatory networks important for pollen development, maturation and pollen tube germination.



Molecular analysis indicated that several developmental pathways like biosynthesis of phytohormone jasmonic acid (JA), apoptosis of tapetal cells and actin polymerization dynamics have been severely affected in the HMGB15 loss of function mutants.

Understanding this mechanism on a model organism used for studying plant biology, not only sheds light on the intricate biology of plants but also opens new possibilities for improving crop fertility and seed production. The studies have been published in reputed plant journals namely, Plant Physiology (Sachdev et al.,2024) and Plant Reproduction (Biswas et al.,2024). Financial support for this work was provided by SERB, India.

https://pib.gov.in/PressReleasePage.aspx?PRID=2074228

THE ECONOMIC TIMES

Wed, 19 Nov 2024

India's GSAT-20 rides SpaceX Falcon-9 to orbit: New satellite set to revolutionise telecom infrastructure

On November 18, 2024, at 12:01 AM IST, India achieved a significant milestone with the launch of GSAT-20 aboard SpaceX's Falcon-9 rocket. This marks the first time NewSpace India Limited (NSIL), the commercial arm of ISRO, has partnered with SpaceX for satellite deployment. The satellite separated from the rocket 34 minutes post-launch and was successfully placed into its geosynchronous transfer orbit. In an earlier TOI report, NSIL Chairman and Managing Director Radhakrishnan D emphasized the importance of the collaboration, stating, "SpaceX was selected against an RFP we had floated last year. There were other bidders too. This marks a new beginning as we launch on a US rocket from their soil. The present agreement is only for this launch, and we will look at future requirements as and when we need."

Key Features of GSAT-20

The GSAT-20 satellite represents a cutting-edge advancement in satellite communication technology, with features tailored to meet India's growing connectivity needs.

- High Data Capacity: With a throughput of 48 Gbps across 32 beams, the satellite ensures robust broadband coverage, extending to remote areas like the Andaman, Nicobar, and Lakshadweep Islands.
- Ka-Band Technology: Utilizing the Ka-band frequency, GSAT-20 is designed to support in-flight internet services and Smart Cities initiatives.
- Durability and Efficiency: The satellite is engineered for a 14-year mission life and features advanced materials, including CFRP structures and Li-ion batteries.

Demand-Driven Model

This launch is part of the Indian government's 2020 space sector reforms, which mandate NSIL to develop satellites based on service demand. GSAT-20 is NSIL's second demand-driven satellite after GSAT-24, which was launched in 2022 and leased entirely to Tata Play.

Unlike GSAT-24, which served a single client, GSAT-20 will cater to multiple users. An official noted in a TOI report, "While this is also a dedicated satellite, it is not meant for a single company. There are multiple players in the fray."

Why SpaceX Was Chosen

Historically, India relied on French Arianespace rockets for launching heavier satellites. However, the 4,700 kg GSAT-20 exceeded the capacity of India's launch vehicles, prompting NSIL to choose SpaceX's Falcon-9 through a competitive bidding process. The partnership with SpaceX not only marks a new chapter for NSIL but also reflects India's increasing engagement with international space agencies.

India's Expanding Space Ambitions

NSIL, established as part of India's push to commercialize space, is tasked with owning, operating, and funding satellite missions to meet market needs. Its first demand-driven mission, GSAT-24, launched in June 2022, set a precedent for private sector involvement in India's satellite industry. With the GSAT-20 launch, NSIL is furthering its mission to enhance connectivity infrastructure across India. This aligns with the government's vision to leverage space technology for national development, especially in bridging the digital divide. In June 2022, NSIL successfully launched its first demand-driven satellite mission, GSAT-24 (now called GSAT-N1), which is fully leased by TataPlay. "While this is also a dedicated satellite, it is not meant for a single company. There are multiple players in the fray," an official told TOI.

Implications and the Road Ahead

The successful launch of GSAT-20 highlights India's evolving approach to space exploration, combining domestic expertise with global partnerships. As connectivity becomes increasingly vital for Smart Cities, in-flight internet, and remote regions, GSAT-20 is poised to play a crucial role. This mission underlines India's ability to innovate in satellite technology while leveraging international platforms to realize its ambitions, marking another singnificanrt step in india's significant journey.

https://economictimes.indiatimes.com/news/science/indias-gsat-20-rides-spacex-falcon-9-to-orbit-new-satellite-set-to-revolutionise-telecom-infrastructure/articleshow/115432638.cms

THE ECONOMIC TIMES

Tue, 18 Nov 2024

This is how air pollution silently damages your eyes

1. Delhi's AQI crisis : The rising air pollution in Delhi and parts of North India has made many people notice how their eyes feel itchy, watery, or just plain tired. As the AQI (Air Quality Index) worsens, it's not just our lungs that suffer – our eyes are also at risk. Here's how pollution affects them and what you can do about it.

2. Irritation and redness : Ever felt a burning sensation in your eyes when you step outside? Polluted air is full of harmful particles like dust, smoke, and chemicals. These tiny particles irritate the eyes, leading to redness and a constant urge to rub them, which can worsen the problem

3. Dryness and fatigue : Pollution can reduce the natural moisture in your eyes, making them feel dry and scratchy. Staring at screens in polluted environments only adds to the strain, leaving your eyes feeling tired and heavy. This dryness is more common in areas with high AQI levels, like Delhi during the smog season.

Risk of infections : Pollution lowers your eyes' natural defences, making them more prone to infections like conjunctivitis or styes. The bacteria and toxins in the air stick to the surface of your eyes, increasing the chances of infections, especially if you touch your face often.

Worsening of existing eye issues : If you already wear glasses, have allergies, or suffer from conditions like dry eye syndrome, pollution can make things worse. Sensitive eyes are more likely to react to pollutants, leading to flare-ups and discomfort that are hard to ignore.

Risk of infections : Continuous exposure to high levels of pollution can cause long-term damage to the eyes. Studies show that prolonged contact with polluted air may lead to more serious problems like corneal damage or even cataracts over time.

https://economictimes.indiatimes.com/news/science/this-is-how-air-pollution-silently-damages-your-eyes/delhis-aqi-crisis/slideshow/115415315.cms

THE TIMES OF INDIA

Tue, 19 Nov 2024

NASA plans to lay oxygen pipeline at Moon’s south pole for Artemis mission

NASA is developing the Lunar South Pole Oxygen Pipeline (L-SPoP) to revolutionize lunar exploration. This innovative pipeline will transport oxygen extracted from lunar resources to support human missions under the Artemis program. By utilizing in-situ materials and robotic construction, L-SPoP aims to reduce costs, risks, and is pushing the boundaries of lunar exploration with the proposed Lunar South Pole Oxygen Pipeline (L-SPoP), a revolutionary project designed to enhance Moon operations. This initiative aims to address the critical challenge of transporting oxygen on the Moon, a key resource for sustaining long-term human missions under the Artemis program.

By utilising in-situ resources, L-SPoP seeks to reduce both the costs and risks associated with oxygen transport, which is essential for life support and rocket propulsion. The pipeline will be constructed using lunar materials, primarily aluminium, and is designed to operate autonomously with minimal power requirements. NASA's Lunar South Pole Oxygen Pipeline (L-SPoP): A game changer for lunar exploration NASA is pioneering an ambitious initiative to improve operations on the Moon with the proposed Lunar South Pole Oxygen Pipeline (L-SPoP). This groundbreaking project aims to dramatically reduce the cost and risks associated with transporting oxygen, a vital component for sustaining long-term human missions under the Artemis program.

The Artemis program, which seeks to establish a permanent human presence on the Moon, relies heavily on utilising in-situ resources to reduce the need for Earth-based supplies. Oxygen, essential for life support and rocket propulsion, is being extracted from lunar regolith and water ice using advanced technologies that NASA has already invested in. These oxygen extraction methods are set to be demonstrated on a large scale by 2024, with plans to support Artemis astronauts as early as 2026. Currently, oxygen extracted from the Moon is stored in compressed gas tanks or liquefied in dewars, which are then transported across the lunar surface. This process is energy-intensive and costly due to the vast distances between resource extraction sites and lunar habitats.

The science behind NASA’s Lunar South Pole Oxygen (L-SPoP) pipeline system

The proposed L-SPoP system envisions a 5-kilometre pipeline to transport oxygen from extraction sites to storage or liquefaction facilities near lunar bases. Made from in-situ materials, primarily lunar aluminium extracted from the Moon's surface, the pipeline would feature a modular design that is adaptable, repairable, and sustainable. This approach aims to reduce reliance on Earth-based resources and lower operational costs.

Key features of the L-SPoP system

1. Robotic construction and repair: Robotic systems would construct and maintain the pipeline using metals derived from lunar regolith.

2. Oxygen flow rate: The pipeline would transport oxygen at a rate of about 2 kg per hour, enough to meet NASA's initial requirement of 10,000 kg annually.

3. Minimal power requirements: The pipeline is designed to operate with low power demands, ensuring sustainability over time.

4. Long lifespan: Projected to last over 10 years, the pipeline will have high operational reliability, even in the harsh lunar environment.

Innovative materials and design considerations for the L-SPoP system

NASA's plan for the L-SPoP also incorporates innovative materials, such as lunar aluminium from the South Pole, with a passivation coating applied to prevent corrosion. Other materials, including iron and magnesium, will be considered during the design phase. The L-SPoP project marks a significant leap toward building a sustainable lunar infrastructure. By reducing the costs and risks of oxygen transportation, NASA hopes to enable a permanent human presence on the Moon, supporting the Artemis program and future deep-space exploration.

https://timesofindia.indiatimes.com/science/nasa-plans-to-lay-oxygen-pipeline-at-moons-south-pole-for-artemis-mission/articleshow/115407366.cms

Mon, 18 Nov 2024

IIT Bombay researchers develop AroTrack water pollution detection device

RIn a significant development for sustainable environmental management, scientists at the Indian Institute of Technology Bombay (IIT Bombay) have introduced an economical and portable device to accurately detect harmful pollutants such as phenol or benzene in water. The device, named AroTrack, can be a game-changer given the increasing water pollution due to industrialisation, urbanisation, and unregulated effluent discharge.

When access to safe drinking water is shrinking, pollution of the remaining freshwater bodies is a serious concern. In cities worldwide, untreated industrial effluents are often discharged into the rivers, bringing in hazardous pollutants like phenol, benzene, and xylenols. Such chemicals, collectively called 'aromatic xenobiotic' compounds, are organic compounds that are similar in structure to benzene, consisting of a ring of carbon molecules. In large quantities, the aromatic xenobiotics can be extremely toxic to living organisms and yet difficult to detect.

Over the past few years, such pollutants have resulted in water contamination, leading to health crises with millions of people affected worldwide. For instance, a massive oil spill in Lanzhou, China, exposed about 2.4 million people to benzene. Similarly, in the southern Indian city of Madurai, benzene-contaminated groundwater has increased human health risks. Unfortunately, current methods for detecting aromatic xenobiotics in water are expensive, require skilled technicians, and lack portability, limiting their widespread use.

In a bid to address these challenges, Prof. Ruchi Anand from the Department of Chemistry, Prof. Rajdip Bandyopadhyaya from the Department of Chemical Engineering and their team at the Indian Institute of Technology Bombay (IIT Bombay) have now introduced a simple and affordable biosensing device capable of detecting these harmful compounds. “AroTrack was born out of the philosophy to make field-usable analytical devices, based on translating analytical capabilities generated in the laboratory into actual field-ready devices. It is designed so that almost any user, technically trained or layman, may quickly learn and generate accurate data for traditionally difficult to measure and distinguish aromatic xenobiotic pollutants,” remarks Prof. Bandyopadhyaya about the motivation behind developing AroTrack.

The IIT Bombay device uses proteins typically found in bacteria living in heavily polluted environments to effectively identify multiple aromatic pollutants in water. Once mixed in the water sample, the protein undergoes a highly selective ATP hydrolysis chemical reaction if an aromatic compound is present in the sample. This reaction is expressed with a change in the colour of the protein solution, which AroTrack can then detect. The device is highly robust and compact, measuring slightly smaller than a small projector. “AroTrack can do (detect) multiple pollutant aromatic xenobiotics and can be carried to remote places. It is quite small and will also work in rural settings or difficult-to-reach sites,” explains Prof. Anand.

The key component of the device is a biosensing module called MopR - a sensitive sensor for detecting phenol. Prof. Anand’s research team engineered it from the Acinetobacter calcoaceticus bacteria in 2017. MopR is both selective and stable, meaning it can detect pollutants even in complex environments with a high degree of precision. Researchers at IIT Bombay have further diversified the MopR biosensor to detect other pollutants from the benzene and xylenol groups by engineering mutations in the bacterial protein. “The protein biosensing is very specific as the protein sensing pocket is tailor-made for the ligand (ion or molecule, like phenol or benzene). We have engineered mutations in the DNA of the protein sequence that can give mutant versions of the protein that now sense different molecules, creating a battery of sensors. Each sensor is particularly designed for a ligand,” explains Prof. Anand.

Once interfaced with an in-house, multi-channel monitoring apparatus, the MopR-based sensor forms the core of the newly developed aromatics tracking device—AroTrack. Talking about how the AroTrack detects the pollutants using the biosensor modules, Prof. Bandyopadhyaya explains, “AroTrack contains a light emitting diode (LED)-phototransistor assembly, that shines a light of

appropriate wavelength through the sample and detects how much is absorbed. A more intense colour generates a higher absorbance."

Despite the complexity of AroTrack's function, the team managed to keep the overall cost of the device to a minimum of $50 (less than Rs. 5000) without compromising its sensitivity. "Using in-house 3D printing in our laboratory, we were able to economically design, fabricate and iterate a fully functional device. Also, the cost could be kept down by using basic electronics and open-source, mass-produced microcontrollers for data processing and analysis," remarks Prof. Bandyopadhyaya.

AroTrack can detect several aromatic contaminants, including phenol, benzene, and 2,3-dimethylphenol, even when these pollutants are present in low concentrations - usually in the 10-200 parts per billion (ppb) range. Tests in simulated wastewater and actual environmental samples have found that the AroTrack is highly reliable, offering a degree of accuracy and efficiency on par with modern spectrophotometers, which are currently used for detection. The device also reliably worked in water temperatures up to 50 degrees Celsius and completed the tests in under 30 minutes.

Moreover, due to its low cost, battery-operated nature, and portability, AroTrack can be ideal for rural and low-income settings that often lack resources and have difficulty accessing expensive laboratory tests. Explaining the next steps in expanding the capabilities of AroTrack, Prof. Anand says, "We are currently trying to increase the type of pollutants to biphenyl aromatics and pollutants that are complex aromatics ".

Speaking about its market readiness, Prof. Bandyopadhyaya adds, "The product is ready as an initial functional prototype, which can demonstrate all the reported functions. To make it fully market-ready, more field trials and quality analysis are needed to assess its robustness under more varied working conditions in the field, with a wider variety of water sources and compositions."

The AroTrack device underscores the significant potential of employing low-cost, open-source electronic components to create field-ready, environment-monitoring devices. As a viable alternative to traditional analytical technologies, it has the potential to revolutionise how we test water quality—a critical first step toward a safer, healthier world.

IIT Bombay's address for source information (https://www.iitb.ac.in/research-highlight/iit-bombay-team-develops-affordable-portable-water-pollutant-detecting-device*)*

News Link https://www.news9live.com/science/iit-bombay-researchers-develop-arotrack-water-pollution-detection-device-2753115