

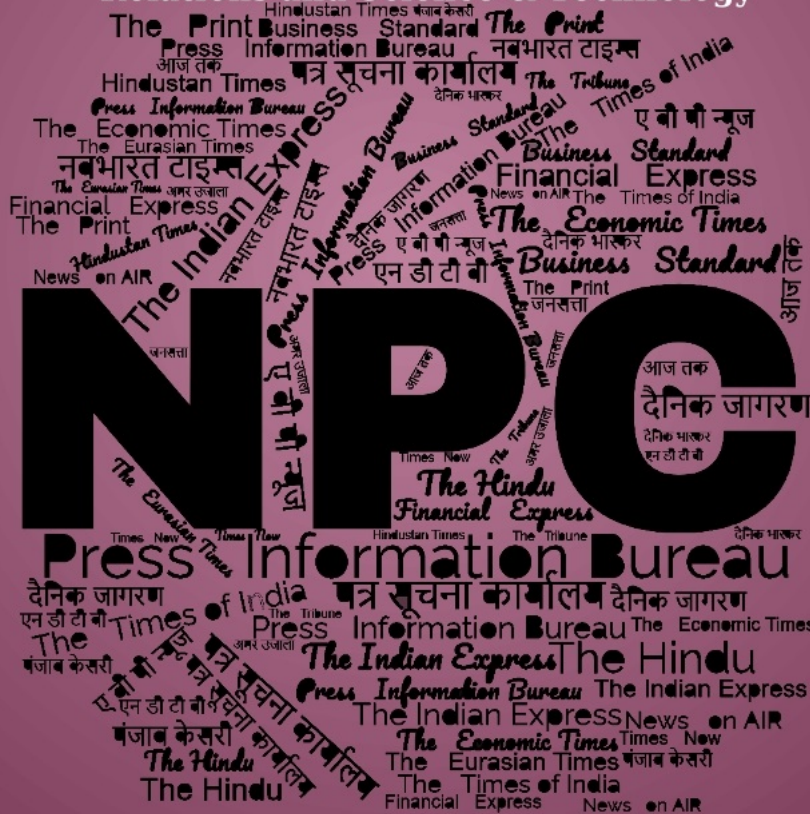
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Defence Ministry issues RFI to procure 1,500 anti-tank guided missiles for Indian Army

Indian Army is planning to augment its tank-based offensive capabilities with the Ministry of Defence (MoD) issuing a request for information (RFI) for capital procurement of 1,500 new generation anti-tank guided missile (ATGMs) launchers on Thursday.

The sources said that the missile counts might touch 20,000 pieces. The RFI also sought information for simulators, for the Indian Army, aimed at further enhancing its operational capabilities to strike and destroy tanks and other armoured vehicles.

These ATGMs are to be procured under the "Buy (Indian-IDDMM)" category with 60 per cent indigenous content. Under the Buy (Indian-IDDMM) the procurement of products is done from an Indian vendor that has been indigenously designed, developed and manufactured with a minimum of 50 per cent indigenous content on the cost basis of the total contract value.

The RFI has been issued with a view to finalising SQRs (Service Quality Requirements), deciding procurement category and identifying probable Indian vendors who are capable of supplying new generation ATGMs along with launcher systems within four years of the award of the contract. SQRs are parameters set for the equipment to be inducted.

As per the RFI, the ATGMs along with launcher systems should have the ability to be deployed in all terrains, including plains, deserts, high-altitude up to 5500 meters or 18,000 feet, coastal as well as island areas. These ATGMs can be deployed along the western border with Pakistan and the northern border with China.

The RFI requires the weapon systems to be operational by day and night and in commonly encountered weather conditions including rain, fog, humidity and dust. The missiles and all other sub-systems should be operational in - 45 degrees to + 45 degrees Celsius.

The ATGMs must be able to destroy enemy tanks, armoured personnel carriers, combat vehicles, low-flying helicopters, concrete structures and other vehicle-based weapon platforms and positions. The requirement also includes modular design so that it can be lent for future upgrades through simple modifications not leading to design and structural change.

"It should also facilitate integration and installation, without impacting the performance of any system or subsystem," the RFI read.

The Indian Army has been successful in deploying armoured vehicles including tanks in all three sectors of the Line of Actual Control (LAC). The Line of Actual Control has a peculiar terrain where the altitude varies from 9,000 ft to 18,000 ft with intermittent plains and valleys. The protracted standoff in eastern Ladakh saw the mobilisation of tanks and BMPs (Russian Boyevaya Mashina Pekhoty), or Infantry Fighting Vehicles, which were lined up as close as 50 ft to each other.

These vehicles can operate in the plains, semi-desert, desert and mountainous terrain with the capability to cross the rivers and streams (amphibious capability) and operate in a CBRN (Chemical, Biological, Radiological and Nuclear) environment. Coming to the ATGMs the Indian Army operates second-generation French-origin anti-tank guided missile Milan and Soviet semi-automatic wire-guided missile Konkur, which are in service with the Army. India also has indigenous anti-tank guided missile Nag in its arsenal.

In April this year, successful final developmental trials of the third generation Man Portable Anti-Tank Guided Missile (MPATGM) were carried out. **Indigenously designed and developed by Defence Research and Development Organisation (DRDO)**, the short-range missile is said to be equipped with day/night and top attack capability.

<https://www.newindianexpress.com/nation/2024/Oct/10/defence-ministry-issues-rfi-to-procure-1500-anti-tank-guided-missiles-for-indian-army>

Defence News

Defence Strategic: National/International

THE ECONOMIC TIMES

Thu, 10 Oct 2024

India to get \$4bn predator's drones: How 31 new killing machines will strengthen defence against China

In a significant step to enhance India's defense capabilities, the Cabinet Committee on Security (CCS), led by Prime Minister Narendra Modi, has approved two strategic projects: the procurement of 31 armed drones from the United States and the indigenous development of two nuclear-powered attack submarines.

This decision arrives at a pivotal time, especially with the upcoming US Presidential elections, highlighting the importance of the defense deal for both nations. The deal arrives at a critical juncture when there is a perceived need for India to bolster its aerial capabilities. As China continues to advance its drone technologies and enhance its military presence, India's acquisition of Predator drones represents a proactive step to secure its interests and respond effectively to regional security challenges.

Strategic Acquisition of Armed Drones

The primary focus is on India's acquisition of 31 MQ-9B Predator drones from General Atomics, valued at approximately \$3.99 billion. This deal marks a transformative moment in India's defense modernization efforts, underscoring the growing strategic partnership between India and the US. The acquisition is expected to significantly enhance India's intelligence, surveillance, and reconnaissance (ISR) capabilities.

The MQ-9B drones, capable of flying for up to 40 hours, can strike targets on land, sea, and in the air, making them invaluable for the Indian Armed Forces. The deal includes 16 Sky Guardian and 15 Sea Guardian variants, with the Indian Navy receiving 15 drones, while the Army and Air Force will each get eight. These drones will provide real-time surveillance and conduct precision strikes in high-threat environments, crucial for maintaining regional stability.

What makes predator drones so deadly

The Predator drones are capable of carrying a range of munitions, including Hellfire missiles, GBU-39B precision-guided bombs, and high-fire rotary cannons. Their high endurance in challenging terrains and ability to operate at altitudes of up to 25,000 feet allow them to gather intelligence and conduct strikes over extended periods. This operational versatility positions the drones as formidable assets in various combat scenarios.

Their superior surveillance capabilities surpass those of the P-8I aircraft manufactured by Boeing, enabling more effective monitoring of maritime activities. The drones' advanced sensors and cameras provide real-time video and intelligence data, allowing operators to track enemy movements without risking personnel. The high accuracy of Predator drones facilitates strikes against critical infrastructure and high-value targets with minimal collateral damage, although concerns remain about civilian casualties from drone strikes.

How will it help India's defence capabilities?

The acquisition of Predator drones is set to significantly bolster the maritime surveillance capabilities of the Indian Navy, particularly in strategically important waters from the Gulf of Aden to the Sunda Straits. With growing concerns over illicit maritime activities and the presence of Chinese surveillance vessels in the Indian Ocean, the Navy plans to utilize these drones to monitor potential threats effectively.

This enhanced capability is crucial for India's national security, given the increasing assertiveness of China in the region and its support for India's regional rival, Pakistan. The Predator drones can play a vital role in ensuring the Indian Navy can counter these threats and maintain a strategic edge in the Indian Ocean.

Versatility Across the Armed Forces

While primarily assigned to the Navy, the proposed acquisition allows for potential utilization by the Indian Air Force and Army as well. The versatility of the drones enables them to support various operational requirements, from reconnaissance missions to targeted strikes against enemy installations.

This multi-service integration aligns with India's broader defense strategy to improve aerial responses amid advancements in drone technologies by adversaries.

Technological Advantages and Timeliness

The agreement must be finalized by October 31, 2024, to avoid price renegotiations. The urgency emphasizes India's commitment to enhancing its unmanned aerial capabilities amid escalating regional security concerns.

The acquisition aligns with India's broader defense modernization strategy, which aims to bolster military posture in the Indo-Pacific region. Dr. Vivek Lall, Chief Executive of General Atomics Global Corporation, has played a key role in negotiating this deal. His expertise in defense trade and diplomacy has significantly contributed to strengthening US-India defense ties.

Under his leadership, General Atomics is working with several Indian companies for maintenance and potential manufacturing of drone components, aligning with India's "Make in India" initiative.

Nuclear-Powered Attack Submarines Development

Alongside the drone procurement, the CCS has also approved the indigenous construction of two nuclear-powered attack submarines (SSNs). This project is classified, but it aims to enhance India's deterrent capabilities against regional adversaries, particularly in the context of China, which possesses advanced nuclear submarines.

The Indian Navy has long advocated for at least two indigenously designed SSNs to strengthen its strategic position in the Indo-Pacific. The SSNs can remain submerged for extended periods, determined mainly by crew endurance and supplies, unlike diesel-electric submarines, which must surface daily to recharge. The government has prioritized the SSN project to bolster India's underwater capabilities significantly.

Strengthening India-US Defense Relations

This procurement is part of a broader defense cooperation strategy between India and the US, which has seen notable progress in recent years. Prime Minister Modi's recent visit to the US highlighted the importance of defense collaborations, with the drone acquisition being a significant outcome of discussions with President Joe Biden.

The MQ-9B deal reflects growing trust and collaboration between the two nations, facilitated through the US Foreign Military Sales (FMS) program, which simplifies defense transactions. This partnership aims to address common security challenges, particularly in the Indo-Pacific region, reinforcing the shared commitment to peace and stability.

The acquisition of 31 MQ-9B Predator drones and the approval for two indigenous nuclear-powered attack submarines represent critical advancements in India's defense modernization

efforts. These initiatives are designed to enhance India's ISR capabilities and strengthen maritime and territorial security, essential for maintaining regional stability in the IndoPacific.

<https://economictimes.indiatimes.com/news/defence/india-to-get-4bn-predators-drones-how-31-new-killing-machines-will-strengthen-defence-against-china/articleshow/114112877.cms>

THE ECONOMIC TIMES

Fri, 11 Oct 2024

Navy chief meets Japan Self Defence Force chief to strengthen bilateral ties during MALABAR 2024

Indian Navy Chief Admiral Dinesh K Tripathi met with General Yoshihide Yoshida, Chief of Staff of the Japan Self Defence Force, on Thursday in New Delhi. This meeting was part of Exercise 'MALABAR 2024,' a military exercise involving India, Japan, the United States, and Australia aimed at promoting stability in the Indo-Pacific region. During their meeting, General Yoshida and Admiral Tripathi discussed ways to enhance existing defence cooperation avenues, explore technological collaboration, and identify new opportunities to strengthen bilateral ties.

The Indian Navy shared pictures from the meeting, stating, "Gen Yoshihide Yoshida, Chief of Staff, Joint Staff, Japan Self Defence Force, on a visit to India for Exercise #MALABAR2024, interacted with Adm Dinesh K Tripathi, #CNS on #10Oct 24, #NewDelhi."

"Discussions progressed on existing defence cooperation avenues, technological collaboration and new opportunities to strengthen bilateral ties towards a Free and Open #IndoPacific," the post added.

On Wednesday, naval forces from Australia, Japan, and the US joined India for the opening ceremony of the field training exercise "Malabar 2024" in Vishakhapatnam. This year marks the 28th iteration of the Malabar exercise, which began in 1992 as a bilateral exercise between the United States and India.

The exercise has since evolved in scope and complexity and now includes Japan and Australia. This marks the fifth time that all four nations have participated in Malabar to advance the collective planning, integration and employment of advanced warfare tactics across participating nations.

Australian, Indian, Japanese, and US maritime forces routinely operate together across the Indo-Pacific in support of regional security and stability. The lead of this year's exercise is India. The Malabar planning and exercise lead rotates each year among participating nations, along with the exercise location to demonstrate the combined ability to exercise across the entire Western Pacific and Indian Ocean.

<https://economictimes.indiatimes.com/news/defence/navy-chief-meets-japan-self-defence-force-chief-to-strengthen-bilateral-ties-during-malabar-2024/articleshow/114133828.cms>

CCS clears launch of 52 surveillance satellites

The Cabinet Committee on Security (CCS) headed by Prime Minister Narendra Modi has approved phase III of its Space Based Surveillance (SBS) mission for better land and maritime domain awareness for civilian and military applications. The project is being handled by the National Security Council Secretariat along with the Defence Space Agency under the integrated headquarters in the Defence Ministry.

While the Modi government is silent on the approval, it is understood that the proposal cleared by CCS involves the launch of at least 52 satellites in low earth orbit and geostationary orbit for surveillance. Costing ₹26,968 crore, the proposal involves the construction and launch of 21 satellites by ISRO and the remaining 31 by private companies.

SBS 1 was initiated by the Vajpayee government in 2001, and involved the launch of four satellites for surveillance, Cartosat 2A, Cartosat 2B, Eros B and Risat 2. SBS 2 came in 2013 with the launch of six satellites, Cartosat 2C, Cartosat 2D, Cartosat 3A, Cartosat 3B, Microsat 1 and Risat 2A. The newly cleared SBS 3 shows that India will be launching 52 satellites within the next decade. HT learns that the three services will have dedicated satellites for their land, sea or air-based missions.

With the Modi government already signing in January, a letter of intent with France for the joint construction and launch of military satellites, the Indian focus is to acquire capabilities which can detect enemy submarines in the Indo-Pacific as well as track infrastructure construction by its adversaries on the land and sea border with India. The SBS 3 mission will also be helped by the Indian acquisition of 31 Predator drones from US-based General Atomics as the platform has very potent surveillance capabilities apart from its weapons package. India tested its anti-satellite capabilities through test firing on March 29, 2019, when an Indian missile destroyed a live satellite in orbit.

<https://www.hindustantimes.com/india-news/exclusive-ccs-clears-launch-of-52-surveillance-satellites-101728615288379.html>

THEWEEK

Thu, 10 Oct 2024

India's Rs 40,000 crore nuclear submarine plans set to significantly boost Navy's fighting powers

On Wednesday, the Cabinet Committee on Security (CCS), approved the construction of two nuclear-powered conventional submarines in a bid to significantly enhance India's military

proWess. These submarines will be built at a cost of around Rs 40,000 crore. The initial plan was to go for as many as 6 nuclear-powered attack submarines (SSNs).

The move to construct the indigenous submarines is part of India's efforts to modernise its military which includes enhancing its naval capabilities and improving domestic weapons-making capabilities in the wake of China's increased presence in the Indian Ocean region.

India currently does not possess an SSN.

Nuclear-powered attack submarines are among the most potent naval weapons in the world as they are much faster, quieter, and can stay longer in water when compared to diesel-powered variants of submarines, making them tough to detect. Designed primarily for offensive operations against enemy submarines and surface ships, SSNs use nuclear reactors for propulsion. Indian Navy currently has 17 diesel-powered attack submarines and one nuclear-powered ballistic missile submarine, while China has 12 nuclear-powered submarines.

“SSNs are a game changer. They are powerful platforms with stealth and unlimited endurance. They can remain underwater indefinitely and operate far away from the port for long periods and at high speeds. They can move along as part of the carrier battle group. Armed with long-range missiles, they can change the shape of maritime battle,” EurAsian Times quoted former Indian Navy submariner Commodore Anil Jai Singh as saying.

The construction of submarines, which will happen at the Ship Building Centre in Visakhapatnam will also involve private players like Larsen & Toubro, according to news agency ANI. According to reports, the new submarines will be different from the Arihant-class nuclear-powered submarines the country is now building.

<https://www.theweek.in/news/defence/2024/10/10/indias-rs-40000-crore-nuclear-submarine-plans-set-to-significantly-boost-navys-fighting-powers.html>

ThePrint

Thu, 10 Oct 2024

Amid concerns about use of Chinese parts in drones, Army general urges industry to be transparent

Concerned about the use of Chinese spare parts in drones supplied to the Army, a top Army officer Wednesday sought honesty from companies dealing in drones. This comes after intelligence agencies flagged the use of Chinese components in drones purchased by the armed forces. Speaking at Bharat Drone Varta-Road to Indigenisation—an event organised by the Federation of Indian Chambers of Commerce & Industry (FICCI) in New Delhi—Major General CS Mann, additional director general, Army Design Bureau, said, “Since it’s a matter of national security concern, there have to be truthful claims of indigenous capabilities. That’s the start point for every one of us. Only then will we be able to address the challenges which are there.”

Intelligence agencies have raised concerns about Chinese components in drones purchased from domestic private players, mostly for deployment in border areas in the northern and eastern sectors, as reported by ThePrint earlier. Moreover, it came to light in August that the defence ministry had put on hold an order for 200 logistics drones from Dhaksha Unmanned Systems Pvt Ltd, following allegations that it was using Chinese components.

Earlier, in a letter on 25 June, the defence ministry had warned industry bodies—FICCI, the Associated Chambers of Commerce & Industry of India (ASSOCHAM) and the Society of Indian Defence Manufacturers (SIDM)—to “sensitise” their members so that they exercise “caution” while procuring defence items from Dhaksha and two other companies. The ministry and the Army are now formulating protocols to ensure Chinese parts do not go unnoticed. Maj Gen Mann also talked about how the requirement for indigenisation had long been seen in the light of logistical concerns—to have “adequate protection against supply chain disruptions, which have been felt more in the near past”—but events such as the pager blasts in Lebanon had now made it a matter of national security.

Israel’s Mossad spy agency had allegedly planted a small number of explosives inside 5,000 pagers ordered by the Lebanese group Hezbollah months before the detonations that killed nine people and wounded nearly 3,000 others last month, as has been reported by Reuters. Therefore, indigenisation must go far beyond lip service, he said. “We need to look under the hood and we need to do it seriously.”

Referring to the Drone Shivir, a conference held by the Army in collaboration with the Drone Federation of India this month, he said, “The biggest takeaway from the Drone Shivir, conducted only six days back, was that unless we have full indigenisation of components within the country, it is actually difficult.”

He listed out the “vulnerable and critical components” that India needs to pay special attention to in drones. On a broader spectrum, he said, “Anything to do with data, communications and command and control are the components which are critical for us, which have to be indigenised. These are the ones which create security vulnerabilities. Hardware is also important.”

The major components that need to be indigenised, he said, are autopilots with redundant sensors, secure communications with short- and long-range radios (short-range being anything from 5 to 10 km, long-range 25-50 km), handheld ground stations and remote controls with integrated radio. He also referred to electro-optical/infrared (EO/IR) payloads—sensors used for purposes like target acquisition and tracking—and brushless DC (BLDC) motors with compatible speed controllers.

The need for R&D and investment is a major challenge when it comes to indigenisation, he said. “But I can assure you that because of the various provisions available, under the defence procurement and specifically talking about the Army Technology Board, we are ready to do the funding. That funding is direct funding and not in terms of incentives later on.” He said that the Army would give industry “any amount of funding” based on the means and financial powers at various levels.

<https://theprint.in/defence/amid-concerns-about-use-of-chinese-parts-in-drones-army-general-urges-industry-to-be-transparent/2305866/>

Science & Technology News



Press Information Bureau
Government of India

Ministry of Science & Technology

Thu, 10 Oct 2024

Experts deliberated on challenges & prospects of hydrogen energy commercialisation

Industrialists, entrepreneurs, business aspirants and enthusiasts from various sectors discussed the challenges and prospects of hydrogen energy commercialization at a workshop on fostering start-up ecosystems for commercialization of hydrogen technologies.

Dr. R Vijay, Director of ARCI, stressed on the importance of reducing the cost of hydrogen production to make it more market-attractive while speaking as Guest of Honour at the workshop organised by ARCI an autonomous institution of the Department of Science and Technology (DST) on the occasion of National Hydrogen and Fuel Cell Day on 8th October 2024.

He also showcased ARCI's role in transferring hydrogen technologies both at the component level and through integrated systems and said that ARCI is supporting many start-ups in the energy sector.

The 7th consecutive annual hydrogen workshop was organised at the Centre for Fuel Cell Technology of International Advanced Research Centre for Powder Metallurgy and New Materials (ARCI), at IITM Research Park, Chennai.

In his inaugural address, Prof. Mohammad Rihan Director General of the National Institute of Solar Energy (NISE), highlighted the mission-mode approach of integrating solar power with electrolyzer for green hydrogen generation for energy storage and conversion to electricity through fuel cells. He underscored the synergy between solar energy and hydrogen technologies, offering a sustainable pathway toward green energy. He also mentioned that ARCI and NISE have already signed a MoU to jointly work for the realisation of the above approach.

Dr. R. Gopalan, Former Regional Director of ARCI, Chennai, emphasized the need for a circular economy in hydrogen production to further reduce costs and highlighted India's emerging leadership in green ammonia synthesis alongside other developed nations.

Eminent speakers such as Dr. G.A. Pathanjali, Managing Director of High Energy Batteries, Tiruchirappalli, Shri. Krishnan Sadagopan, Senior Vice President at Ashok Leyland, and Dr. Ramadas Arumugam Sakunthalai, Director at the Global Automotive Research Centre (GARC), discussed the critical role of hydrogen in the Indian automotive market. They delved into hydrogen's application in transportation and the challenges and potential for growth in this sector.

Several start-up founders and representatives shared their experiences with hydrogen production and utilization, discussing their capabilities as well as the hurdles they face in scaling their technologies. Key challenges such as cost, infrastructure development, and regulatory barriers were highlighted. Participants explored strategies to reduce production and distribution costs to make hydrogen more economically viable.

The workshop underscored the need for collaboration between industry, academia, and research institutions, with ARCI playing a pivotal role in fostering these partnerships. This collaboration is seen as essential for achieving hydrogen economy in India.

This year's workshop not only celebrated National Hydrogen and Fuel Cell Day but also marked a significant step in India's journey towards a green energy future. The discussions and insights shared during the event will contribute to the development of hydrogen technologies that can reshape the global energy landscape.

<https://pib.gov.in/PressReleasePage.aspx?PRID=2063774>



Press Information Bureau
Government of India

Ministry of Science & Technology

Thu, 10 Oct 2024

New cancer therapy target could help patients overcome resistant to current treatments

Scientists have identified a promising new target for cancer treatment by activating a DNA repair enzyme called TDP1, suggesting a combination therapy which could be a potential precision medicine especially for those resistant to current cancer remedies. Existing anticancer drugs like Camptothecin, Topotecan, and Irinotecan target an enzyme crucial for DNA replication and transcription called Topoisomerase 1 (Top1). Cancer cells often develop resistance to such single-agent treatments and hence require alternate therapy methods.

In order to explore such alternative routes to treatment, scientists at the Indian Association for the Cultivation of Science (IACS), Kolkata, an autonomous institute of the Department of Science and Technology (DST) probed how cancer cells repair DNA during cell division and respond to chemotherapy that targets the enzyme Top1, often leading to drug resistance.

The research published in The EMBO Journal 2024 highlights two key proteins --Cyclin-dependent kinase 1 (CDK1) and Tyrosyl-DNA phosphodiesterase 1 (TDP1). The researchers led by Prof. Benu Brata Das found that cancer cells can counteract the effect of existing drugs by activating TDP1, a DNA repair enzyme, allowing them to survive. While investigating how cancer cells repair DNA during cell division and respond to DNA damage induced by enzyme Topoisomerase 1 (Top1), the scientists discovered the critical roles of the proteins CDK1 and TDP1 that regulate the DNA repair process and repairs drug-induced trapped Top1 respectively.

The TDP1, was known to be a dedicated enzyme that repairs drug-induced trapped Top1 during the S phase when the DNA replicates, but its role and regulation during the mitotic phase were previously unknown. CDK1, on the other hand, the key regulatory kinase in the mitotic phase, was found to regulate the DNA repair process by phosphorylating TDP1, which enhances its ability to resolve Top1-DNA adducts.

The scientists stressed that the phosphorylation event was crucial for efficient DNA repair during cell division, allowing cancer cells to survive Top1-targeted chemotherapy.

“Our work demonstrates that CDK1 directly regulates TDP1, aiding cancer cells in repairing DNA breaks caused by Top1 inhibitors,” explains Prof. Benu Brata Das, the study's corresponding author. “By targeting both CDK1 and TDP1, we can potentially overcome resistance and improve treatment effectiveness,” he added.

The study suggests that using CDK1 inhibitors—such as avotaciclib, alvocidib, roniciclib, riviciclib, and dinaciclib—alongside Top1 inhibitors could enhance cancer cell killing. This combination disrupts DNA repair mechanisms and halts the cell cycle, making it more difficult for cancer cells to survive.

“We discovered that phosphorylation of TDP1 by CDK1 is essential for cancer cells to manage DNA damage during cell division. By inhibiting CDK1, we can induce chromosome instability, effectively targeting cancer cells,” said Prof Das.

“Cancer cells often develop resistance to single-agent treatments. By using both CDK1 and Top1 inhibitors, we can more effectively target and eliminate cancer cells,” said Prof. Das emphasizing the potential of this combination therapy.

By identifying CDK1 as a key regulator and TDP1 as a repair enzyme, this research highlights both as potential targets for developing cancer therapies that inhibit DNA repair in cancer cells.

This breakthrough points to a promising avenue for precision medicine in treating cancers, especially those resistant to current therapies. Further studies using animal models are ongoing to validate this approach.

<https://pib.gov.in/PressReleasePage.aspx?PRID=2063775>

ThePrint

Fri, 10 Oct 2024

MIT engineers develop solar-powered system to make salty groundwater drinkable, without using batteries

Engineers from the Massachusetts Institute of Technology (MIT) have created a system that uses solar power to turn salty groundwater into safe drinking water, without a battery. Their research,

published Tuesday in *Nature Water*, explains how the system adjusts to changing sunlight conditions throughout the day to purify water efficiently.

“Being able to make drinking water with renewables, without requiring battery storage, is a massive grand challenge. And we’ve done it,” said Amos Winter, co-author of the study, and mechanical engineering professor and director of MIT’s K. Lisa Yang Global Engineering and Research (GEAR) Center in a statement.

Desalination, the process of removing salts from seawater to make it drinkable, has gained significant importance over the past two decades, according to a 2019 study published in *Science of The Total Environment*. It suggests that desalination is becoming more popular due to the increasing problem of water scarcity, which is expected to affect 60 percent of the global population by 2025.

According to the United Nations University scientists who undertook this research, removing salts from seawater is not a practical solution for most people who live far from the coast. Many inland families rely heavily on groundwater for drinking, but this water is becoming saltier due to climate change. As groundwater becomes more saline, finding clean water is a growing challenge for communities that depend on desalinated water to meet their water needs.

This is what makes the creation of the solar-powered system disruptive. “This technology could bring sustainable, affordable clean water to underreached places around the world,” said Jonathan Bessette, PhD student at MIT and a co-author of the new paper.

Simpler control system enables battery-free operation

To remove salt from brackish groundwater, MIT scientists used reverse osmosis and electro dialysis, both of which need energy. In reverse osmosis, salty water is forced through a filter that removes most of the salt, making it safe to drink. Electro dialysis, on the other hand, uses electric currents to pull charged salt particles out of the water by passing it over materials, called ion exchangers, that attract these particles.

In order to reduce greenhouse gas emissions from energy-intensive desalination, scientists have explored using renewable energy sources for generating electricity. However, this is difficult with reverse osmosis systems, which need a steady power supply—something that’s hard to achieve with variable sources like solar power.

In a study earlier this year, Winter and his team had focused on using electro dialysis and worked on making it adaptable, allowing the system to adjust to changes in sunlight throughout the day. They managed to adjust water production based on sunlight variations, using a model-based control system. They predicted the optimal water flow rate and the voltage needed to remove the most salt from the water. These predictions were made using sensors connected to each component of the system—water pumps, ion exchange membranes and solar panels.

However, this electro dialysis system required further improvement due to a slow response time, which needed energy stored in costly batteries upon the sudden appearance of clouds.

“We could only calculate every three minutes, and in that time, a cloud could literally come by and block the sun,” said Winter. “The system could be saying, ‘I need to run at this high power.’ But

some of that power has suddenly dropped because there's now less sunlight. So, we had to make up that power with extra batteries.”

This time, Bessette, Winter and their colleague Shane Pratt designed a new system that reduces the response time and eliminates the need for batteries.

They introduced a simpler control strategy called “flow-commanded current control”. This new automated version senses how much solar power is being produced and quickly adjusts the water pumps and electric current to match it.

If there's extra power, it automatically increases water flow and electrical current to remove more salt as the water flows faster through the system. This controlled battery-less system maximises the use of solar energy, producing huge amounts of clean water despite variations in sunlight throughout the day.

The way forward

The engineers successfully tested a community-scale prototype of these battery-free new versions, that produced up to 5,000 litres of water per day, even with changing weather and sunlight conditions. The fully automated system treated brackish groundwater in New Mexico over six months and used more than 94% of the solar energy generated by its panels, compared to just 71% in the previous version designed by Winter's team.

“Compared to how you would traditionally design a solar desal system, we cut our required battery capacity by almost 100 percent,” Winter said in a statement.

The team now plans to launch a company based on this technology in the upcoming months.

However, before the launch they intend to further test the product to maximise reliability and scale up the system to meet the needs of larger communities, including whole municipalities.

“While this is a major step forward, we're still working diligently to continue developing lower cost, more sustainable desalination methods,” Bessette said.

<https://theprint.in/science/mit-engineers-develop-solar-powered-system-to-make-salty-groundwater-drinkable-without-using-batteries/2306014/>

