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New non-invasive formaldehyde sensor

Context: A new low-cost sensor made of metal oxide nanoparticles–reduced graphene oxide composite can detect formalin adulteration in fishes at room temperature.

- Food adulteration involves adding illegal or harmful substances to food for various reasons.
- Commercial formalin sensors for fish are often expensive and invasive in nature, facing challenges in low-level and selective detection.
- The Nanomaterials and Nanoelectronics Laboratory at Guwahati University developed a cost-effective formalin sensor.
- The sensor uses a tin oxide-reduced graphene oxide composite, addressing the low electrical conductivity challenge of graphene oxide.
- The tin oxide-decorated reduced graphene oxide sensor effectively detects formaldehyde vapor at room temperature.
- The sensor has been tested for adulterated fish in the Guwahati region, demonstrating the non-invasive detection of formalin.
- The prototype of this sensor is in development, offering potential breakthroughs in affordable formalin sensor devices for addressing food adulteration.

➤ Formaldehyde:

- Formaldehyde, with the systematic name methanal, is an organic compound represented by the formula CH₂O and structure H-CHO.
- It exists as a pungent, colorless gas that spontaneously polymerizes into paraformaldehyde, often stored as aqueous solutions known as formalin, primarily composed of the hydrate CH₂(OH)₂.
- As the simplest of the aldehydes (R-CHO), formaldehyde serves as a crucial precursor in the commercial production of various materials and chemical compounds.
- Despite small natural occurrences, formaldehyde is known to be classified as a carcinogen, presenting health risks such as respiratory and skin irritation upon exposure.

• Applications:

▪ Industry:

- ✓ **Versatile Applications:** Integral in car manufacturing, explosives, plastics, resins, and artificial materials.
- ✓ **Sanitary Products:** Used in the production of paper towels, napkins, and tissues.
- ✓ **Disinfectant:** Employed as a disinfectant in industrial settings.

▪ Medicine:

- ✓ **Antiseptic:** Valued for its ability to eliminate bacteria and fungi in medical applications.

- ✓ **Parasite and Wart Treatment:** Used in medical treatments for parasites and warts.
- ✓ **Vaccine Production:** Essential in vaccine production and sterilization.
- ✓ **Infection Treatment:** Applied in treating infections, preventing bacterial growth.
- **Building and Construction:**
 - ✓ **Wooden Products:** Key in manufacturing furniture, cabinetry, flooring, and other wooden products.
- **Food and Others:**
 - ✓ **Preservative:** Used as a preservative in food, paints, and cosmetics.
 - ✓ **Antiseptic and Disinfectant:** Widely utilized in medicine and funeral homes.
 - ✓ **Fuel Yield Improvement:** Enhances fuel yield in petroleum and natural gas industries.
 - ✓ **Ink Manufacturing:** Employed in ink manufacturing for writing and printing materials.

T+0: Instant Settlement Cycle

Context: SEBI has suggested the implementation of an optional facility for the clearing and settlement of funds and securities on the same day (T+0) and an instant settlement cycle.

➤ Current Settlement Cycle:

- SEBI shortened the settlement cycle to T+3 in 2002 and subsequently to T+2 in 2003.
- The current settlement cycle is T+1, introduced in 2021 and fully implemented in January 2023.
- Funds and securities are settled by the next day of the trade (T+1).

➤ SEBI's Proposal:

- SEBI proposes to introduce an optional shorter settlement cycle in two phases.
- Phase 1: T+0 Settlement Cycle (optional) for trades till 1:30 PM, settling on the same day by 4:30 PM.
- Phase 2: Instant Settlement Cycle (optional) allowing immediate trade-by-trade settlement till 3:30 PM.

➤ Implementation Details:

- T+0 settlement initially available for the top 500 listed equity shares based on market capitalization.
- Implementation in three tranches of 200, 200, and 100 shares, from lowest to highest market cap.
- Exchanges to coordinate and publish a common list of securities and migration calendar under T+0 settlement.
- Surveillance measures applicable in T+1 settlement cycle will apply to T+0.

➤ Reasons for Shorter Settlement Cycle:

- Growth in Indian securities markets demands greater efficiency and safety, especially for retail participants.

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- Evolution of payment systems and advanced technologies present opportunities for shorter settlement cycles.
- Increased adoption of instant payment platforms like UPI.

➤ **Features of T+0 Settlement Mechanism:**

- High percentage of retail investors bring upfront funds and securities before placing an order.
- Instant settlement ensures immediate receipt of funds and securities, eliminating settlement shortages.
- Strengthens investor protection by enhancing control over securities and funds, especially for UPI clients.

➤ **Benefits of the New Mechanism:**

- Provides flexibility for faster pay-out of funds against securities to sellers and vice versa.
- Establishes Indian equities as an asset class with resilience, low cost, and quick transaction times.

INS Imphal Commissioned

Context: Vishakhapatnam Class INS Imphal has been commissioned into the Indian Navy.

➤ **Construction and Naming:**

- The Mazagon Dock Shipbuilders Limited (MDSL) undertook the construction of the Visakhapatnam Class guided missile destroyers as part of Project 15B, initiated in January 2011.
- The lead ship, INS Visakhapatnam, was commissioned in November 2021.
- The second ship, INS Mormugao, was commissioned in December 2022.
- The fourth ship, to be commissioned as INS Surat (D69), was launched in May.

➤ **Design and Development:**

- The design, conceptualized by the Indian Navy's Warship Design Bureau, focused on incorporating advanced capabilities.

- Project 15B aimed at building destroyers with similar tonnage, usage, and weaponry.

➤ **Technical Characteristics:**

- The Visakhapatnam Class destroyers have a length of 163 meters, a width of 17.4 meters, and a displacement of 7,400 tonnes.
- The propulsion system features a Combined Gas and Gas (COGAG) configuration with four gas turbines.
- The ships can achieve a maximum speed of 30 knots and have a range of 4000 nautical miles.

➤ **Crew and Accommodation:**

- Operated by a crew of approximately 350, including 50 officers and 250 sailors.
- The destroyers provide superior ergonomics and habitability compared to their predecessor classes.

➤ **Survivability and Control Systems:**

- Elaborate battle damage control systems contribute to improved survivability.
- The Total Atmospheric Control System (TACS) safeguards against chemical, biological, and nuclear threats.

➤ **Combat Management and Arsenal:**

- Equipped with a state-of-the-art combat management system for tactical evaluation.
- The arsenal includes BrahMos surface-to-surface cruise missiles and Barak-8 surface-to-air missiles.
- Features comprise a 127 mm main gun, AK-630 30mm guns, torpedo launchers, and anti-submarine rocket launchers.

➤ **Strategic Significance:**

- Guided missile destroyers play a pivotal role in protecting fleets and carrier battle groups.
- The Visakhapatnam class enhances operational efficiency with modern sensors and communication facilities.
- A high indigenous component provides a strategic edge to the destroyers in terms of reliability and control.

NEWS IN BETWEEN THE LINES

Kudankulam Nuclear Power Plant



Recently, India and Russia signed some "very important" agreements related to the construction of the future power-generating units of the Kudankulam nuclear power plant.

About Kudankulam Nuclear Power Plant:

- The Kudankulam Nuclear Power Plant (KNPP) is **India's largest nuclear power station** located in the Tirunelveli district of **Tamil Nadu**.
- It is being developed by the Nuclear Power Corporation of India (NPCIL).
- The plant is a joint collaboration between **India** and **Russia's Rosatom State Atomic Energy Corporation**.
- The project is executed in two phases: Phase 1 saw the operationalization of Units 1 and 2 starting **December 31, 2014**, while Phase 2 encompasses the ongoing construction of four additional reactors.
- Its construction began in **2002**, but was delayed by opposition from local fishermen.
- The plant has a capacity of **2,000 MW**, with an additional 2,000 MW under construction.
- It uses **AES-92**, also called the V-466 model, which is the latest version of the third-generation VVER-1000.

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FEMA



Recently, the Reserve Bank of India released a draft 'Licensing Framework for Authorised Persons (APs)' under Foreign Exchange Management Act (FEMA), 1999.

About FEMA:

- The Foreign Exchange Management Act (FEMA) is a **set of regulations** that **enable the Government of India to pass rules relating to foreign exchange**.
- It was introduced in **1999** and replaced the Foreign Exchange Regulation Act (FERA) in **2000**.
- Its primary goal is to regulate foreign exchange transactions in a way that promotes **economic growth and stability**.
- The act gives the Reserve Bank the authority to define the categories of capital account transactions and the exchange restrictions that apply to such transactions.
- It deals with provisions relating to **procedures, formalities, dealings**, etc. of foreign exchange transactions in India.
- It has **five zone offices**, each **led by a Deputy Director**, located in Delhi, Mumbai, Kolkata, Chennai, and Jalandhar.

Wildlife Protection Society of India



Recently, Wildlife Protection Society of India revealed that India lost a record 204 tigers this year from January 1-December 25.

About Wildlife Protection Society of India:

- The Wildlife Protection Society of India (WPSI) is **an organization** that provides information and support to government authorities to combat poaching and the illegal wildlife trade.
- It was **founded in 1994** by **Belinda Wright**, its Executive Director, who was an award-winning wildlife photographer and filmmaker.
- The **Wildlife Protection Act of 1972** aims to protect and conserve wildlife in India.
- The act prohibits the **hunting, poaching and trading** of endangered species, and establishes penalties for such activities.
- The Act consists of **60 Sections** and **VI Schedules**.
- In **2005 and 2006**, **WPSI and the UK-** based Environmental Protection Agency (EIA) carried out a joint investigation into the **tiger and leopard skin trade** in the Tibet Autonomous Region and other provinces in China.

AS-24 Killjoy



Recently, in the ongoing aerial offensive against Ukraine, Russia utilized its AS-24 KILLJOY hypersonic missile.

About AS-24 KILLJOY:

- The AS-24 KILLJOY is a **hypersonic missile** that Russia recently used in an aerial strike on Ukraine.
- It is a nuclear-capable missile that can travel at **speeds of up to Mach 10** and has a range of **1,500–2,000 km**.
- In March **2018**, Russian President Vladimir Putin announced the Kinzhal as one of **six "next generation"** weapons.
- The missile is reportedly a ballistic missile that was used on **December 14, 2023** to target a military airfield in central Ukraine.
- Hypersonic missiles can travel through the atmosphere and maneuver while in flight, making them difficult to detect and intercept.
- Hypersonic missiles fly at **least five times** the speed of sound, which is **Mach 5**.

Pasteurization



December 27, commemorates the birth anniversary of **Louis Pasteur**, a famous French scientist known as the "**Father of Microbiology**."

- He is known for his discoveries of the principles of **vaccination, microbial fermentation and pasteurization**.

Pasteurization:

- Pasteurization is a **food preservation process** that involves heating food products to kill harmful **bacteria and pathogens**.
- It **deactivates microbes** and **reduces enzyme activity** by reducing the temperature.
- Some types of pasteurization methods including, **Vat Pasteurization** (low temperature), **High Temperature/Short Time (HTST)**, **Ultra pasteurization (UP)** and **Ultra-High-temperature (UHT)**.
- UHT pasteurization involves heating milk or cream to **138–150 °C (280–302 °F)** for one or two seconds.
- Pasteurization and sterilization both involve heating a food to break down its bacterial load.
- However, sterilization almost **completely eliminates the bacterial load**, while **pasteurization only reduces it**.

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Place in News

France

Recently, a charter plane carrying 276 passengers, mostly Indians, which was grounded in France for four days over suspected human trafficking, landed in Mumbai.

France (Capital: Paris)

Location: France is a country located in Western Europe.

Boundaries: France shares its border with **Switzerland** and **Italy** (East), **The English Channel** and **Bay of Biscay** (West), **Belgium**, **Luxembourg** and **Germany** (North) and **Andorra** and **Spain** (South).

Physical Features:

- **The Alps and the Pyrenees are the highest points in France.**
- The **Alpine peak of Mont Blanc** is the highest point in Western Europe.
- The **Seine river** flows through Paris and into the **English Channel**.
- The **Loire** is the longest river in France, famous for its chateaux along its course.
- France's mineral resources encompass **coal** in **Nord-Pas-de-Calais** and Lorraine, **iron ore** in Lorraine, bauxite in Provence-Alpes-Cote d'Azur, potash in Alsace and Lorraine.
- Some smaller reserves of **uranium**, salt, limestone, lead, zinc, copper, **gypsum** and **fluorspar** also scattered across the country.



POINTS TO PONDER

- Namdapha flying squirrel, that was recently in news, is endemic to which Indian State/UT? - **Arunachal Pradesh**
- Recently, which Indian airport received recognition at UNESCO's 2023 Prix Versailles? - **Kempegowda International Airport**
- Which country has recently announced to leave Organization of the Petroleum Exporting Countries (OPEC)? - **Angola**
- Church of Epiphany, that has recently secured prestigious UNESCO Asia-Pacific Award for Cultural Heritage Conservation, is located in which state? - **Haryana**
- As per the India Skills Report 2024, which state is the most preferred state to work? - **Kerala**

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