

## 1. Superhydrophobic Coating

### Why in News?

- Recently, a team from the Indian Institute of Technology Dhanbad, and Ohio State University has created a superhydrophobic coating to save steel from Rusting.

### About Superhydrophobic Coating Surfaces:

- It is made from polyurethane and silicon dioxide nanoparticles.
- It is a nanoscopic surface layer that repels water.
- It is Added to makes a surface liquid and water repellent, easy to clean, and boosts its anti-icing performance, which is ability to delay the formation of ice for a certain period of time
- It is also found in nature; they appear on plant leaves, such as the Lotus leaf, and some insect wings.
- It can be coated to other metallic surfaces apart from steel, such as aluminium, copper, brass. The coatings have also been developed for glass, cloth, paper and wood. Without this, the coating tends to easily peel off due to smoothness of steel.
- Its spin coating was found to be more advantageous and cost-effective compared to immersion coating and spray coating. Spin coating dried quickly and the thickness of the coat could be controlled easily
- **Silicon dioxide (SiO<sub>2</sub>)**, also known as silica, is a natural compound made of two of the earth's most abundant materials: silicon (Si) and oxygen (O<sub>2</sub>). It is most often recognized in the form of quartz. It's found naturally in water, plants, animals, and the earth.
- Polyurethane is a polymer composed of organic units joined by urethane links. It is a plastic material, which exists in various forms.

### Properties of the Superhydrophobic Coating

- Chemically Stable in both acidic (pH 5) and alkaline (pH 8) conditions for more than six weeks.
- **Thermal Stable up to 230°C.**
- Highly Mechanical stable when tested with water jet, floating, bending, sand abrasion tests.
- When water droplets were made to fall on an uncoated surface they stuck to it and made a messy surface.

- The chemicals used to make the coating are easily available and are also environmentally friendly.
- The cost of coating will further reduce when mass-produced on commercial scale.

## **2. Experimental Coronavirus Vaccine**

### **Why in News?**

- A healthy volunteer is the first person in the U.S. to receive a dose of an experimental coronavirus vaccine as part of a new clinical trial.

### **Highlights:**

- Over the next six weeks, researchers plan to enrol 45 participants in the trial, which will test the safety of the vaccine as well as its ability to induce an immune response in the volunteers.
- The National Institute of Allergy and Infectious Diseases (NIAID) allowed the new vaccine to be fast-tracked into clinical trials without thorough testing in animal models, which usually stands as a strict prerequisite to human testing.
- New drugs must pass through three iterative phases of clinical trials before being deemed safe and effective for widespread use.
- Assuming the initial tests go well, it may be 12 to 18 months before any vaccine is ready for public use. The trial is known as a "Phase 1 clinical trial," meaning its main purpose is to provide information about how the vaccine interacts with a healthy human body.
- Phase 1 trials examine a small group of people, typically between 20 and 80 individuals, who receive different doses of an experimental treatment.
- Over the course of several months, researchers monitor how each volunteer metabolizes the given treatment and what common side effects emerge in response to different doses.
- The 45 volunteers in the new trial will receive varying doses of the new vaccine, called mRNA-1273, and be monitored over a 14-month period. Volunteers will receive two injections of the vaccine in the upper arm, with a 28-day gap between doses.
- In addition to monitoring for side effects, the researchers will test whether the vaccine triggers an immune response by Analyzing the volunteers' blood for antibodies. If the vaccine works as designed, the immune system should generate antibodies that grab hold of a characteristic protein found on the surface of the novel coronavirus SARS-CoV-2.

- Rather than introducing a dead or weakened virus into the body to prompt this reaction, as conventional vaccines do, the vaccine instructs cells to build the viral protein themselves using a molecule called messenger RNA (mRNA).

### **3. Radioactive Dumping in Fukushima**

#### **Why in News?**

- The Nuclear disaster at Fukushima sent an unprecedented amount of radiation into the Pacific. But, before then, atomic bomb tests and radioactive waste were contaminating the sea, the effects are still being felt today.

#### **Highlights:**

- Exactly how the water should be dealt with has become highly controversial in Japan, not least because the nuclear disaster caused extreme contamination off the coast of Fukushima.
- Almost 1.2 million liters (320,000 gallons) of radioactive water from the Fukushima nuclear power plant is to be released into the ocean. The contaminated water has since been used to cool the destroyed reactor blocks to prevent further nuclear meltdowns.
- It is currently being stored in large tanks, but those are expected to be full by 2022. Radiation levels in the sea off Fukushima were millions of times higher than the government's limit of 100 becquerels.
- And still today, radioactive substances can be detected off the coast of Japan and in other parts of the Pacific.
- The research found that even the smallest possible dose, a photon passing through a cell nucleus, carries a cancer risk. Although this risk is extremely small, it is still a risk.
- Over the past few decades, more than 250 nuclear weapons tests were carried out on the high seas. Most of them (193) were conducted by France in French Polynesia, and by the US (42), primarily in the Marshall Islands and the Central Pacific.
- But the ocean wasn't just being used as a training ground for nuclear war. Until the early 1990s, it was also a gigantic dump for radioactive waste from nuclear power plants. From 1946 to 1993, more than 200,000 tons of waste, some of it highly radioactive, was dumped in the world's oceans, mainly in metal drums.

- The US had dropped more than 90,000 barrels and at least 190,000 cubic meters of radioactive waste in the North Atlantic and Pacific.
- Other countries including Belgium, France, Switzerland and the Netherlands also disposed of tons of radioactive waste in the North Atlantic in the 1960s, 70s and 80s. The long-term consequences are clear.
- The radiation will be “absorbed by the marine animals surrounding it. They will eventually end up caught in fishing nets, and come back to our plates.

#### **4. Uranium Contamination in Ground Water**

##### **Why in News?**

- There is a prevalence of Uranium concentration above 30 micro-gram per litre (World Health Organization (WHO) provisional guidelines) in some of the localized pockets of a few States/UTs in the country.

##### **Highlights:**

- A report brought out by Duke University, USA in association with the Central Ground Water Board and State Ground Water departments states that Andhra Pradesh, Chhattisgarh, Gujarat, Haryana, Himachal Pradesh, Jharkhand, Karnataka, Maharashtra, Odisha, Punjab, Rajasthan, Tamil Nadu, Telangana, Uttar Pradesh, West Bengal and Jammu & Kashmir have localised occurrence of Uranium concentration.
- As per the Department of Atomic Energy, elevated uranium levels in drinking water may affect human health.
- Health studies carried out elsewhere in the world suggest that elevated uranium levels in drinking water may be associated with kidney toxicity.
- Further, several studies focusing on health effects have been carried out in Finland among people who use their drilled wells as sources of drinking water having uranium concentrations in the range 5.6 – 3410 ppb. However, no clear clinical symptoms have been observed among the exposed population.
- The Indian Standard IS 10500: 2012 for Drinking Water specification has specified the maximum acceptable limits for radioactive residues as alpha and beta emitters, values in excess of which render the water not suitable. These requirements take into account all radioactive elements including uranium. No individual radioactive elements have been specifically identified.

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- Further, as per information provided by the Bureau of Indian Standard (BIS), they are working to incorporate maximum permissible limit of Uranium as 0.03 mg/l (as per WHO provisional guidelines) in all drinking water standards after following the due process.

## **5. ISRO's Assistance in Fishing**

### **Why in News?**

- Minister of State for Fisheries, Animal Husbandry and Dairying has provided the necessary data to Lok Sabha about ISRO's Assistance in finding Rich Fishing Areas.

### **Key Points:**

- Indian Space Research Organization (ISRO) has developed the methodology for the generation of fishery advisories and transfer to Indian National Centre for Ocean Information Services (INCOIS) as an operational service for providing Potential Fishing Zone (PFZ) advisories.
- This INCOIS utilizes data on chlorophyll concentration obtained from ISRO's Oceansat-2 satellite and the sea surface temperature from National Oceanic Atmospheric Administration (NOAA / USA satellites).
- The INCOIS uses these satellite datas to prepare the PFZ advisories on the potential rich fishing areas and provide to the sea faring fishermen in all stat
- PFZ advisories helped fishermans in avoiding the unwanted search for fish shoals. This reduces their fuel consumption.

### **About INCOIS:**

- INCOIS is an autonomous body under the Ministry of Earth Sciences (MoES) headquartered at Hyderabad.
- It is mandated to provide the best possible ocean information and advisory services to society, industry, government agencies and the scientific community through sustained ocean observations and constant improvements through systematic and focussed research.