FAQs

Artificial Photosynthesis

Why is it in News?

Scientists have found a method to mimic nature's own process of reducing carbon dioxide in the atmosphere, namely photosynthesis, to capture excess carbon dioxide in the atmosphere.

What is Artificial Photosynthesis?

- Artificial photosynthesis (AP) is a chemical process that mimics the natural process of photosynthesis to convert sunlight, water, and carbon dioxide into carbohydrates and oxygen.
- The term artificial photosynthesis is commonly used to refer to any scheme for capturing and storing the energy from sunlight in the chemical bonds of fuel (a solar fuel).
- Photocatalytic water splitting converts water into hydrogen and oxygen and is a major research topic of artificial photosynthesis.
- Light-driven carbon dioxide reduction is another process studied that replicates natural carbon fixation.

What are the challenges in Artificial Photosynthesis (AP)?

- Research on this topic includes the engineering of enzymes and photoautotrophic microorganisms for microbial biofuel and biohydrogen production from sunlight.
- This AP harnesses solar energy and converts the captured carbon dioxide to carbon monoxide (CO), which can be used as a fuel for internal combustion engines.
- In AP, scientists are essentially conducting the same fundamental process in natural photosynthesis but with simpler nanostructures.
- However, there are plenty of hurdles to overcome as a successful catalyst to carry out AP.

What have Indian researchers achieved?

- Indian researchers have designed and fabricated an integrated catalytic system based on a metal-organic framework (MOF-808) comprising of a photosensitizer that can harness solar power and a catalytic centre that can eventually reduce CO2.

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- A photosensitizer is a molecule that absorbs light and transfers the electron from the incident light into another nearby molecule.
- The scientists have immobilized a photosensitizer, which is a chemical called ruthenium bipyridyl complex ([Ru (bpy)2Cl2]) and a catalytic part which is another chemical called rhenium carbonyl complex ([Re(CO)5Cl]).
- They have fabricated it inside the nano space of a metal-organic framework for artificial photosynthesis.

What is outcome of the research?

- The developed catalyst exhibited excellent visible-light-driven CO2 reduction to CO with more than 99% selectivity.
- The catalyst also oxidizes water to produce oxygen (O2).
- The Photocatalytic assembly, when assessed for CO2 reduction under direct sunlight in a water medium without any additives, showed superior performance of CO production.
- Being heterogeneous, the integrated catalytic assembly can be reused for several catalytic cycles without losing its activity.