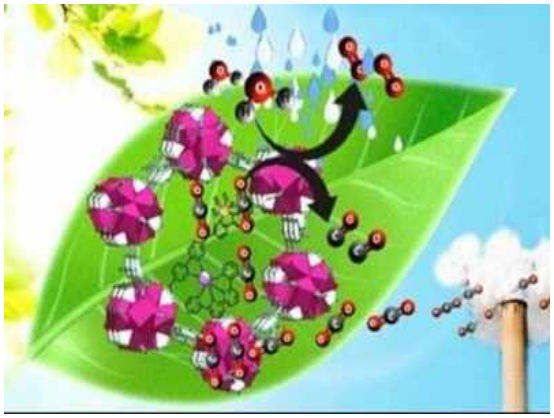
Printed from
THE TIMES OF INDIA

Researchers mimic photosynthesis, convert CO2 into solar fuel

TNN | Mar 18, 2021, 08.29 AM IST



BENGALURU: Researchers from the Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR) have developed an integrated system that can capture carbon dioxide (CO2) and convert it into solar fuel — a process they call artificial photosynthesis (AP) — which they feel can aid mitigate effects of emissions made by use of fossil fuels. This process of converting CO2 into solar fuel also generates oxygen from water.

Pointing out that owing to the excessive consumption of fossil fuels, extreme emissions of carbon dioxide (CO2), sulfur dioxide (SO2), and nitrogen oxides are the prime reasons for severe pollution and global warming, Prof Tapas Kumar Maji, who led the team, said that for humanity, however, nature provides oxygen and foods for aerobic life cycles via photosynthesis, which produces oxygen (O2) and carbohydrates from CO2 and water by utilizing solar energy.

(From left to rigt) Tapas Kumar Maji, Sanchita Karmakar, Soumitra Barman and Faruk Ahamed Rahimi

In other words, solar energy, he said, gets converted into chemical energy and stowed in carbohydrates. That they have demonstrated this under the sunlight and not just in lab conditions has the researchers elated.

“We have tried to mimic nature’s design of the energy supply method by CO2 capture and conversion. The system we’ve developed is configured in such a way that it can capture CO2, harness the solar energy, produce charge-separated electron-hole pairs and reduce CO2 selectively in water in a sustainable condition,” Maji told TOI.

Their findings, including the method used to develop their integrated system and the various components it contains, and the process used to create artificial photosynthesis, have been published in the scientific journal Energy and Environmental Science. Maji’s team comprises three other JNCASR scientists: Sanchita Karmakar, Soumitra Barman and Faruk Ahamed Rahimi.

“We have designed and fabricated an integrated catalytic system that can harness solar power and a catalytic centre that can eventually reduce CO2. In addition, by mimicking natural photosynthesis, the photocatalytic assembly is assessed for CO2 reduction under direct sunlight in a water medium without any additives, where it shows the superior performance of CO production,” Maji explained.

Further, pointing to various challenges, Maji said that for a designed material to comprehend the solar energy conversion technology of the leaf, the light-absorbing material must capture a solar photon to generate a wireless current which can be harnessed by catalysts and drive the subsequent oxidation and reduction reaction in sustainable conditions to produce value-

added carbon-feedstock.

In artificial photosynthesis (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. First and foremost, the catalyst platform should possess excellent CO2 absorbing capability so that the CO2 reduction reaction (CO2 RR) can be carried out in the later stage. Secondly, the catalyst should be able to harness solar energy to gain enough fuel to drive CO2 RR," Maji explained.