Synthesis of hydrogen peroxide

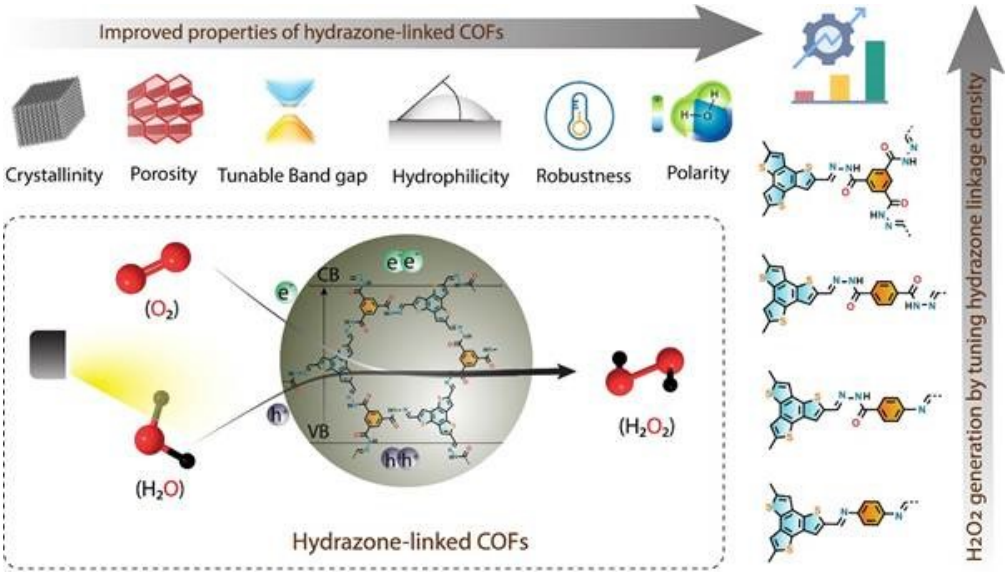
Why in News?

Researchers have found an efficient, less energy-intensive, and environmentally friendly way of synthesizing hydrogen peroxide.

- Currently, over 95% of H_2O_2 is produced industrially using the ***anthraquinone oxidation process***.
    - It is very energy intensive, expensive and produces many hazardous chemicals as by-products.
- **Recent Findings -** Scientists discovered a new class of porous and ordered polymers with modifiable catalytic sites and light-harvesting properties in visible range, called covalent organic frameworks (COFs).
- It have emerged as promising photocatalysts.
- **Done by -** S. N. Bose National Centre for Basic Sciences, Kolkata, an autonomous institute under the Department of Science and Technology (DST).
- They have designed and prepared a series of COFs having good water affinity through careful control of the hydrazone linkage density.
- They also studied their effect on the photocatalytic performance for H2O2 generation.
- It was observed that the *hydrazone-linked COFs* provide abundant docking sites for water and oxygen, thereby promoting 2 main pathways for *photocatalytic H2O2 generation*
    - Water oxidation reaction (WOR) and
    - Oxygen reduction reaction (ORR)
- As a result, the hydrazone-linked COF exhibited exceptional photocatalytic H2O2 production without external sacrificial electron donors when irradiated with a 40 W blue LED (λ = 467 nm).
- Interestingly, a significant amount of H2O2 (550 μmol g-1 h-1) was also produced under sunlight irradiation.
- It outperforms most organic photocatalysts under similar conditions, thus demonstrating a clean and sustainable pathway.
- Furthermore, as-synthesized hydrazone-linked COFs can generate H2O2 up to 21641 μmol g-1 h-1 using an aqueous benzyl alcohol solution by preventing the degradation of H2O2.

Aqueous benzyl alcohol consists of (water: benzyl alcohol = 90:10)

- This strategy will be helpful in developing a continuous flow reactor for the sustainable production of H2O2 and will reveal a laboratory-to-industry technology transfer for the benefit of mankind.



Hydrogen peroxide (H_2O_2)
• It is a chemical, versatile oxidizing agent widely used in environmental disinfection, chemical synthesis, paper bleaching, and fuel cells. • **Significance –** Driven by the increasing awareness of disinfection, the rise in the number of surgeries, and the prevalence of hospital-acquired infections.

References

PIB | Hydrazone-linked COFs

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