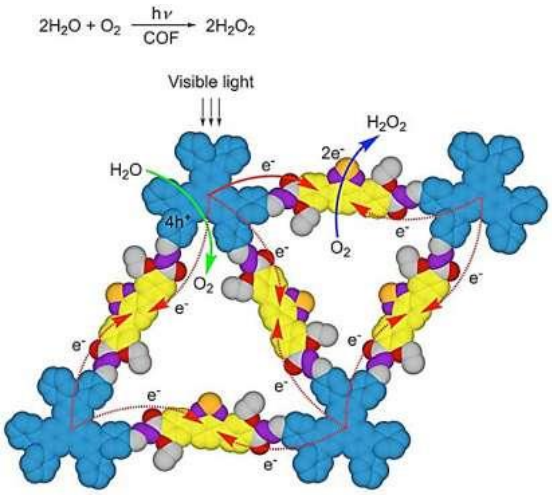
1-3-24

Novel method to photosynthesize hydrogen peroxide using water and air



A newly designed hexavalent covalent organic framework (COF) material that mimics photosynthesis. Credit: National University of Singapore

Researchers at the National University of Singapore (NUS) have developed a microporous covalent organic framework with dense donor–acceptor lattices and engineered linkages for the efficient and clean production of hydrogen peroxide (H_2O_2) through the photosynthesis process with water and air. Traditional industrial production of H_2O_2 via the anthraquinone process using hydrogen and oxygen is highly energy-intensive. This approach employs toxic solvents and expensive noble-metal catalysts and generates substantial waste from side reactions.

In contrast, photocatalytic production of H_2O_2 from oxygen and water offers an energy-efficient, mild, and clean route. Most importantly, it addresses the common drawbacks of existing photocatalytic systems, such as low activity, heavy use of additional alcohol sacrificial donors, and the necessity for pure oxygen gas input. Under laboratory conditions, the COFs demonstrate a quantum efficiency of 17.5 percent under visible light at 420 nm in batch reactors. This system can be developed to construct self-cleaning surfaces and for disinfection treatments. (Source: Ruoyang Liu et al, Nature Catalysis (2024).