



iH₂O₂: Iron catalyzed H₂O₂ production

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What is the problem?

Hydrogen peroxide (H₂O₂) is an important chemical used for the bleaching of paper, preparation of chemicals, water treatment, and disinfection. Currently, H₂O₂ is almost exclusively produced by the [anthraquinone process](#) (Figure 1) that uses a large amount of organic chemicals and palladium catalysts to produce this very simple molecule. As a result, H₂O₂ is ranked as one of the [top 10 most energy-intensive chemicals](#) in the United States, and the production is only economically feasible at centralized large scale production sites. One of the simplest ways to synthesize H₂O₂ is the reaction of H₂ and O₂ using a catalyst. Currently, [palladium](#) (Pd) is the most active catalyst in this reaction. Combination of this process and electrolysis of water will enable onsite production of H₂O₂ for water treatment at remote locations. However, the price of Pd catalysts is one of the burdens of this process.

What is your solution?

In this project, we will develop simple and cheap [organometallic](#) iron (Fe) catalysts to synthesize H₂O₂ from O₂ and H₂ (Figure 2). Iron is the most abundant transition metals in the Earth's crust, and used in important industrial processes such as [Haber–Bosch process](#) and [Fischer–Tropsch process](#); however its use in the formation of H₂O₂ is unknown. We are aiming to synthesize iron catalysts that can react with H₂ and form Fe-H species. By tuning properties of iron catalyst, we will generate Fe-H species that have similar reactivity as the key Pd-H species and transfer two H from H₂ to O₂ to form H₂O₂. Our preliminary experiments showed that our iron catalyst can generate this type of Fe-H! Now, we are developing a process to form H₂O₂ from H₂ and O₂ using this catalyst.

Keywords: Hydrogen peroxide, hydrogen, Catalyst, Iron

Current method

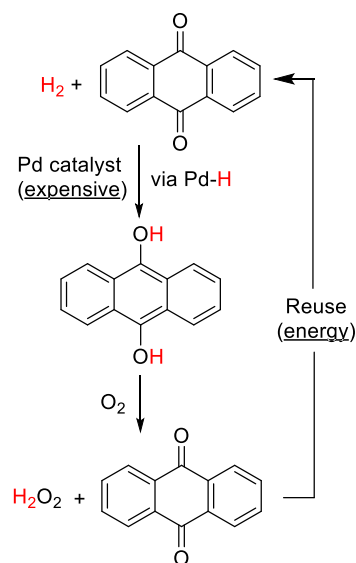


Figure 1 Current method.

Our method

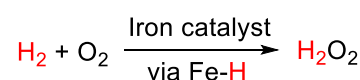


Figure 2 Our method.

Other resources

- [The group homepage](#)

Contribution to SDGs

