

## Hydrogen production by inorganic/whole-cell biohybrid photocatalyst system

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In recent years, it has become difficult to continue using limited resources such as fossil fuels, and the transition to a sustainable energy society is underway around the world. Among them, sunlight is an energy source that continues without limitation compared to the human history, and its utilization methods are being studied in various fields. However, there are limits to the direct use of solar energy itself, so methods of storing the energy is receiving a lot of attention, and one of them is research using hydrogen.

One of the reasons why hydrogen attracts attention as a clean energy is that only water is used as a raw material for obtaining hydrogen. For this, energy can be stored without using carbon, and only water is released after the combustion reaction, so it is easy to reuse and can be said to be an ideal energy carrier. Hence the water splitting reaction using sunlight and storing it energy as hydrogen is important technology that should be realized.

A lot of research are being conducted with the aim of hydrogen production by constructing an inorganic-bio hybrid photocatalyst system. As an example, there is one using the enzyme hydrogenase, which produces hydrogen with high efficiency. However, when using the enzyme, there are problems such as purification costs and durability.

It follows that, we focused on using whole-cells instead of the enzyme for the biological side of inorganic-bio hybrid photocatalyst. If whole-cell is available, not only reduces the purification cost of the enzyme, but also the enzyme is protected in the cell membrane, which may have a positive effect on durability. In the previous study, recombinant *Escherichia coli* BL21(DE3)/pEHydEA + pCHydFG, which harbors [FeFe]-hydrogenase and maturase genes (*hydA*, *hydE*, *hydF*, and *hydG*) from *Clostridium acetobutylicum* NBRC 13948, was constructed, and demonstrated that as the recombinant *E. coli* whole-cell biocatalyst produced hydrogen. In addition to these contents, I will report the effect of pH in inorganic/whole-cell biohybrid photocatalyst system.