Docket #: S15-300

Oxygen tolerant hydrogenases by mutating electron supply pathway

Stanford researchers at the Swartz Research Group have engineered an Iron-Iron (Fe-Fe) hydrogenase with as high as 5-fold enhancement in O_2 tolerance by introducing cysteine mutations around the electron supply pathway within the enzyme. The best mutant can sustain at least 15% of the anaerobic H_2 production activity for an hour in the presence of 5% O_2. This advance is a key step toward sustainable H_2 production using sunlight as the energy source since this process does not release greenhouse gas emissions. Currently, 38% of California's energy comes from gaseous fuels in the form of natural gas which release huge quantities of carbon dioxide. This invention will help curb global warming by providing an alternative and sustainable supply of gaseous fuels.

Figure

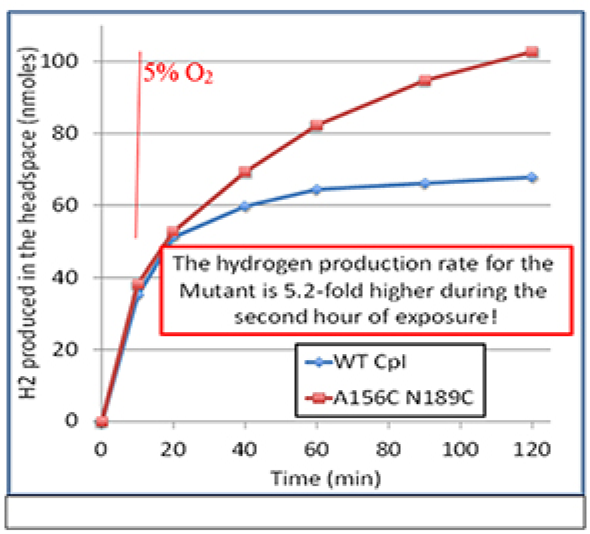

Figure description - Double cysteine introduction confers oxygen tolerance during hydrogen production.

Applications

- Sustainable biological hydrogen production
- Useful for many technologies where oxygen exposure is possible or probable:
    - Photosynthetic hydrogen production in engineered organisms
    - Hydrogen production in which electrons are supplied by pathways within cell-free cellular extracts
    - Technologies in which reducing equivalents are supplied by electricity or by photovoltaic or photocatalytic devices

Advantages

- **Dramatic improvement in oxygen tolerance** while producing hydrogen
- **Enzymatic stability**
- **Method applicable to study similar or combination of mutations** to improve hydrogenase stability
- **Environmentally friendly–** process does not emit CO2 unlike natural gas

Publications

- Jamin Koo, James R. Swartz, "System analysis and improved [FeFe] hydrogenase O2 tolerance suggest feasibility for photosynthetic H2 production" Metabolic Engineering 49 (2018) 21–27.

Patents

- Published Application: 20170067034
- Issued: 10,221,401 (USA)

Innovators

- James Swartz
- Jamin Koo

Licensing Contact

Seth Rodgers

Licensing Manager, Life Sciences

Email