

August 9-10, 2007

2007 Ohio Student Research Forum

Wright State University
Dayton, OH

RESEARCH ABSTRACT FORM

TITLE: Photoelectronic Hydrogen Production Catalyzed by Hydrogenase

AUTHOR: David Alers

MENTOR(S): Mekki Bayachou

INSTITUTION: Cleveland State University

The idea behind this research project was to use solar energy to create hydrogen (H_2) gas from aqueous solution. Using a hydrogenase protein that was expressed in the lab to catalyze the reaction of hydrogen production from protons. Titanium dioxide was used as a photo-catalyst to absorb the energy from light and in other words to initiate the reaction when put under light.

In one experiment, an electrochemical technique (Cyclic Voltammetry) was used to characterize the catalytic activity of the protein. This was done in a pH 7 phosphate buffer solution. The hydrogen production at pyrolytic graphite (PG) electrode was observed using a hydrogenase-modified electrode as working electrode. The same test was performed on a bare PG electrode was used as a control. The result shows that there was a positive shift of proton reduction potential when the hydrogenase was added, indicating that it takes less energy to start the reaction.

In the second Experiment, we used a spectrophotometric technique to detect the hydrogen production in the mixture. The Experiment was done by adding Tris into a vile then placing the vile in the UV-Vis spectrometer, taking a measurement as blank, then placing it under light and taking a measurement again. Next phenolphthalein was added to the solution the same steps were taken. The same steps were also taken for the additions of titanium dioxide, methyl viologen and the hydrogenase protein. The results of this experiments was that after the hydrogenase was added and was placed in the light it turned an intense blue. This means that there is a decrease in the amount of hydrogen atoms (H^+) in the solution, also indicate that hydrogen was generated.