

Application Data Sheet

No. 9

GC
Gas Chromatograph

Analysis of Reaction Products in Artificial Photosynthesis Research

Artificial photosynthesis refers to a technique for the manufacture of high-energy substances using energy from sunlight. It is expected to become the 4th type of sunlight-based renewable energy after solar cells, solar heating, and biomass technologies.

This data sheet introduces an example of the simultaneous analysis of CO and H₂, generated in a photochemical carbon dioxide reduction utilizing a photo-catalyst, using the Shimadzu Tracera High-Sensitivity Gas Chromatograph system.

Instruments Used and Analysis Conditions

Instruments Used

Software	GCsolution
Gas chromatograph	Tracera (GC-2010 Plus A + BID-2010 Plus)

Analysis Conditions

Column	Micropacked ST
Column temperature	35 °C(2.5 min) – 20 °C/min – 180 °C (0.5 min) Total.10.25 min
Carrier gas controller	Pressure
Pressure program	250 kPa (2.5 min) – 15 kPa/min – 360 kPa (0.42 min) (He)
Injection mode	Split (1:10)
Injection port temperature	150 °C
Detector temperature	280 °C
Discharge gas volume	70 mL/min
Injection volume	50 µL

Results

Fig. 1 shows a chromatogram of substances generated in a photochemical carbon dioxide reduction. Fig. 2. shows a graph of CO and H₂ production plotted against reaction time. It was confirmed that CO production increased sharply for the first 30 minutes of reaction time, after which it shifted to a more gradual increase.

The BID detector in the Tracera system can provide simultaneous high-sensitivity measurements of CO and H₂. This detector can detect all components eluted from the column, thus enabling acquisition of a variety of information as well as the target component measurements.

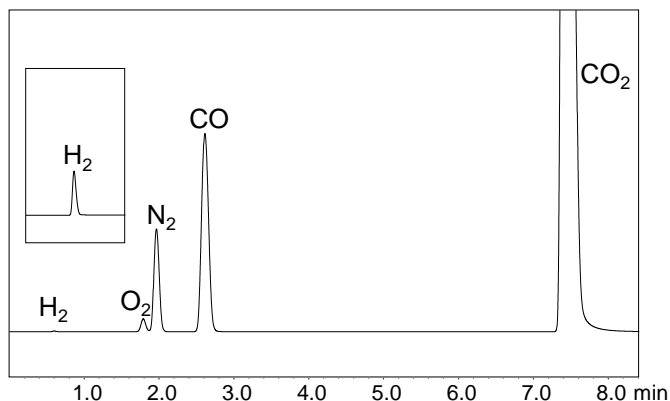


Fig. 1: Chromatogram of Substances Generated in a Photochemical Carbon Dioxide Reduction

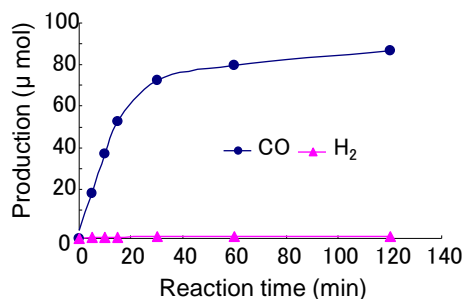


Fig. 2: CO and H₂ Production Versus Reaction Time

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