Messages from Modern Inventors to the Next Generation

6. *Photocatalysis: Making the World Clean* - Dr. Akira Fujishima, Tokyo University of Science

Dr. Fujishima discovered a dreamlike substance. With this substance, stains are removed when they are exposed to the sun or rain. This eliminates the need for other types of cleaning procedures. Dr. Fujishima discovered that the water in the air was decomposed by applying light to titanium dioxide and that stains and bacteria were decomposed as a result. This technology called “photocatalysis” is being used on houses.

What inspired you to become an inventor/researcher?

When I was a child, I attended elementary school deep in the mountains of Aichi Prefecture. My elementary school days included natural activities such as counting shooting stars and chasing fire flies. I had 14 elementary school classmates. Even now, more than 50 years after graduation, all of my classmates are fine, and we still get together occasionally. We visit the school buildings that we recall from years ago. We also visit our former teacher, Mr. Kanichi Kamiya, two or three times a year, and enjoy talking about the old days where we were together.

I first felt the joy of study when I was a senior at university involved in an experiment. As a graduate student at the University of Tokyo, I fully enjoyed the excellent atmosphere of the laboratory and became deeply absorbed in experiments. It was during this period that I happened to come across crystals of titanium dioxide. I was moved by the discovery that oxygen gas bubbles came out of the crystals after being placed in water and exposed to light rays. I will never forget the particular moment when I realized that I was successful in artificially imitating plant photosynthesis.

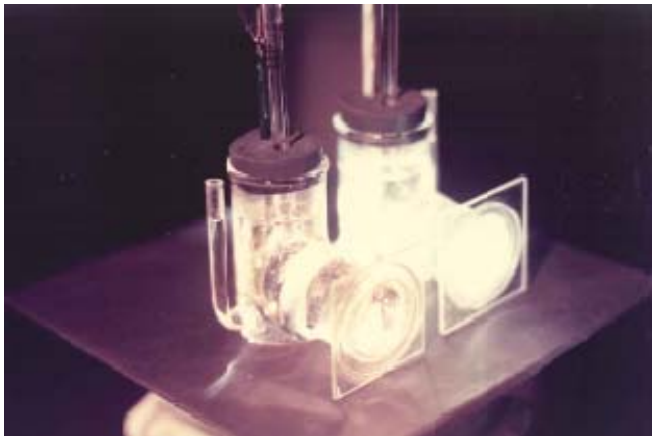


Photo of the equipment of the water decomposition experiment using titanium dioxide crystals

What kinds of challenges have you faced as an inventor, and how have you overcome those challenges?

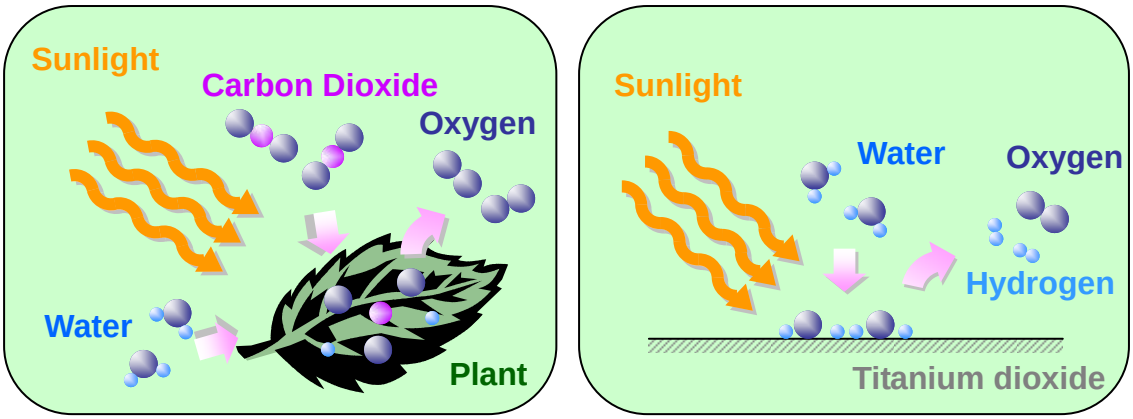
When I was a graduate student at the University of Tokyo, I made a presentation at the academic society on the fact that water can be decomposed by sunlight with titanium dioxide. Nobody, however, believed this. I had artificially achieved something which is one of the important reactions in the natural world and occurs on leaves as a photosynthetic reaction. I first did not understand why people did not believe what I had achieved. However they did believe me eventually when an article on my achievement appeared in “Nature” (one of the world’s most prestigious scientific journals). I have learned that it is hard for something new to be easily accepted.

You may have heard of the word “photocatalysis.” This refers to a decomposition phenomenon. The commercial application of photocatalysis involves coating various materials with thin and transparent titanium dioxide ultrafine particles of 10nm in diameter to prevent tiles from getting stained and mirrors from being steamed up.

What gives you joy as an inventor/researcher?

During a long series of experiments while recording data, it was a tough and even painful moment when anticipated values were not obtained. Redesigning the experiment with new anticipated values, however, sometimes brings about the highest pleasure of discovery.

As the result of our hard and conscientious work, the subject matter of photocatalysis has now been included in the textbooks for junior-high and high schools. This gives me as a researcher supreme joy.



Illustrations: Mechanisms of photosynthesis (left) and photocatalysis (right)
A plant absorbs sunlight and uses its energy to provide nutrition by decomposing water. In a similar manner, titanium dioxide absorbs sunlight and uses its energy to decompose stains and water.

What message you like to give to future inventors?

When do morning glory flowers open? Why do cherry blossoms open all at once? Why are water striders able to smoothly walk on the surface of the water? There are so many interesting phenomena surrounding you, and you should carefully observe them while constantly raising questions. It should be fun to think, for example, how many fire flies are required to provide sufficient lighting to read a book. There is in fact a historical record that a Chinese man captured twenty fireflies to be a light source for reading a book.

Science Café* was started nearly 150 years ago in London/England with a series of six lecture meetings on the theme of “a single candle burning.”. This was in 1867 when the Meiji period started after the EDO era in Japan. Science Café was started by Michael Faraday who invented the electrical generator. You know electricity very well, don’t you? Observing things around you inform the perspective of science, you’ll certainly find the things that you see to be much more interesting.

* Science Café is a café gathering on a scientific topic, where scientists and the general public freely enjoy talking together.

MM Towers in Yokohama Minato Mirai area are covered with photocatalytic tiles. The surface of all the building tiles is coated with titanium dioxide. The buildings are self-cleaning and thus always look nice and clean.