Challenges in the utilization of unlimited sunlight energy to sustain a safe and clean environment --Investigations of highly active Ti-oxide based photo-functional materials from molecular level to bulk semiconductor thin films--

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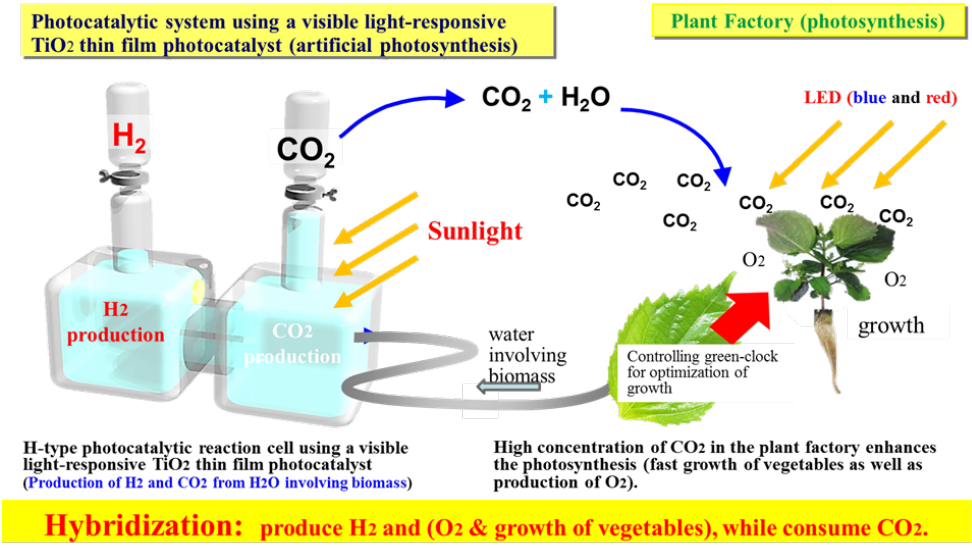
Environmentally harmonious, clean and safe scientific technologies to address energy needs as well as pollution and climatic change are the subject of much research, especially in Japan where almost all of our energy is imported. Research into photocatalytic processes would advance the development of sustainable, non-hazardous and economic technologies. We have successfully developed Ti-oxide photocatalysts which enable the absorption of visible light (of longer than 400 nm) and which can operate as efficient environmentally-friendly photocatalytic materials. The presentation will focus on H_2 production from H_2O involving biomass using visible light-responsive TiO2 thin film photocatalysts for the separate evolution of H_2 and CO_2 under sunlight irradiation.[1-4)]

Also, our university's research into the development of an artificial-light type plant factory to cultivate various vegetables will then be explained. These vegetables can be grown within a shorter time than in outdoor fields using fluorescent and LED lights in clean rooms due to the high concentration of CO_2. Such plant factories are a new concept in agriculture to supply safe and nutritious produce year-round regardless of any adverse or disruptive natural or manmade influences such as global warming, climate change, pollution or other potentially damaging circumstances. Photocatalytic H_2 and CO_2 production from H_2O involving biomass as a sacrificial reagent will be discussed in connection with the hybridization of artificial photosynthesis and photosynthesis of green vegetables in the plant factory for the cevelopment of clean and sustainable chemical systems to utilize unlimited sunlight energy.



1) M. Anpo and P. V. Kamat, "*Environmentally Benign Photocatalysts –Applications of Titanium Oxide-based Materials*", Springer, USA, (2011), and references therein.
2) M. Anpo, *J. CO_2 Utilization,* **1**, 8 (2013), and references therein.
3) Y. Horiuchi, M.Takeuchi, M. Matsuoka, M. Anpo, *Phys. Chem. Chem. Phys*., **15**, 13243 (2013).
4) J. Schneider, M. Anpo, D. Bahnemann, et al., *Chem. Rev*., in press (2014), and references therein.