Enhancing the Efficiency of CO2 Recycling by Using Visible Rays with Natural Dyes

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In 2012, the World Economic Forum selected utilization of CO2 as a resource as one of 10 technologies which should be developed within the next three years. Also, many environmental problems have been highlighted. So here are the purposes of the research: First is reusing CO2 by the process of CO2 reduction, and second, expanding the available range of lights from ultra violet rays to visible rays with natural dyes. For the first experiment, TiO2 were compounded and coated on five FTO glasses. On four of them, four kinds of natural dyes were absorbed on the TiO2. Then, cells for photo reaction were made with the glasses and 1M sulfuric acid solution which saturated the CO2. The reaction proceeded under the solar simulator for 60 hours with samples being collected every 12 hours. During the experiment, UV-cut filter was needed for blocking ultra violet rays with cells containing natural dyes. By using XRD and SEM, a phase and size of TiO2 were confirmed. The GC analysed the yield of methane. According to previous research, the CO2 reduction reaction only used 3.2eV light(UltraViolet). However, in the GC results of natural dyes, despite cutting UV rays with a filter, methane was produced. Also the UV-visible graph showed that the natural dyes have optical density of visible rays. In conclusion, by absorbing natural dyes on the TiO2 surface, not only UV rays but also visible rays, the most common form of radiation can be used on photo reactions, improving reduction efficiency. It is expected that efficiency will increase 1.6 times. Moreover, developing a colorful reductant suggests the possibility of future commercialization.