Abstract

As the human population grows, the needs for fertilizers will keep increasing by time. However, the most practiced industrial method of making ammonia fertilizers is by applying the Haber Bosch process which requires a lot of energy and produces a massive amount of carbon dioxide gas emissions (CO_2). On the other hand, nitrate pollution in water sources becomes an emerging concern that can cause a fatal effect on the human body. By that, finding a way of producing ammonia fertilizers without releasing CO_2, or so-called green ammonia from nitrate waste may become an interesting solution to a global environmental and food stock problem. One of the possible techniques to achieve this is by mimicking photosynthesis, a redox reaction using only sunlight as the energy, by applying artificial photosynthesis photo-electrocatalysis concept. In this research, we study a promising dual photo-electrocatalyst material based on TiO_2 nanotube (TNT) for photoanode (water oxidation) and dark cathode reaction (direct nitrate reduction with water to produce green ammonia). Two modifiers will be introduced to control oxygen vacancy as an active site: electrochemical reduction and cobalt doping. This work has not particularly been done nor reported before. It is hoped that this work will contribute to the development of the technology for nitrate removal and green ammonia production. In the long term, fixing the pollution problems will hopefully be a solution to a global problem one step at a time.

Keyword: Green Ammonia, Nitrate waste, Photo electro-catalysis, TiO_2 nanotube (TNT), Oxygen Vacancy