World Academy of Science, Engineering and Technology
International Journal of Mathematical and Computational Sciences
Vol:14, No:12, 2020

The Photocatalytic Approach for the Conversion of Polluted Seawater CO_2 into Renewable Source of Energy

Authors : Yasar N. Kavil, Yasser A. Shaban, Radwan K. Al Farawati, Mohamed I. Orif, Shahed U. M. Khanc

Abstract : Photocatalytic way of reduction of CO_2 in polluted seawater into chemical fuel, methanol, was successfully gained over Cu/C-co-doped TiO_2 nanoparticles under UV and natural sunlight. A homemade stirred batch annular reactor was used to carry out the photocatalytic reduction experiments. Photocatalysts with various Cu loadings (0, 0.5, 1, 3, 5 and 7 wt.%) were synthesized by the sol-gel procedure and were characterized by XRD, SEM, UV–Vis, FTIR, and XPS. The photocatalytic production of methanol was promoted by the co-doping with C and Cu into TiO_2. This improvement was attributed to the modification of bandgap energy and the hindrance of the charges recombination. The polluted seawater showing the yield depended on its background hydrographic parameters. We assessed two types of polluted seawater system, the observed yield was 2910 and 990 µmol g^{-1} after 5 h of illumination under UV and natural sunlight respectively in system 1 and the corresponding yield in system 2 was 2250 and 910 µmol g^{-1} after 5 h of illumination. The production of methanol in the case of oxygen-depleted water was low, this is mainly attributed to the competition of methanogenic bacteria over methanol production. The results indicated that the methanol yield produced by Cu-C/TiO_2 was much higher than those of carbon-modified titanium oxide (C/TiO_2) and Degussa (P25-TiO_2). Under the current experimental condition, the optimum loading was achieved by the doping of 3 wt % of Cu. The highest methanol yield was obtained over 1 g L-1 of 3wt% Cu/C-TiO_2.

Keywords : CO_2 photoreduction, copper, Cu/C-co-doped TiO_2, methanol, seawater
Conference Title : ICSRD 2020 : International Conference on Scientific Research and Development
Conference Location : Chicago, United States
Conference Dates : December 12-13, 2020