THE EFFECT OF pH IN CONVERTING CO₂ INTO METHANOL BY NANO-SCALE TiO₂

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Abstract: The increase of carbon dioxide concentration in the atmosphere has become a severe environmental problem, since it could cause global warming due to greenhouse effects. Thus the reduction of carbon dioxide emission to tackle the greenhouse effect has become one of the most important tasks for sustainable development. TiO₂ is the most famous photocatalyst during these years, especially for the nano-scale particle of TiO₂. The pH effect on the photocatalytic process of titania was seldom discussed. This study designed a lab scale reactive chamber and experimental system, then performing the batch tests of photocatalytic process to convert CO₂ to methanol. The nano-scale of commercial TiO₂ and a 5W UV lamp of 365nm wavelength were used in this photocatalytic process. Moreover, NaOH was used as the alkali to control the initial pH environment. The initial used masses of NaOH were 1.91g, 2.98g and 4.01g in 5L solution for batch tests #1, #2 and #3, respectively. Besides, this study added 1g NaOH extra every two hours for batch test #2. This work estimated the pH effect on the photocatalytic reduction process of CO₂ by the production rate of methanol. The results of indicated the increasing in pH increasing the production rate of methanol. The production rates of methanol were 1067.8 umole/g, 1907.2 umole/g and 1697.6 umole/g for batch test #1, #2 and #3, respectively under the controlled temperature of 30⁰C. The possible reason is that the NaOH increases the dissolution of CO₂ in water, increasing the concentration of reactant.

Keyword: TiO₂, CO₂, greenhouse effects, pH, methanol