Effective Remediation of Air Pollution through an Algal System Integrated with Carbon Mineralization Technology: Phase II - Enhancing the Biohydrogen Production using Flue Gas Derived Bicarbonate and Nutrient Limitation Methods

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Biohydrogen generated from algal cultures can be an effective solution as cleaner alternative fuel to reducing greenhouse gas emissions. Most of the related research is focused on limited strains and little has been known so far about improving hydrogen production. Flue gas derived bicarbonate generated from the Carbon Mineralization technique can be instrumental in boosting algal growth. If it can also enhance the hydrogen production capabilities, the algal system integration can lead to sustainable biohydrogen production. In this study, the hydrogen production capabilities of 5 macro algae that were collected using standard field techniques and 6 microalgae strains obtained from the UTEX culture collection have been studied. The experiment was conducted under anaerobic conditions/dark incubation after inducing nutrient limitation through dilution. Algal growth, cell count, starch amount and hydrogen concentrations were measured before and after the dark incubation period of 7 days per batch. Results obtained from batches of algal strains grown without bicarbonate and grown with 0.1M and 0.2M flue gas derived bicarbonate over 14 days were compared. Preliminary results indicate that in 8 out of 11 algal strains bicarbonate resulted in an increased hydrogen production of up to approximately 406 ml of gas/L of algae. In conclusion, bicarbonate addition significantly increased algae growth and hydrogen production in micro and macro algae, although the responses are species specific when compared under similar conditions. Bicarbonate produced from carbon mineralization has the potential to be used as feedstock for algae cultures and yield biohydrogen with the promise of negative carbon emissions.

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