Effective Remediation of Air Pollution through an Algal System Integrated with Carbon Mineralization Technology, Phase I: Selection of Algal Strains that Perform Well in a Flue Gas Derived Bicarbonate Environment

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Carbon capture and storage is a major strategy to mitigate greenhouse gasses (GHGs) but the associated high costs and risk of CO2 leakage can deter its adaptability. Carbon Mineralization technology is an innovative alternative to convert GHGs into common industrial products. The integration of an algal system can make it a sustainable solution if appropriate strains can be identified. In this study, the effect of 0.03M bicarbonate solution was studied on 9 macro algae collected using standard field techniques and 6 microalgae strains obtained from the lab. Algal growth was monitored over 24 days. Seven cultures that exhibited higher growth rate were further exposed to 0.06M and 0.12M NaHCO3 and monitored for another 14 days. Titration with 0.01M HCL was performed to determine the rate of NaHCO3 absorption. Preliminary results indicate that microalgae exhibited better carbon sequestration ability compared to macro algae even at higher NaHCO3 concentrations. Chlorococcum rugosum and Scenedesmus obliquus exhibited high absorption rates (k constant of 15.1 and 18.8) and increased growth rates of 473% and 188% compared to growth rate without bicarbonate. Nannochloris sp., continued to grow at all concentrations of bicarbonate at similar rates. In conclusion, bicarbonate addition can significantly affect algae growth and rate of CO2 absorption in micro and macro algae, although the responses are species specific when compared under similar conditions. Bicarbonate solution produced from the carbon mineralization has the potential to be used as feedstock for algae cultures, to regenerate carbonate economically and yield valuable byproducts making the process effective.

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