The Variation of Carbon Dioxide Levels and the Subsequent Measurement of Dissolved Oxygen to Indicate Photorespiration in Crassulacean Acid Metabolism Plantlife: A Novel Method

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The purpose of this experiment was to test a possible method to reduce photorespiration, a variation in the process of organic molecule formation, in crassulacean acid metabolism (CAM) plants. I hypothesized that increased concentrations of carbon dioxide (CO_2) would result in increased oxygen output by CAM plants, indicating reduced rates of photorespiration. Each of the twelve airtight chambers that I constructed contained one liter of deionized water, with a starting concentration of 41.6 milligrams per liter (mg/L) of dissolved oxygen; one photorespirative Crassula ovata; a dissolved oxygen sensor; and a CO_2 sensor. I then placed each chamber in an environment of 30 degrees Celsius, with consistent light exposure. Three chambers each contained one of the following: 50 parts per million (ppm) of CO_2, 400 ppm of CO_2, 750 ppm of CO_2, and 1,100 ppm of CO_2. Dissolved oxygen levels in each system were monitored and recorded for 5 hours. The relationships displayed between CO_2 concentrations and dissolved oxygen concentrations were directly proportional: as CO_2 concentrations increased, dissolved oxygen concentrations also increased. The average dissolved oxygen concentration at the fifth hour of testing for each variable is as follows: systems containing 50 ppm of CO_2 averaged 41.648 mg/L; systems containing 400 ppm of CO_2 averaged 41.676 mg/L; systems containing 750 ppm of CO_2 averaged 41.729 mg/L; systems containing 1,100 ppm of CO_2 averaged 41.756 mg/L. The results of my experiment validate my claim that increased CO_2 concentrations result in a larger release of molecular oxygen from CAM plants. This is indicative of lower photorespiration rates, and thus, less energy consumption by the plant.