

# RAPID DETERMINATION OF ALGAL GROWTH KINETICS USING EXTANT RESPIROMETRY

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## ABSTARCT

Algae have received increasing attention as a potential renewable source due to ease of biomass culture, fast growth rate, high biomass productivity, CO<sub>2</sub> fixation and O<sub>2</sub> production. For massive algal production algal kinetic parameters should be carefully determined and monitored. This study was aimed to explore the potential of using respirometry to rapidly measure algal growth kinetics. Compared to the standard batch growth study that lasts for more than 10 days, algal growth kinetics could be determined within a few hours. For the mixed algal the specific growth rates were  $0.35 \pm 0.02 \text{ d}^{-1}$  and  $0.62 \pm 0.02 \text{ d}^{-1}$  from the standard batch and respirometry tests, respectively. For *Chlorella vulgaris*, these values were  $0.45 \pm 0.02$  and  $0.65 \pm 0.02$  from the standard batch and respirometry tests, respectively. In addition to the specific growth rate calculation, the effects of different factors such as pH, bicarbonate, organic carbon sources (e.g. glucose) and toxicants (e.g. Cu<sup>2+</sup>) on algal growth were investigated by respirometry. pH range from 7 to 9 appeared to have no impact on algal growth. The half saturation constant (K<sub>s</sub>) values for *Chlorella vulgaris* and mixed algal species were 0.3 and 0.7 mg/L with  $\mu_{\text{max}}$  of 0.9 and 0.68 d<sup>-1</sup>, respectively. Both algal cultures maintained their maximum growth rate at the NaHCO<sub>3</sub> concentration of 1500 mg/L, indicating that algae can effectively grow under a broad range of CO<sub>2</sub> concentrations. The presence of glucose resulted in a decrease of the specific oxygen production rate for both *Chlorella vulgaris* and mixed algal species but each culture behaved differently in response to increasing glucose concentrations from 0.1 to 1.6 g/L. The decrease was not due to the presence of low concentrations of bacteria in the algal cultures. Bacterial cell numbers in the *Chlorella vulgaris* and mixed algal culture were  $3.6 \times 10^4$  and  $1.3 \times 10^3$  CFU/mL, respectively. Cupric ions have been used as a common algaecide. Short-term algal toxicity tests indicate that the growth of *Chlorella vulgaris* and the mixed algal species was not affected at 0.4 mg/L Cu<sup>2+</sup>. However, as the Cu<sup>2+</sup> concentration increased, significant algal growth inhibition was observed.