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Growing Algae in a Community College Biology Course: Inquiry Into The Algae-to-Biodiesel Pipeline

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Fast-growing algae fix the greenhouse gas carbon dioxide via photosynthesis and absorb environmental contaminants while accumulating on average 20-35% of their dry-weight in neutral lipids (1). These lipid molecules can be harvested and reacted with simple alcohols to produce biodiesel. Although the algae-to-biodiesel pipeline is a potential source of liquid transportation fuel, there remain many challenges that scientists presently are attempting to overcome including optimizing culture conditions for algal growth (2). The Boyce Thompson Institute for Plant Research (BTI) created a classroom algal photobioreactor laboratory (APBL) incorporating current research efforts and provided the curriculum, experimental materials and methods, and expertise for execution in a classroom setting. We discuss herein a pilot of APBL with honors biology (majors) students at Chandler Gilbert Community College, in Chandler, Arizona.

Students were assigned the scenario of being scientific advisors to a biofuel startup company and asked to determine the optimal conditions for growing the alga, *Chlorella protothecoides*. Thereafter, each student group, acting as independent biofuel companies, created a testable hypothesis and designed experiments to examine algal growth (cell concentration) in mini-photobioreactors across different culture media (sugar type, nitrogen and phosphorus [fertilizer] concentrations, and salinity). Photoperiod, light intensity, and ambient temperature across media combinations were identical and a media minus treatment (water) was utilized as a negative control. The students collected algal growth data at various intervals throughout the duration of their experiments using hemocytometers (cell/mL) and spectrophotometers (optical density at 550 nm). Cell concentration by culture media was analyzed statistically and, according to these results, students prepared a recommendations for optimal algal growth for the company and "informed stakeholders". Students conceived innovative ideas for future experiments including determining whether light color (wavelength) influences algal growth. Unfortunately, we were not equipped with the materials to implement experiments beyond those circumscribed in and provided by the BTI module. For future semesters, students will be provided with resources to study additional variables and the opportunity to participate in a civic engagement module on energy policy, thereby providing an interdisciplinary focus.

References: **(1)** Kirrolia et al. Renew. Sust. Energ. Rev. 20: 642-656, 2013. **(2)** Pragya et al. Renew. Sust. Energ. Rev. 24:159-171, 2013.

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