

ABSTRAK

Euglena gracilis merupakan mikroalga yang berpotensi tinggi dalam produksi biomassa dan karotenoid, melalui optimalisasi faktor lingkungan berupa suplementasi etanol dan intensitas cahaya. Penelitian ini bertujuan menentukan variasi intensitas cahaya dan penambahan etanol yang paling sesuai untuk meningkatkan biomassa dan karotenoid yang dibuktikan secara fisiologis, morfologis, dan molekuler. Penelitian dilakukan dalam dua tahap. Tahap pendahuluan, penentuan penambahan etanol (0 g/L, 2 g/L, 4 g/L, dan 6 g/L) menunjukkan konsentrasi 6 g/L paling optimal dalam peningkatan biomassa, baik berdasarkan metode hitung sel, biomassa kering, maupun absorbansi *optical density*. Konsentrasi etanol ini kemudian digunakan pada tahap kedua dengan perlakuan intensitas cahaya (rendah (2000 lux), sedang (4000 lux), tinggi (8000 lux), dan tanpa cahaya). Hasil pertumbuhan biomassa tertinggi didapat dari perlakuan 8000 lux mencapai 227×10^5 sel/mL pada hari ke-10 kultivasi. Perlakuan yang sama juga menghasilkan karotenoid total paling optimal mencapai 18 $\mu\text{g/mL}$, dengan turunan karotenoid dominan berupa Diadinoxanthin. Secara morfologis, perlakuan tanpa cahaya terjadi reduksi pigmen dan berbentuk *spherical*. Hasil pengukuran ekspresi gen menggunakan qPCR menunjukkan gen *Egcrtp1* dan *Egcrtp2* pada hari ke-10 juga paling optimal pada intensitas cahaya tinggi. Perlakuan tanpa cahaya dengan etanol mengekspresikan kedua gen lebih tinggi dibandingkan tanpa etanol dengan cahaya rendah. Pengukuran serapan etanol tertinggi terjadi pada perlakuan intensitas cahaya sedang. Studi ini memberikan pemahaman mendalam tentang respons *E. gracilis* terhadap faktor lingkungan dan metabolik, serta berimplikasi pada strategi optimalisasi produksi karotenoid di masa depan.

Kata Kunci: *Euglena gracilis*, intensitas cahaya, etanol, karotenoid.

ABSTRACT

Euglena gracilis is a microalga with significant potential for producing biomass and carotenoids. This potential can be harnessed by optimizing environmental factors such as ethanol supplementation and light intensity. This study aimed to identify the most suitable variations in light intensity and ethanol addition to enhance biomass and carotenoid production, with evidence from physiological, morphological, and molecular analyses. The research was conducted in two stages. In the preliminary stage, various concentrations of ethanol (2, 4, 6 g/L) were tested. The 6 g/L ethanol concentration was found to be optimal for increasing biomass, as evidenced by cell count, dry biomass, and optical density absorbance. This optimal ethanol concentration was then applied in the second stage, which involved different light intensity treatments: low (2000 lux), medium (4000 lux), high (8000 lux), and no light. The highest biomass growth was observed at 8000 lux, reaching 227×10^5 cells/mL on day 10 of cultivation. The same treatment also yielded the most optimal total carotenoid production, reaching 18 $\mu\text{g/mL}$, with Diadinoxanthin being the dominant carotenoid derivative. Morphologically, the no-light treatment resulted in a reduction of pigments and form spherical shape. Furthermore, measurement the expression of both *Egcrp1* and *Egcrp2* genes using qPCR on day 10 was also most optimal under high light intensity. Interestingly, the no-light treatment with ethanol led to higher expression of both genes compared to the low-light treatment without ethanol. The highest ethanol uptake was observed in the medium light intensity treatment. This study provides a deep understanding of *E. gracilis*'s responses to environmental and metabolic factors, offering valuable insights for future strategies to optimize carotenoid production.

Keywords: *Euglena gracilis*, gene expression, light intensity, ethanol, carotenoids.