RESPONS FISIOLOGIS DAN MOLEKULER *Chlorella* sp. BPBAP SITUBONDO DALAM MEDIUM *LIQUID DIGESTATE OF POME* (LDP) TERHADAP INDUKSI SALINITAS

Faradilla
23/527558/PBI/01975

ABSTRAK

Astaksantin merupakan karotenoid dengan aktivitas antioksidan yang sangat tinggi dan memiliki nilai ekonomi signifikan dalam industri farmasi, pangan, dan akuakultur. Produksi astaksantin alami masih terkendala oleh biaya tinggi dan efisiensi rendah, terutama pada *Haematococcus pluvialis*. Sebagai alternatif, *Chlorella* sp. BPBAP Situbondo dipelajari karena memiliki pertumbuhan cepat dan toleransi tinggi terhadap lingkungan. Penelitian ini bertujuan mengevaluasi potensi *liquid digestate of* POME (LDP) sebagai medium alternatif yang ramah lingkungan serta mengeksplorasi induksi salinitas sebagai strategi peningkatan kandungan astaksantin. Penelitian dilakukan melalui dua tahap: tahap pertama menguji pertumbuhan pada media BBM dan berbagai konsentrasi LDP, dan tahap kedua mengevaluasi dampak induksi salinitas (1% dan 2% NaCl) terhadap akumulasi biomassa, metabolit primer, pigmen, serta ekspresi gen *bkt* (β-carotene ketolase). Hasil menunjukkan bahwa LDP 11,25% mampu mendukung pertumbuhan dan produksi pigmen yang optimal. Induksi salinitas memicu peningkatan kandungan karbohidrat, lipid, dan astaksantin, serta ekspresi gen *bkt* yang menunjukkan aktivasi jalur biosintesis astaksantin. Namun, pada medium LDP, tanpa perlakuan stres salinitas pun, *Chlorella* sp. menunjukkan peningkatan produksi astaksantin secara signifikan. Hal ini menunjukkan bahwa medium LDP mampu berfungsi ganda sebagai sumber nutrien sekaligus pemicu stres ringan yang mendukung produksi metabolit bernilai tinggi. Temuan ini menegaskan bahwa pendekatan *two-stage cultivation* berbasis LDP dan induksi salinitas merupakan strategi yang menjanjikan untuk produksi astaksantin secara berkelanjutan dan ekonomis.

Kata kunci: *Chlorella*, *Liquid digestate of* POME (LDP), salinitas, astaksantin, β-carotene ketolase (*bkt)*

PHYSIOLOGICAL AND MOLECULAR RESPONSES OF *Chlorella* sp. FROM BPBAP SITUBONDO IN LIQUID DIGESTATE OF POME (LDP) ON SALINITY INDUCTION

Faradilla
23/527558/PBI/01975

ABSTRACT

Astaxanthin is a carotenoid with very high antioxidant activity and significant economic value in the pharmaceutical, food, and aquaculture industries. The production of natural astaxanthin is still limited by high costs and low efficiency, especially in *Haematococcus pluvialis*. Alternatively, *Chlorella* sp. BPBAP Situbondo was investigated due to its rapid growth and high environmental tolerance. This study aims to assess the potential of liquid digestate of POME (LDP) as an environmentally friendly alternative medium, as well as to investigate salinity induction as a strategy for increasing astaxanthin content. The research was conducted in two stages: the first stage tested growth on BBM medium and various concentrations of LDP, and the second stage evaluated the impact of salinity induction (1% and 2% NaCl) on biomass accumulation, primary metabolites, pigments, and *bkt* (β-carotene ketolase) gene expression. The results showed that 11.25% LDP was adequate to support optimal growth and pigment production. Salinity induction increases carbohydrate, lipid, and astaxanthin content, as well as *bkt* gene expression, indicating that the astaxanthin biosynthetic pathway has been activated. However, in LDP medium, even without salinity stress treatment, *Chlorella* sp. produced significantly more astaxanthin. This suggests that the LDP medium can act both as a nutrient source and a mild stressor, promoting the production of high-value metabolites. These findings confirm that the two-stage cultivation approach based on LDP and salinity induction is a promising strategy for sustainable and economical astaxanthin production.

Kata kunci: *Chlorella*, *Liquid digestate of* POME (LDP), salinity induction, astaxanthin, β-carotene ketolase (*bkt)*