

ABSTRAK

Bakteri endofit mampu menghasilkan senyawa bioaktif termasuk beberapa senyawa fitokimia. Bakteri endofit banyak ditemukan pada beberapa tanaman dengan kondisi lingkungan berbeda – beda, salah satunya lingkungan ekstrem. Geotermal merupakan salah satu contoh lingkungan dengan beberapa faktor ekstrem. Lumut telah dilaporkan terdapat bakteri endofit dengan kemampuannya menjadi bioaktivitas seperti antioksidan serta menjadi antimikroba. Penelitian ini dilakukan untuk memperoleh isolat bakteri endofit dari lumut geotermal sumber air panas Gedong Songo yang harapannya dapat diaplikasikan sebagai antioksidan, antiagregasi, dan antiinflamasi.

Tahap pada penelitian ini diawali dengan proses isolasi, produksi ekstrak metabolit dari setiap isolat untuk dilakukan uji antibakteri dan antioksidan hingga diperoleh isolat terpilih. Selanjutnya dilakukan proses produksi metabolit sekunder dari isolat terpilih dimulai pada kurva pertumbuhan hingga produksi metabolit sekunder pada fase kematian, ekstrak kemudian dilakukan penapisan fitokimia. Pengujian akhir yang dilakukan adalah bioaktivitas serta karakterisasi dan identifikasi fenotipik serta genotipiknya melalui tahap-tahap: isolasi dan pemurnian DNA, amplifikasi fragmen gen 16S rRNA dengan PCR elektroforesis, sekuensing dan konstruksi pohon filogeni.

Hasil yang diperoleh pada penelitian ini ialah dipilih sebelas koloni hasil isolasi dengan nilai penghambatan rendah pada bakteri *E.coli* dari kesebelas ekstrak metabolit sekunder ditunjukkan isolat L3, L6, L4, L8, L9, dan L11 dengan aktivitas antioksidan tertinggi pada isolat L11. Ekstrak metabolit L11 mengandung terpenoid, tanin, dan flavonoid terlihat pada hasil penapisan fitokimia. Ekstrak metabolit L11 dilakukan uji bioaktivitas dengan hasil aktivitas antioksidan sangat kuat IC50 sebesar 41,82 ppm, aktivitas antiagregasi pada konsentrasi 40 ppm sebanyak 56%, dan aktivitas antiinflamasi konsentrasi 40 ppm menghasilkan persen inhibisi sebesar 87.5%. Hasil fenotipik bakteri endofit L11 diperoleh morfologi dengan bentuk koloni bulat, tepian halus, elevasi convex, bentuk sel kokus, dan termasuk pada jenis bakteri gram positif. Kemudian hasil genotipik bakteri endofit L11 menunjukkan, bakteri endofit L11 memiliki kekerabatan dekat dengan *Micrococcus luteus* dan *Micrococcus endophyticus*.

Kata Kunci : Bakteri endofit, lumut geotermal, senyawa bioaktif, bioaktivitas, genotipik

ABSTRACT

Endophytic bacteria are capable of producing bioactive compounds, including several phytochemical compounds. Endophytic bacteria are commonly found in various plants with different environmental conditions, one of which is extreme environments. Geothermal areas are an example of environments with several extreme factors. Mosses have been reported to harbor endophytic bacteria with abilities such as antioxidant and antimicrobial activities. This research was conducted to obtain endophytic bacterial isolates from geothermal mosses of the hot spring source Gedong Songo, with the hope of applying them as antioxidants, antiglycation, and antiaggregation agents.

The stages of this research began with the isolation process, production of metabolite extracts from each isolate for antibacterial and antioxidant tests until selected isolates were obtained. Subsequently, the production process of secondary metabolites from the selected isolates was carried out starting from the growth curve until the production of secondary metabolites in the death phase, followed by phytochemical screening of the extracts. The final tests conducted were bioactivity assays, as well as phenotypic and genotypic characterization and identification through the following stages: isolation and purification of DNA, amplification of the 16S rRNA gene fragments using PCR electrophoresis, sequencing, and construction of a phylogenetic tree.

The results obtained in this research were the selection of eleven colonies resulting from isolation with low inhibition values against *E. coli* bacteria. Among the eleven secondary metabolite extracts, isolates L3, L6, L4, L8, L9, and L11 showed the highest antioxidant activity, with isolate L11 exhibiting the highest antioxidant activity. The L11 metabolite extract contained terpenoids, tannins, and flavonoids as observed in the phytochemical screening results. The L11 metabolite extract was tested for bioactivity, resulting in very strong antioxidant activity with an IC₅₀ of 41.82 ppm, antiglycation activity of 56% at a concentration of 40 ppm, and antiaggregation activity producing an inhibition percentage of 87.5% at a concentration of 40 ppm. The phenotypic characteristics of the endophytic bacterium L11 included morphology with round colonies, smooth edges, convex elevation, cocci cell shape, and classification as a gram-positive bacterium. Furthermore, the genotypic results of the endophytic bacterium L11 showed close relatedness to *Micrococcus luteus* and *Micrococcus endophyticus*.

Keywords : Endophytic bacteria, geothermal moss, bioactive compounds, bioactivity, genotypic.