

**POTENSI EKSTRAK FLAVONOID *Spirulina platensis* SEBAGAI KANDIDAT
BAHAN ANTI JERAWAT BERDASARKAN STUDI *IN VITRO* DAN *IN SILICO***

SKRIPSI

diajukan untuk memenuhi sebagian syarat untuk memperoleh gelar Sarjana Sains
Program Studi Kimia



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UNIVERSITAS PENDIDIKAN INDONESIA
BANDUNG
2023**

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Skripsi ini diajukan untuk memenuhi salah satu syarat memperoleh gelar Sarjana Sains pada Program Studi Kimia Fakultas Pendidikan Matematika dan Ilmu Pengetahuan Alam

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Agustus 2023

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PERNYATAAN

Dengan ini menyatakan bahwa skripsi dengan judul “**Potensi Ekstrak Flavonoid *Spirulina platensis* Sebagai Kandidat Bahan Anti Jerawat Berdasarkan Studi *In vitro* dan *In silico***” ini beserta seluruh isinya adalah benar-benar karya saya sendiri. Saya tidak melakukan penjiplakan atau pengutipan dengan cara-cara yang tidak sesuai dengan etika ilmu yang berlaku dalam masyarakat keilmuan. Atas pernyataan ini, saya siap menanggung resiko/sanksi apabila dikemudian hari ditemukan adanya pelanggaran etika keilmuan atau ada klaim dari pihak lain terhadap keaslian karya saya ini.

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KATA PENGANTAR

Puji dan syukur senantiasa penulis panjatkan kehadiran Allah SWT., berkat rahmat dan hidayah-Nya, penulis dapat menyelesaikan penulisan skripsi yang berjudul “**Potensi Ekstrak Flavonoid *Spirulina platensis* Sebagai Kandidat Bahan Anti Jerawat Berdasarkan Studi *In vitro* dan *In silico***”. Sholawat serta salam penulis sampaikan kepada Nabi Muhammad SAW serta para keluarga, sahabat, dan pengikutnya sampai akhir zaman.

Penulisan skripsi ini disusun untuk menempuh salah satu syarat memperoleh gelar Sarjana Sains pada Program Studi Kimia, Fakultas Pendidikan Matematika dan Ilmu Pengetahuan Alam, Universitas Pendidikan Indonesia. Penulis menyadari bahwa dalam penulisan ini masih banyak kekurangan dan jauh dari kata sempurna baik dalam segi penulisan maupun materi. Oleh sebab itu, penulis berharap adanya kritik dan saran untuk perbaikan di waktu mendatang. Semoga skripsi ini dapat menambah wawasan serta memberikan manfaat bagi penulis dan umumnya bagi para pembaca.

Bandung, 21 Agustus 2023

Penulis,

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UCAPAN TERIMA KASIH

Puji dan syukur penulis panjatkan ke hadirat Allah SWT., berkat rahmat dan hidayah-Nya, penulis dapat menyelesaikan semua proses penelitian dan penulisan skripsi ini. Pada penelitian dan penulisan skripsi ini penulis banyak menerima bantuan dari berbagai pihak. Oleh karena itu, pada kesempatan ini penulis ingin menyampaikan rasa terima kasih kepada seluruh pihak yang telah berpartisipasi dan membantu penulis, terutama kepada:

1. Kedua orang tua penulis yang senantiasa mendoakan dan memberikan dukungan baik secara moril maupun material.
2. Bapak Gun Gun Gumilar, M.Si., selaku pembimbing I dan Ketua KBK Kimia Hayati yang telah memberikan arahan, bimbingan, masukan, dan saran selama penelitian dan penulisan skripsi.
3. Ibu Heli Siti Halimatul Munawaroh, Ph.D., selaku pembimbing II dan pembimbing akademik yang telah memberikan arahan, bimbingan, masukan, dan saran selama penelitian dan penulisan skripsi.
4. Ibu Prof. Fitri Khoerunnisa, Ph.D., selaku Ketua Program Studi Kimia FPMIPA UPI.
5. Dosen, Laboran, serta Staf Departemen Pendidikan Kimia FPMIPA UPI yang telah memberikan ilmu, motivasi, dorongan, serta pelayanan terbaik kepada penulis selama proses studi.
6. Anisa Noorlela, Deaniar Hafilah, Muhammad Fauzan Fakhrurozi, dan Trisa Sukma Nur Insani selaku teman satu bimbingan yang selalu menemani, membantu, dan mendukung penulis pada proses penelitian serta penulisan skripsi.
7. Anisa Klarasita, Eka Nikita Pratiwi, Jihan Nurafifah Hernawan, dan Riska Kurnelia Ananda selaku teman penulis selama menempuh pendidikan yang selalu memberikan dukungan, motivasi, dan bantuan kepada penulis.
8. Seluruh rekan kimia angkatan 2019, khususnya Kimia C 2019 dan KBK Kimia Hayati yang telah kebersamai penulis selama proses studi.

Ghea Dinda Nugraha, 2023

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9. Semua pihak yang telah berpartisipasi atas terselesaikannya penelitian beserta skripsi ini.

Semoga Allah SWT. selalu melindungi dan memberikan balasan melebihi apa yang mereka semua berikan kepada penulis.

Bandung, 21 Agustus 2023

Penulis,

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ABSTRAK

Jerawat merupakan salah satu gangguan pada kulit yang dapat disebabkan oleh tertutupnya pori akibat adanya infeksi bakteri. Pada penelitian ini dilakukan analisis potensi ekstrak flavonoid *Spirulina platensis* sebagai kandidat bahan anti jerawat menggunakan pendekatan *in vitro* dan *in silico*. Karakterisasi ekstrak *Spirulina platensis* ditentukan menggunakan skrining fitokimia, FTIR, dan penentuan total senyawa flavonoid. Potensi aktivitas ekstrak ditentukan melalui uji antibakteri yang dilakukan secara *in vitro* terhadap bakteri *Propionibacterium acnes*, *Staphylococcus aureus*, dan *Staphylococcus epidermidis*. Selain itu, dilakukan studi *in silico* dengan cara melakukan penambatan (*docking*) kelompok senyawa flavonoid terhadap enzim DNA gyrase B yang berperan dalam regulasi topologi DNA pada bakteri. Flavonoid dari *Spirulina platensis* diekstraksi menggunakan etanol 80% dan didapatkan ekstrak kering sebanyak 4,6137 gram dari biomassa sebesar 40,0732 gram. Pada karakterisasi senyawa didapatkan hasil bahwa ekstrak *Spirulina platensis* mengandung senyawa flavonoid dengan total flavonoid sebesar $606,20 \pm 5,4$ mg QE/g ekstrak. Pengujian *in vitro* menunjukkan bahwa ekstrak flavonoid memiliki aktivitas antibakteri dimana pada bakteri *Propionibacterium acnes* dan *Staphylococcus aureus* memiliki nilai *minimum inhibitory concentration* (MIC) sebesar $500 \mu\text{g/mL}$ dan *minimum bactericidal concentration* (MBC) sebesar $1000 \mu\text{g/mL}$. Terhadap bakteri *Staphylococcus epidermidis* memiliki nilai MIC dan MBC yang sama, yaitu $500 \mu\text{g/mL}$. Pengujian *in silico* berdasarkan *molecular docking* menunjukkan adanya interaksi antara senyawa flavonoid dengan reseptor DNA gyrase B yang menghasilkan nilai energi afinitas $-7,4$ kkal/mol untuk apigenin; $-7,2$ kkal/mol untuk kaempferol; $-7,3$ kkal/mol untuk katekin; $-7,7$ kkal/mol untuk naringin dan naringenin; $-7,6$ kkal/mol untuk quercetin; $-7,3$ kkal/mol untuk rutin; serta $-7,9$ kkal/mol untuk ciprofloxacin sebagai kontrol positif. Interaksi yang terlibat pada pembentukan kompleks adalah interaksi hidrogen, hidrofobik, Van der Waals, dan interaksi elektrostatik. Hasil interaksi menunjukkan bahwa kelompok senyawa flavonoid termasuk ke dalam inhibitor kompetitif dikarenakan menempati sisi pengikatan yang sama dengan ciprofloxacin sebagai kontrol positif. Berdasarkan hasil penelitian dapat disimpulkan bahwa senyawa flavonoid dari ekstrak *Spirulina platensis* memiliki potensi untuk digunakan sebagai kandidat bahan anti jerawat.

Kata Kunci: antibakteri, flavonoid, jerawat, *molecular docking*, *Spirulina platensis*

ABSTRACT

Acne is a condition where the skin is blocked due to a bacterial infection. This study aims to analyze the potential of flavonoid extract derived from *Spirulina platensis* as a candidate anti-acne agent using in vitro and in silico approaches. Characterization of *Spirulina platensis* extract was determined using phytochemical screening, FTIR, and total flavonoid content in the extracts. The anti-acne activity was determined through an antibacterial test of the extract against the bacteria *Propionibacterium acnes*, *Staphylococcus aureus*, and *Staphylococcus epidermidis*. In addition, an in silico study was carried out by docking the flavonoid group of compounds against the DNA gyrase B enzyme which plays a role in regulation of DNA topology in bacteria. Flavonoids from *Spirulina platensis* were extracted using 80% ethanol and produced 4.6137 grams of dry extract from a biomass of 40.0732 grams. The total content of flavonoid compounds in the *Spirulina platensis* extract is 606.20 ± 5.4 mg QE/g extract. The flavonoid extract show antibacterial activity againsts *Propionibacterium acnes* and *Staphylococcus aureus* with a minimum inhibitory concentration (MIC) value of 500 $\mu\text{g}/\text{mL}$ and a minimum bactericidal concentration (MBC) value of 1000 $\mu\text{g}/\text{mL}$. *Staphylococcus epidermidis* bacteria gave the same MIC and MBC values of 500 $\mu\text{g}/\text{mL}$. In silico analysis using molecular docking showed that there are interaction among the flavonoid compounds and the DNA gyrase B with energy affinities value of -7.4 kcal/mol for apigenin; -7.2 kcal/mol for kaempferol; -7.3 kcal/mol for catechins; -7.7 kcal/mol for naringin and naringenin; -7.6 kcal/mol for quercetin; -7.3 kcal/mol for rutin; and -7.9 kcal/mol for ciprofloxacin as a positive control. The complex formation involved in hydrogen, hydrophobic, Van der Waals and electrostatic interactions. The site location interaction simulation showed that inhibition of the flavonoid compounds were competitive inhibition since it occupied the same binding site as ciprofloxacin as a positive control. Based on the results of the study it can be concluded that the flavonoid compounds from extract *Spirulina platensis* has the potential to be used as an anti-acne agent candidate.

Keywords: antibacterial, flavonoids, acne, molecular docking, *Spirulina platensis*

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