

**STUDI MOLECULAR DOCKING, EVALUASI *IN VITRO*, DAN
UJI STABILITAS PENYIMPANAN FIKOSIANIN
Spirulina platensis SEBAGAI KANDIDAT ANTIDIABETES**

SKRIPSI

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



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1505013

**PROGRAM STUDI KIMIA
DEPARTEMEN PENDIDIKAN KIMIA
FAKULTAS PENDIDIKAN MATEMATIKA DAN ILMU PENGETAHUAN ALAM
UNIVERSITAS PENDIDIKAN INDONESIA
BANDUNG
2019**

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Sebuah skripsi yang diajukan untuk memenuhi salah satu syarat memperoleh gelar Sarjana Sains pada Fakultas Pendidikan Matematika dan Ilmu Pengetahuan Alam

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Agustus 2019

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ABSTRAK

Fikosianin adalah pigmen utama pada *Spirulina platensis* yang dilaporkan berpotensi sebagai inhibitor alami α -amilase dan α -glukosidase, membantu mengatasi kondisi hiperglikemia serta efektif digunakan untuk mengobati diabetes mellitus tipe-2. Namun, interaksi molekuler antara fikosianin dengan kedua enzim belum banyak diketahui. Pada penelitian ini dilakukan studi *molecular docking* untuk mengetahui interaksi molekuler, mekanisme inhibisi dan potensinya sebagai antidiabetes. Evaluasi *in vitro* fikosianin sebagai antidiabetes ditentukan melalui aktivitas inhibisi fikosianin terhadap α -amilase yang bersumber dari saliva manusia. Stabilitas penyimpanan pada tiga kondisi dievaluasi dalam aplikasinya sebagai suplemen fungsional. Simulasi *docking* antara fikosianin dan akarbosa sebagai obat komersial dengan enzim α -amilase dan enzim α -glukosidase dilakukan menggunakan program AutoDock Tools. Penentuan aktivitas inhibisi dilakukan menggunakan metode FUWA dan pengukuran nilai serapan dengan spektrofotometer UV-Vis. Stabilitas penyimpanan dilakukan menggunakan sampel padatan dan larutan, di simpan pada tiga kondisi yaitu kondisi gelap suhu -4°C , gelap suhu ruang, dan terang suhu ruang yang diukur nilai serapan di λ_{620} dan λ_{652} menggunakan spektrofotometer UV-Vis. Simulasi *molecular docking* menunjukkan bahwa fikosianin menginhibisi dengan cara berikatan dibagian situs aktif enzim menyebabkan terganggunya interaksi substrat pada enzim. Berdasarkan nilai affinitas pengikatan dan interaksi molekul, fikosianin memiliki aktivitas penghambatan terhadap kerja kedua enzim sehingga fikosianin dapat dijadikan sebagai kandidat alami antidiabetes. Hasil uji aktivitas inhibisi menunjukkan bahwa fikosianin menginhibisi kerja enzim α -amilase saliva manusia dengan rentang nilai %inhibisi sebesar $51,129 \pm 2,658\%$. Uji stabilitas penyimpanan menunjukkan bahwa konsentrasi fikosianin dalam bentuk larutan dan padatan, stabil selama tujuh hari pengujian pada kondisi penyimpanan gelap dan suhu rendah.

Kata kunci : Diabetes mellitus tipe-2, Fikosianin, *Molecular Docking*, Stabilitas, α -amilase, α -glukosidase

ABSTRACT

Phycocyanin is the main pigment in *Spirulina platensis* which is reported has potential to be used as a natural inhibitor for α -amylase and α -glucosidase. The pigment can effectively treat type-2 diabetes mellitus by lowering blood glucose. However, molecular interactions between phycocyanin and the two enzymes are less studied. In this study an in silico study through molecular docking simulation was carried out to predict the molecular interactions of phycocyanin and both of α -amylase and α -glucosidase. In vitro evaluation of phycocyanin as an antidiabetic is determined through the inhibitory activity of phycocyanin against α -amylase derived from human saliva. Storage stability in three conditions was evaluated in its application as a functional supplement. Docking simulations between phycocyanin and acarbose as commercial drugs with α -amylase and α -glucosidase enzymes were performed using the AutoDock Tools program. Determination of inhibitory activity was carried out using the FUWA method while the measurement of absorption values with a UV-Vis spectrophotometer. Storage stability study was performed on solid and solutions-stated of phycocyanin at three different conditions, namely dark conditions at -4°C , dark conditions at room temperature, and bright conditions at room temperature. The stability was determined by measuring the absorption values at λ_{620} and λ_{652} using UV-Vis spectrophotometer. Molecular docking simulations show that phycocyanin, inhibits by binding to the active site of the enzyme, causing disruption of the attachment of the substrate to the enzyme. The simulation indicates that phycocyanin has potency to be used as a candidate for antidiabetic natural therapy agents. An in vitro inhibition activity test showed that phycocyanin inhibits α -amylase from human saliva at $51,129 \pm 2,658\%$ Storage stability tests showed that the concentration of phycocyanin in the form of solutions and solids, was stable for seven days of testing under conditions of dark storage and low temperatures.

Keywords: Diabetes mellitus type-2, Phycocyanin, Molecular Docking, Stability, α -amylase, α -glucosidase

DAFTAR ISI

ABSTRAK	iv
ABSTRACT	v
DAFTAR ISI.....	vi
DAFTAR PUSTAKA	viii
BAB I PENDAHULUAN	1
1.1. Latar Belakang	1
1.2. Rumusan Masalah	3
1.3. Tujuan Penelitian	3
1.4. Manfaat Penelitian	4
1.5. Struktur Organisasi Skripsi	4
BAB II TINJAUAN PUSTAKA.....	5
2.1. Diabetes Mellitus	5
2.2. Enzim α -Amilase	11
2.3. Enzim α -Glukosidase	14
2.4. Studi <i>In silico Molecular Docking</i>	15
2.5. <i>Spirulina patensis</i> sebagai Sumber Pigmen Fikosianin	18
2.6. Fikobiliprotein pada <i>Spirulina platensis</i>	20
2.7. Prinsip Dasar Pengujian Aktivitas Inhibisi Enzim α -Amilase	23
BAB III METODE PENELITIAN.....	25
3.1. Waktu dan Lokasi Penelitian	25
3.2. Alat dan Bahan.....	25
3.3. Prosedur Penelitian	26
BAB IV HASIL DAN PEMBAHASAN	36

4.1. Mekanisme Molekuler Inhibisi α -Amilase dan α -Glukosidase Berdasarkan Analisis <i>Molecular Docking</i>	36
4.2. Aktivitas Inhibisi Fikosianin terhadap Enzim α -Amilase.....	46
4.3. Stabilitas Penyimpanan Larutan dan Padatan Pigmen Fikosianin	49
BAB V KESIMPULAN DAN REKOMENDASI.....	59
5.1. Kesimpulan	59
5.2. Rekomendasi.....	59
LAMPIRAN - LAMPIRAN.....	60

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