KAJIAN POTENSI KARAGENAN DARI *Gigartina skottsbergii* SEBAGAI KANDIDAT ANTIVIRUS SARS-CoV-2 MENGGUNAKAN SIMULASI *MOLECULAR DOCKING*

SKRIPSI

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Diah Nurhayati
NIM 1602265

PROGRAM STUDI KIMIA
DEPARTEMEN PENDIDIKAN KIMIA
FAKULTAS PENDIDIKAN MATEMATIKA DAN ILMU PENGETAHUAN ALAM
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DIAH NURHAYATI

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disetujui dan disahkan oleh pembimbing :

Pembimbing I

Gun Gun Gumilar, S.Pd., M.Si.
NIP. 197906262001121001

Pembimbing II

Heli Siti Halimatul Munawaroh, Ph.D.
NIP. 197907302001122002

Mengetahui,
Ketua Departemen Pendidikan Kimia FPMIPA UPI

Dr. Hendrawan, M.Si.
NIP. 196309111989011001

ABSTRAK

Pandemi COVID-19 telah mendorong dilakukannya penelitian tentang bahan alam yang berpotensi digunakan sebagai antivirus SARS-CoV-2 (*Severe Acute Respiratory Syndrome Coronavirus* 2). Karagenan dilaporkan memiliki aktivitas antivirus *human coronavirus* OC43, influenza, DENV, HSV-1, HSV-2, HPV, HRV, dan HIV. Salah satu sumber karagenan adalah alga merah *Gigartina skottsbergi*. Penelitian ini bertujuan untuk melakukan *screening* terhadap potensi karagenan sebagai antivirus SARS-CoV-2 menggunakan simulasi *molecular docking*. *Docking* dilakukan untuk tiga jenis karagenan yang terdapat dalam *Gigartina skottsbergii*, yakni λ-, κ-, dan ι-karagenan terhadap reseptor ACE2 dan RBD serta M^{pro} SARS-CoV-2. Sebagai pembanding potensi aktivitas digunakan nelfinavir, klorokuin dan hidroksi-klorokuin yang telah dilaporkan memiliki aktivitas antivirus SARS-CoV-2. Tahapan penelitian meliputi preparasi protein, validasi metode *docking*, preparasi ligan, proses *docking*, dan visualisasi hasil *docking* menggunakan beberapa perangkat lunak diantaranya AutodockTools 1.1.2, AutodockVina 1.5.6, PyMol 2.2.3, dan BIOVIA *Discovery Studio Visualizer* 2020. Hasil simulasi menunjukkan bahwa afinitas κ-karagenan terhadap reseptor ACE2 memiliki ΔG paling tinggi dan mencapai 1,2 *kkal/mol* lebih tinggi dibanding klorokuin. Afinitas κ-karagenan terhadap reseptor RBD SARS-CoV-2 memiliki ΔG paling tinggi dan mencapai 1,5 *kkal/mol* lebih tinggi dibanding klorokuin. Afinitas ι-karagenan terhadap reseptor M^{pro} SARS-CoV-2 memiliki ΔG paling tinggi dan mencapai 1,7 *kkal/mol* lebih tinggi dibanding klorokuin. Sisi pengikatan κ-karagenan pada ACE2 sama dengan hidroksi-klorokuin, sedangkan sisi pengikatan κ-karagenan dan ι-karagenan pada RBD dan M^{pro} SARS-CoV-2 sama dengan semua senyawa pembanding. κ-karagenan dan ι-karagenan berinteraksi dengan ketiga protein melibatkan ikatan hidrogen, elektrostatik dan Van der Waals. Berdasarkan hasil simulasi dapat disimpulkan bahwa κ-karagenan dan ι-karagenan paling berpotensi sebagai kandidat antivirus SARS-CoV-2. Pengujian eksperimental perlu dilakukan untuk mengetahui lebih lanjut efektifitas karagenan sebagai antivirus SARS-CoV-2.

Kata kunci: Antivirus, COVID-19, *Gigartina skottsbergii*, Karagenan, SARS-CoV-2

ABSTRACT

The COVID-19 pandemic has promoted the exploration of the natural compounds that are potential to be used as antiviral for SARS-CoV-2 (Severe Acute Respiratory Syndrome Coronavirus 2). Antiviral activity of carrageenan has been reported for human coronavirus OC43, influenza, DENV, HSV-1, HSV-2, HPV, HRV, and HIV. Red algae *Gigartina skottsbergii* is rich of carrageenan. Here, this study aims to screen the potential of carrageenan as antiviral for SARS-CoV-2 using molecular *docking* simulations. *Docking* was carried out for three types of carrageenan contained in *Gigartina skottsbergii*, namely λ-, κ-, and ι-carrageenan against ACE2, RBD and M^{pro} SARS-CoV-2 receptors. The activity of the target compounds was compared to chloroquine, hydroxy-chloroquine, and nelfinavir which have been reported to have potential as antiviral SARS-CoV-2. The steps of the research included protein preparation, *docking* method validation, ligand preparation, *docking* process, and visualization of *docking* results using several software including AutodockTools 1.1.2, AutodockVina 1.5.6, PyMol 2.2.3, and BIOVIA Discovery Studio Visualizer 2020. *Docking* results show that the affinity of κ-carrageenan to the ACE2 receptor had the highest ΔG and was 1,2 kcal/mol higher than chloroquine. The affinity of κ-carrageenan to the RBD SARS-CoV-2 receptor had the highest ΔG and was 1,5 kcal/mol higher than chloroquine. The affinity of ι-carrageenan to the M^{pro} SARS-CoV-2 receptor has the highest ΔG and is up to 1,7 kcal/mol higher than chloroquine. The binding site of κ-carrageenan on ACE2 was occupied the same cavity as for hydroxy-chloroquine, while the binding sites for κ-carrageenan and ι-carrageenan in RBD and M^{pro} SARS-CoV-2 were the same as chloroquine, hydroxy-chloroquine, and nelfinavir. Molecular interaction analysis performed that κ-carrageenan and ι-carrageenan interact with all three proteins through hydrogen bond, electrostatic and Van der Waals. Based on the results, it can be concluded that κ-carrageenan and ι-carrageenan show the most potential candidates of antiviral for SARS-CoV-2. Further testing in laboratory needs to be done to experimentally determined the effectiveness of carrageenan as an antiviral SARS-CoV-2.

Keywords: Antiviral, Carrageenan, COVID-19, *Gigartina skottsbergii*, SARS-CoV-2

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