

## Pra-perancangan pabrik dan pengujian *in silico* aktivitas anti-hiperglikemik ekstrak daun sambung nyawa (*Gynura procumbens* L.) dengan pelarut air = Pre-liminary plant design and *in silico* testing for anti-hyperglycemic activity in longevity spinach (*Gynura Procumbens* L.) water extract

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### Abstrak

Tingkat globalisasi yang tinggi mempengaruhi gaya hidup masyarakat yang cenderung menginginkan serba instan dan menyebabkan diet yang tidak sehat. Estimasi dari International Diabetes Federation menyatakan bahwa pada tahun 2035 diperkirakan akan terdapat 592 juta orang penderita diabetes melitus, dengan di Indonesia menjadi penyebab kematian nomor 3 pada tahun 2017. Pada penelitian ini, dilakukan perancangan produksi obat ekstrak daun sambung nyawa yang memiliki efek anti-hiperglikemik dan ekonomis. Tahapan penelitian ini dibagi menjadi 3 fase, yaitu simulasi interaksi zat aktif daun sambung nyawa terhadap protein penyebab hiperglikemik (11-beta-hidroksisteroid dehidrogenase-1; interleukin-1; dan protein tirosin fosfat), simulasi proses pembuatan obat ekstrak daun sambung nyawa dengan pelarut air, serta pemodelan reaksi enzimatik inhibisi non-kompetitif hasil obat hasil simulasi proses dengan besaran interaksi hasil simulasi interaksi zat aktif. Hasil penelitian memperlihatkan interaksi inhibisi zat aktif daun sambung nyawa (Asam p-hidroksibenzoat, asam p-hidroksinamat, kuersetin) dan obat standar (Metformin) terhadap protein penyebab hiperglikemik menggunakan program Autodock v.4.0 berhasil dilakukan dan memperlihatkan adanya interaksi inhibisi zat aktif terhadap protein. Hasil penelitian juga memperlihatkan simulasi produksi ekstrak daun sambung nyawa dengan pelarut air menggunakan program SuperPro Designer v.9.0 berhasil dilakukan dengan memberikan hasil perkiraan produksi setiap tahunnya 4.133.250 kapsul ekstrak dengan harga Rp 11.000 untuk setiap kapsulnya, komposisi zat aktif yang terdapat pada setiap 1 kapsul, serta menghasilkan rasio keuangan yang layak investasi (ROI sebesar 140,84%; PBP sebesar 1,43 tahun; BEP sebesar 782.459 kapsul; IRR sebesar 91,65%; dan NPV sebesar Rp 51.991.389.985). Kedua hasil penelitian kemudian memberikan hasil penelitian fase ketiga untuk pemodelan reaksi enzimatik inhibisi non-kompetitif dan menghasilkan perkiraan besar aktivitas inhibisi setiap zat aktif dan obat standar terhadap protein penyebab hiperglikemik.

.....The effect of high levels of globalization affects the lifestyles of people who tend to want instantaneously and cause an unhealthy diet. Estimates from the International Diabetes Federation state that in 2035 there will be an estimated 592 million people with diabetes mellitus, with Indonesia becoming the number 3 cause of death in 2017. In this research, the design of the production of longevity spinach extract drugs has an anti-hyperglycemic activity and good economic potential. The stages of this research were divided into 3 phases which are the simulation of the interaction of the active substance of the longevity spinach to the target protein that causes hyperglycemic (11-beta-hydroxysteroid dehydrogenase-1; interleukin-1; and protein tyrosine phosphate), the simulation of the process of making the extract of longevity spinach with water solvent, and modeling enzymatic reactions of non-competitive inhibition of the drug which is the results of process simulation with its magnitude of the inhibition interaction results of the simulation of active substance interactions. The results of the study showed that the interaction of the active

substances of the longevity spinach (p-hydroxybenzoic acid, p-hydroxycinnamic acid, quercetin) and standard drug (Metformin) to the target protein using Autodock v.4.0 was successfully carried out and showed interactions of inhibition of the active substances against the protein. The results of the study also showed that the simulation of the production of longevity spinach extracts with water solvent using SuperPro Designer v.9.0 was successfully carried out by providing an estimated annual production of 4,133,250 extract capsules for Rp 11,000 for each capsule, the composition of active substances contained in every 1 capsule, and produce a good financial ratio that is worth investment (ROI of 140.84%; PBP of 1.43 years; BEP of 782,459 capsules; IRR of 91.65%; and NPV of Rp. 51,991,389,985). The two research results then provide the third phase research results for modeling the enzymatic reaction of non-competitive inhibitions and produce estimates of the inhibition activity of each active substance and standard drugs against hyperglycemic-causing proteins.