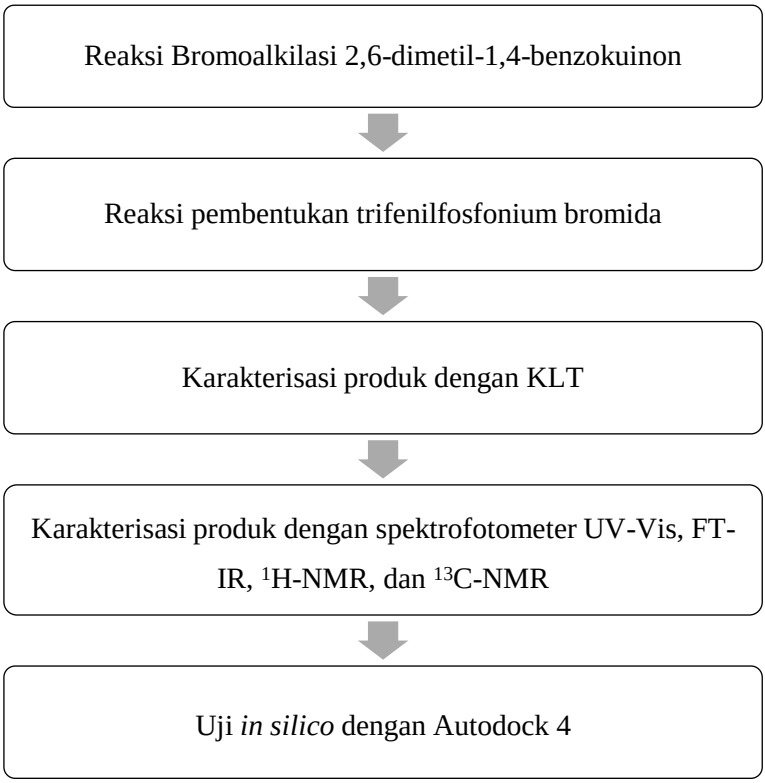
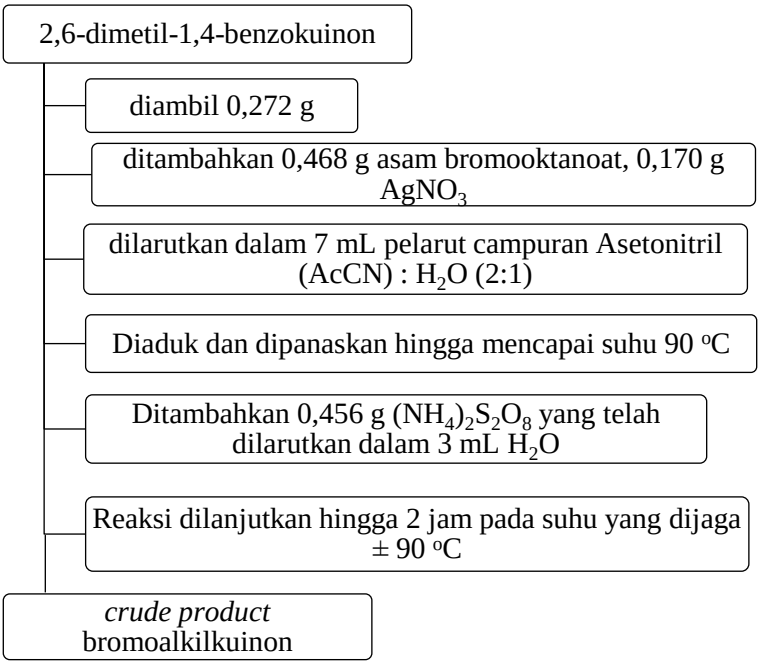
LAMPIRAN

A. Skema Kerja

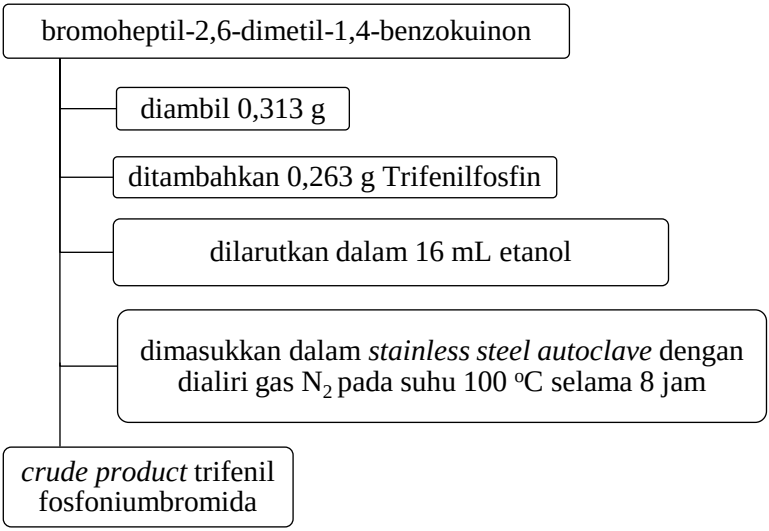
A.1 Diagram alir penelitian



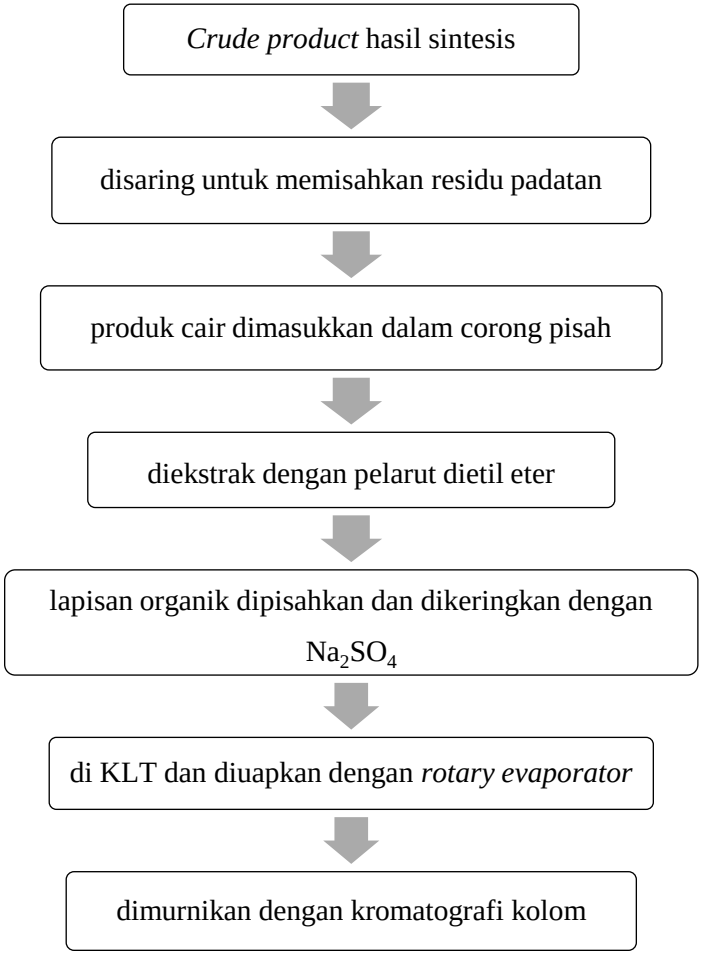
A.2 Reaksi bromoalkilkuinon



A.3 Reaksi pembentukan trifenil fosfoniumbromida

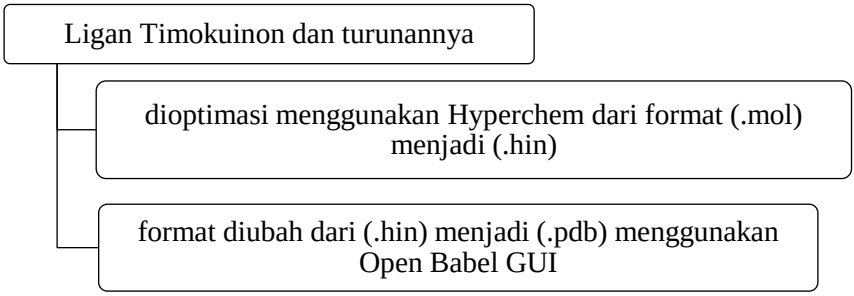


A.4 Ekstraksi dan pemurnian produk hasil sintesis

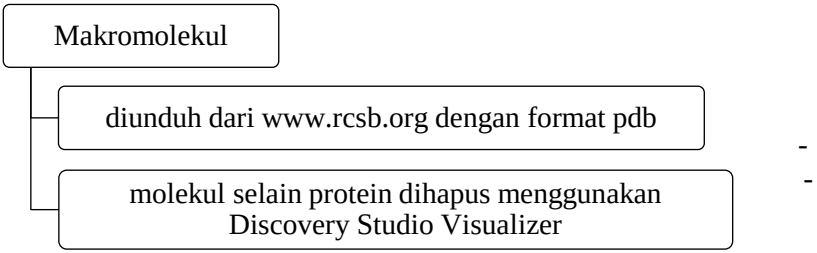


A.5 Uji *in silico*

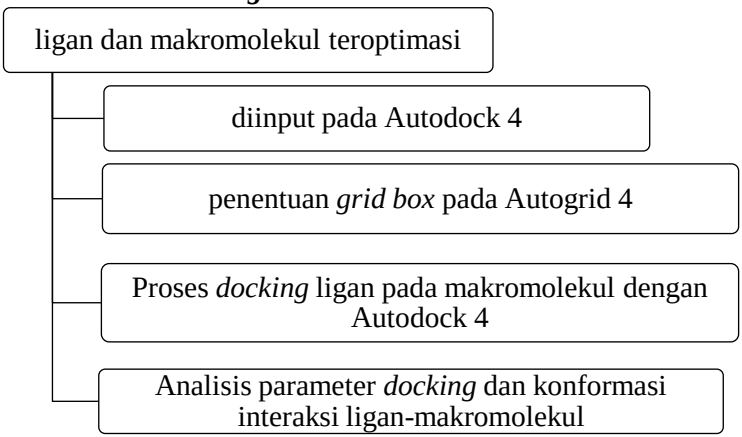
- **Optimasi Ligan**



- **Optimasi Makromolekul**



- **Proses *Docking***



B. Perhitungan

B.1 Sintesis Bromoalkilkuinon

B.1.1 Perhitungan massa dimetil benzokuinon (DBQ)

BM DBQ = 136,15 g/mol

Mol DBQ = $\frac{2\ mmol}{1000\ mmol/mol}$ = 0,002 mol

Massa DBQ = $mol\ DBQ \times BM\ DBQ$

= $0{,}002\ mol \times 136{,}15\ g/mol$

= 0,272 g

B.1.2 Perhitungan massa asam 8-Bromo oktanoat ($HOOC(CH_2)_7Br$)

BM $HOOC(CH_2)_7Br$ = 223,10 g/mol

Mol $HOOC(CH_2)_7Br$ = $\frac{2{,}1\ mmol}{1000\ mmol/mol}$ = 0,0021 mol

Massa $HOOC(CH_2)_7Br$ = $mol\ HOOC(CH_2)_7Br \times BM\ HOOC(CH_2)_7Br$

= $0{,}0021\ mol \times 223{,}10\ g/mol$

= 0,468 g

B.1.3 Perhitungan massa $AgNO_3$

BM $AgNO_3$ = 169,8 g/mol

Mol $AgNO_3$ = $\frac{1\ mmol}{1000\ mmol/mol}$ = 0,001 mol

Massa $AgNO_3$ = $mol\ AgNO_3 \times BM\ AgNO_3$

= $0{,}001\ mol \times 169{,}8\ g/mol$

= 0,170 g

B.1.4 Perhitungan massa $(NH_4)_2S_2O_8$

BM $(NH_4)_2S_2O_8$ = 228,2 g/mol

Mol $(NH_4)_2S_2O_8$ = $\frac{2\ mmol}{1000\ mmol/mol}$ = 0,002 mol

Massa $(NH_4)_2S_2O_8$ = $mol\ (NH_4)_2S_2O_8 \times$BM $(NH_4)_2S_2O_8$

$= 0{,}002\ mol\ \times 228{,}2\ g/mol$

= 0,456 g

B.2 Sintesis Trifenilfosfonium Bromida

B.2.1 Perhitungan massa Trifenilfosfin (PPh_3)

BM PPh_3 = 262,9 g/mol

Mol PPh_3 = $\frac{1\ mmol}{1000\ mmol/mol}$ = 0,001 mol

Massa PPh_3 = mol PPh_3 × BM PPh_3

$= 0{,}001\ \ mol\ \times 262{,}9\ g/mol$

= 0,263 g

B.2.2 Perhitungan massa Bromoheptil dimetil benzokuinon (Bromoheptil DBQ)

BM Bromoheptil DBQ = 312,9 g/mol

Mol Bromoheptil DBQ = $\frac{1\ mmol}{1000\ mmol/mol}$

= 0,001 mol

Massa Bromoheptil DBQ = mol Bromoheptil DBQ × BM Bromoheptil DBQ

$= 0{,}001\ \ mol\ \times 312{,}9\ g/mol$

= 0,313 g

B.3 Perhitungan rendemen produk hasil sintesis

B.3.1 Perhitungan *yield* (%) produk bromoalkilasi C7

Massa produk : 0,22 g

% *yield* = $\frac{mol\ produk}{mol\ reaktan}\ x\ 100\%$

= $\frac{220\ mg\ /\ 313\ mg/mmol}{4{,}1\ mmol}\ x\ 100\%$

= $\frac{0{,}702}{4{,}1}\ x\ 100\%$

= 17,572%

B.3.2 Perhitungan *yield* (%) produk Trifenilfosfoniumheptil

Massa produk : 0,12 g

% *yield* $= \frac{mol\ produk}{mol\ reaktan}\ x\ 100\%$

$= \frac{120\ mg\ /\ 495{,}622\ mg/mmol}{0{,}2\ mmol}\ x\ 100\%$

$= \frac{0{,}242}{0{,}2}\ x\ 100\%$

= 40,353%

B.4 Uji *in silico* produk hasil sintesis

B.4.1 Perhitungan IC_{50} timokuinon

IC_{50} (M) = 2 x Ki

IC_{50} (ppm) = Mr TQ x IC_{50} (M)

Ki berdasarkan hasil *docking* ligan TQ dengan makromolekul GPA :

Ki = 49.15 µM

IC_{50} (M) = 2 x 49.15 µM

= 98.3 µM

= 9.83 x 10^{-5} M

IC_{50} (ppm) = 164.204 mg/mmol x 9.83 x 10^{-5} M

= 164.204 mg/mmol x 9.83 x 10^{-2} mM

= 164.204 mg/mmol x 9.83 x 10^{-2} mmol/L

= 16.141 mg/L

= 16.141 ppm

B.4.2 Perhitungan IC_{50} produk bromoalkilasi C7

IC_{50} (M) = 2 x Ki

IC_{50} (ppm) = Mr C7 x IC_{50} (M)

Ki berdasarkan hasil *docking* ligan C7dengan makromolekul GPA :

Ki = 72.21 µM

IC_{50} (M) = 2 x 72.21 µM

= 144.42 µM

= 1.444×10^{-4} M

IC_{50} (ppm) = 313.235 mg/mmol x 1.444×10^{-4} M

= 313.235 mg/mmol x 1.444×10^{-1} mM

= 313.235 mg/mmol x 1.444×10^{-1} mmol/L

= 45.231 mg/L

= 45.231 ppm

B.4.3 Perhitungan IC_{50} produk trifenilfosfonium heptil

IC_{50} (M) = 2 x Ki

IC_{50} (ppm) = Mr C7 x IC_{50} (M)

Ki berdasarkan hasil *docking* ligan TFH dengan makromolekul GPA :

Ki = 1,28 µM

IC_{50} (M) = 2 x 1,28 µM

= 2,56 µM

= $2,56 \times 10^{-6}$ M

IC_{50} (ppm) = 495.622 mg/mmol x $2,56 \times 10^{-6}$ M

= 495.622 mg/mmol x $2,56 \times 10^{-3}$ mM

= 495.622 mg/mmol x $2,56 \times 10^{-3}$ mmol/L

= 1,268 mg/L

= 1,268 ppm

B.4.4 Data Uji *in silico* ligan dengan makromolekul GPA

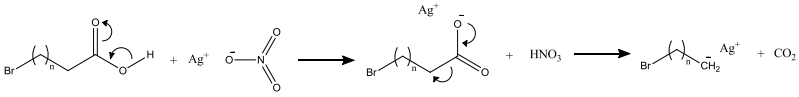
Ligan	Log P	Ki (µM)	IC_{50} (ppm)	Asam amino	
TQ	2,8	49,15	16.141	LYS128	GLY129
				ALA126	HIS93
				GLY127	TYR131
				LYS125	ARG130
				ASP92	CYS124
TF(C_1)	2,44	0,58	0,483	THR319	ARG172
				LEU318	TYR176
				GLY282	TYR177
				ASP324	TYR180
				PRO169	PHE279
				ARG173	
TF(C_2)	2,69	4,76	4,05	LEU318	ARG173
				GLY282	TYR176
				PRO281	TYR177
				PHE279	TYR180
				PHE278	
TF(C_3)	3,09	0,48	0,429	LEU318	PHE279
				PRO281	PHE278
				GLY282	TYR176
				LEU280	TYR177
				ARG173	TYR180

Ligan	Log P	Ki (µM)	IC_{50} (ppm)	Asam amino	Ligan
TF(C_4)	3,49	1,12	1,015	LEU318	PHE279
				PRO283	PHE278
				GLY282	TYR177
				PRO281	TYR180
				ILE280	TYR176
				LYS147	
TF(C_5)	3,88	1,18	1,103	ASP252	GLN97
				TRP274	LYS221
				CYS218	GLU91
				PRO95	PRO89
				ASN94	
				LEU220	
TF(C_6)	4,28	4,63	4,459	LEU318	ARG173
				PHE279	TYR176
				PRO169	TYR177
				UNL1	TYR180
				ARG172	
TF(C_7)	4,68	1,28	1,268	PRO281	ARG172
				PHE279	ARG173
				TYR180	PRO169
				TYR177	ASP324
				TYR176	ASN323

Ligan	Log P	Ki (µM)	IC_{50} (ppm)	Asam amino	Ligan
TF(C_8)	5,07	3,43	3,49	PRO281	TYR177
				ILE280	TYR180
				PHE279	LYS147
				PHE278	SER179
				ARG173	LYS183
				TYR176	
TF(C_9)	5,47	0,95	0,994	LEU318	ARG172
				PRO281	ARG173
				PHE279	TYR176
				PHE278	TYR177
				ASP324	TYR180
				PRO169	
TF(C_{10})	5,86	27,54	29,141	LEU318	ARG172
				LEU320	ARG173
				ASP324	TYR176
				PRO169	TYR177
				PRO281	TYR180
				GLY282	PHE279

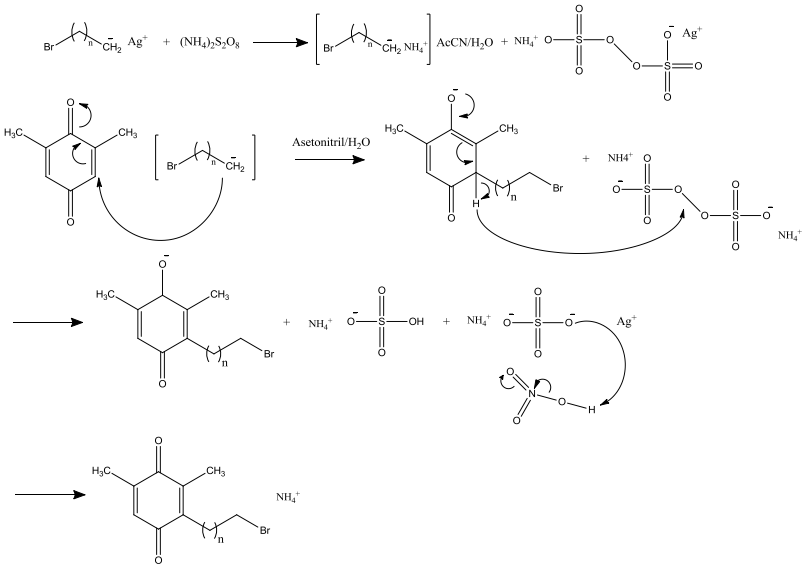
C. Mekanisme reaksi

C.1 Reaksi dekarboksilasi



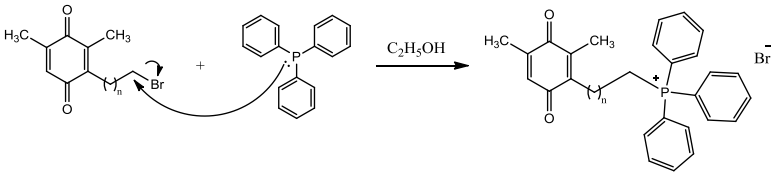
Keterangan : n = 6

C.2 Reaksi Alkilasi



Keterangan : n = 6

C.3 Reaksi penambahan gugus trifenilfosfin



Keterangan : n = 6

D. Dokumentasi Penelitian

D.1 Reaksi bromoalkilasi C7

D.1.1 Proses reaksi bromoalkilasi

Reaksi bromoalkilasi menggunakan seperangkat alat refluks dengan pemanas *oil bath* pada suhu 90^{o}C selama 2 jam

D.1.2 Pemurnian dengan kromatografi kolom

Pemurnian *crude product* C7 hasil sintesis dengan kromatogrfi kolom. Produk alkilasi C7 terdapat pada lapisan berwarna kuning
Fasa diam : silika
Fasa gerak : n-heksana : kloroform (7:3)

D.1.3 Karakterisasi dengan Kromatografi Lapis Tipis

Nilai Rf produk C7 lebih besar dari *starting material*
Fasa diam : silika
Fasa gerak : n-heksana:kloroform (7:3)

D.1.4 Produk alkilasi C7

Produk C7 hasil pemurnian dengan kromatografi kolom

D.2 Reaksi penambahan trifenilfosfonium

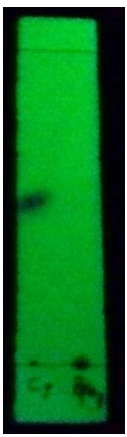
D.2.1 Proses reaksi penambahan trifenilfosfonium

Reaksi menggunakan *stainless steel autoclave* dengan pemanas *oil bath* pada suhu 100^{o}C selama 8 jam

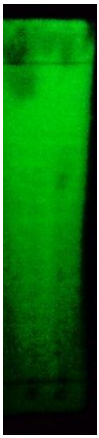
D.2.2 Pemurnian produk

Pemurnian *crude product* TFH hasil sintesis dengan kromatogrfi kolom. Produk TFH terdapat pada lapisan berwarna cokelat kemerahan
Fasa diam : silika
Fasa gerak : metanol : kloroform (1:7)

D.2.3 Karakterisasi dengan Kromatografi Lapis Tipis



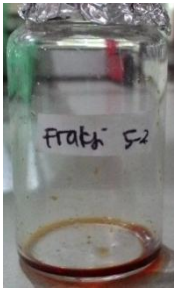
(a)



(b)

Nilai Rf produk TFH lebih rendah dari *starting material C7*
(a) Fasa gerak : n-Hexana:kloroform (7:3)
(b) Fasa gerak : Metanol:Kloroform (1:4)

D.2.4 Produk trifenilfosfoniumheptil



Produk TFH hasil pemurnian dengan kromatografi kolom