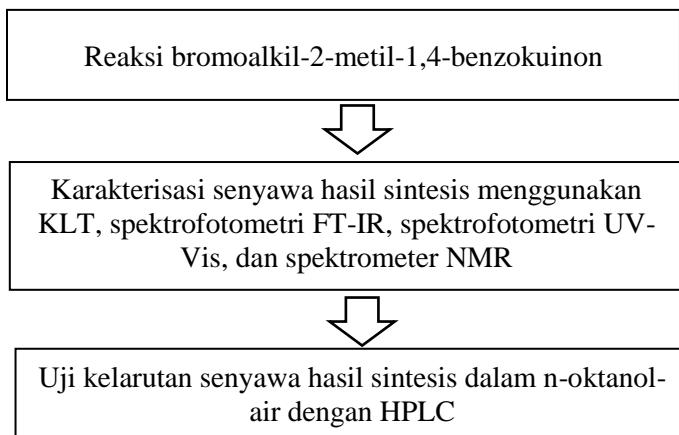


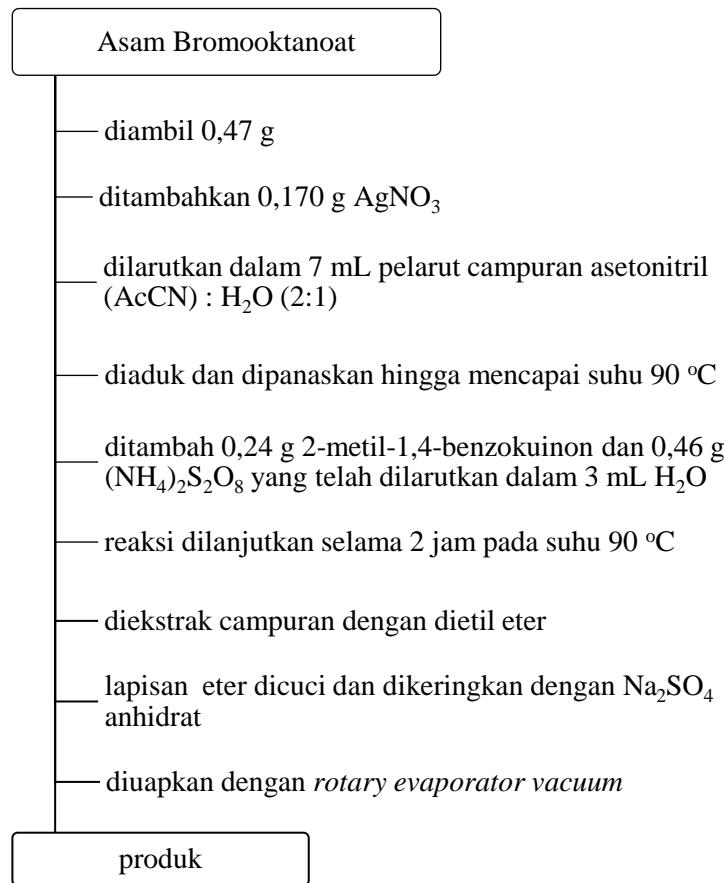
## LAMPIRAN

### Lampiran A: Diagram alir penelitian

#### A.1: Skema kerja penelitian



## A.2: Skema kerja reaksi 5-(7-bromoheptil)-2-metil-1,4-benzokuinon



### A.3: Skema kerja reaksi 5-(10-bromodesil)-2-metil-1,4-benzokuinon

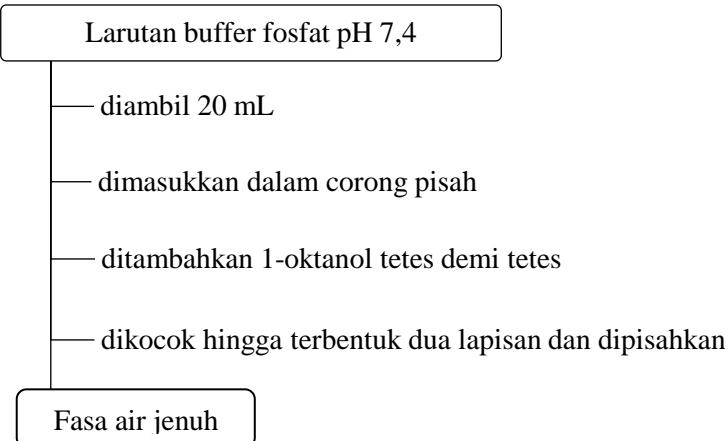
Asam Bromodekanoat

- diambil 0,56 g
- ditambahkan 0,170 g  $\text{AgNO}_3$
- dilarutkan dalam 7 mL pelarut campuran asetonitril ( $\text{AcCN}$ ) :  $\text{H}_2\text{O}$  (2:1)
- diaduk dan dipanaskan hingga mencapai suhu 90 °C
- ditambah 0,24 g 2-metil-1,4-benzokuinon dan 0,46 g  $(\text{NH}_4)_2\text{S}_2\text{O}_8$  yang telah dilarutkan dalam 3 mL  $\text{H}_2\text{O}$
- reaksi dilanjutkan selama 2 jam pada suhu 90 °C
- diekstrak campuran dengan dietil eter
- lapisan eter dicuci dan dikeringkan dengan  $\text{Na}_2\text{SO}_4$  anhidrat
- diuapkan dengan *rotary evaporator vacuum*

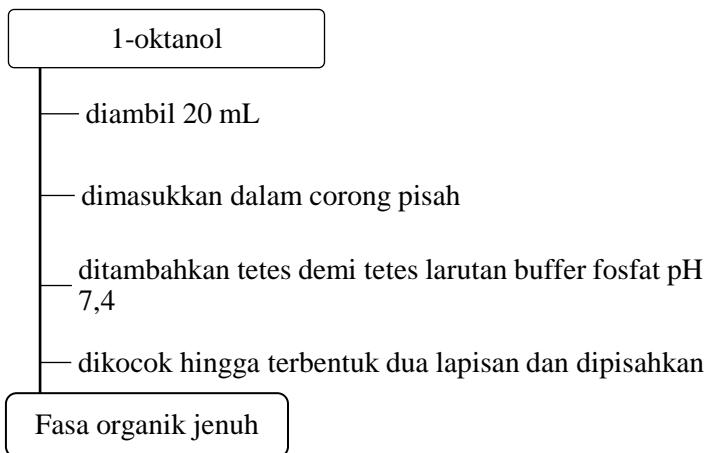
produk

#### A.4: Uji kelarutan dalam n-oktanol-air

##### -Penjenuhan buffer fosfat dengan n-oktanol



##### -Penjenuhan n-oktanol



## --Preparasi sampel

timokuinon dan produk hasil reaksi

- dilarutkan dalam 1-oktanol yang telah dijenuhkan hingga konsentrasi 10 mM (masing-masing)
- ditambah fasa air yang telah dibuat
- dikocok dengan *orbital shaker* selama 1 jam pada suhu kamar dengan kecepatan 200 rpm
- dipisah fasa organik dan fasa air
- dianalisis dengan HPLC

Nilai log P

## Lampiran B: Perhitungan

### B.1 Reaksi Bromoalkil-2-metil-1,4- benzokuinon

#### B.1.1 Perhitungan massa 2 metil-1,4-benzokuinon

BM 2-metil-1,4-benzokuinon = 122,12 gr/mol

- 2-metil-1,4-benzokuinon 2 mmol

$$\text{Mol 2-metil-1,4-benzokuinon} = 2 \text{ mmol} \times \frac{1 \text{ mol}}{1000 \text{ mmol}} = 0,02 \text{ mol}$$

$$\text{Mol 2-metil-1,4-benzokuinon} = \frac{\text{massa 2-metil-1,4-benzokuinon}}{\text{BM 2-metil-1,4-benzokuinon}}$$

$$\begin{aligned}\text{Massa 2-metil-1,4-benzokuinon} &= 0,02 \text{ mol} \times 122,12 \text{ gr/mol} \\ &= 0,244 \text{ gr}\end{aligned}$$

#### B.1.2 Perhitungan massa HOOC(CH<sub>2</sub>)<sub>7</sub>Br

BM HOOC(CH<sub>2</sub>)<sub>7</sub>Br = 223,11 gr/mol

$$\text{Mol HOOC(CH}_2\text{)}_7\text{Br} = \frac{2,1 \text{ mmol}}{1000 \text{ m}} = 0,0021 \text{ mol}$$

$$\text{Mol HOOC(CH}_2\text{)}_7\text{Br} = \frac{\text{massa HOOC(CH}_2\text{)}_7\text{Br}}{\text{BM HOOC(CH}_2\text{)}_7\text{Br}}$$

$$\begin{aligned}\text{Massa HOOC(CH}_2\text{)}_7\text{Br} &= 0,0021 \text{ mol} \times 223,11 \text{ gr/mol} \\ &= 0,47 \text{ gr}\end{aligned}$$

#### B.1.3 Perhitungan massa HOOC(CH<sub>2</sub>)<sub>10</sub>Br

BM HOOC(CH<sub>2</sub>)<sub>7</sub>Br = 265,18 gr/mol

$$\text{Mol HOOC(CH}_2\text{)}_7\text{Br} = \frac{2,1 \text{ mmol}}{1000 \text{ m}} = 0,0021 \text{ mol}$$

$$\text{Mol HOOC(CH}_2\text{)}_7\text{Br} = \frac{\text{massa HOOC(CH}_2\text{)}_{10}\text{Br}}{\text{BM HOOC(CH}_2\text{)}_{10}\text{Br}}$$

$$\begin{aligned}\text{Massa HOOC(CH}_2\text{)}_7\text{Br} &= 0,0021 \text{ mol} \times 265,18 \text{ gr/mol} \\ &= 0,56 \text{ gr}\end{aligned}$$

#### B.1.4 Perhitungan massa AgNO<sub>3</sub>

BM AgNO<sub>3</sub> = 169,87 gr/mol

$$\text{Mol AgNO}_3 = 1 \text{ mmol} \times \frac{1 \text{ mol}}{1000 \text{ mmol}} = 0,001 \text{ mol}$$

$$\text{Mol AgNO}_3 = \frac{\text{massa AgNO}_3}{\text{BM AgNO}_3}$$

$$\begin{aligned}\text{Massa AgNO}_3 &= 0,001 \text{ mol} \times 169,87 \text{ gr/mol} \\ &= 0,17 \text{ gr}\end{aligned}$$

### B.1.5 Perhitungan massa $(\text{NH}_4)_2\text{S}_2\text{O}_8$

BM  $(\text{NH}_4)_2\text{S}_2\text{O}_8 = 228,20 \text{ gr/mol}$

$$\begin{aligned} \text{Mol } (\text{NH}_4)_2\text{S}_2\text{O}_8 &= 2 \text{ mmol} \times \frac{2 \text{ mol}}{1000 \text{ mmol}} = 0,002 \text{ mol} \\ \text{Mol } (\text{NH}_4)_2\text{S}_2\text{O}_8 &= \frac{\text{massa } (\text{NH}_4)_2\text{S}_2\text{O}_8}{\text{BM } (\text{NH}_4)_2\text{S}_2\text{O}_8} \\ \text{Massa } (\text{NH}_4)_2\text{S}_2\text{O}_8 &= 0,002 \text{ mol} \times 228,20 \text{ gr/mol} \\ &= 0,46 \text{ gr} \end{aligned}$$

## B.2 Uji Kelarutan dalam n-oktanol-air

### B.2.1 Pembuatan buffer fosfat

#### a. Perhitungan massa $\text{NaH}_2\text{PO}_4 \cdot \text{H}_2\text{O} 0,1 \text{ M}$

$$\begin{aligned} \text{BM } \text{NaH}_2\text{PO}_4 \cdot \text{H}_2\text{O} &= 137,9 \text{ g/mol} \\ \text{Mol } \text{NaH}_2\text{PO}_4 \cdot \text{H}_2\text{O} &= \text{M} \times \text{V} \\ &= 0,1 \text{ mol/L} \times 0,1 \text{ L} \\ &= 0,01 \text{ mol} \\ \text{Massa } \text{NaH}_2\text{PO}_4 \cdot \text{H}_2\text{O} &= \text{mol} \times \text{BM} \\ &= 0,01 \text{ mol} \times 137,9 \text{ g/mol} \\ &= 1,38 \text{ g} \end{aligned}$$

#### b. Perhitungan massa $\text{Na}_2\text{HPO}_4 0,1 \text{ M}$

$$\begin{aligned} \text{BM } \text{Na}_2\text{HPO}_4 &= 268 \text{ g/mol} \\ \text{Mol } \text{Na}_2\text{HPO}_4 &= \text{M} \times \text{V} \\ &= 0,1 \text{ mol/L} \times 0,1 \text{ L} \\ &= 0,01 \text{ mol} \\ \text{Massa } \text{Na}_2\text{HPO}_4 &= \text{mol} \times \text{BM} \\ &= 0,01 \text{ mol} \times 268 \text{ g/mol} \\ &= 2,68 \text{ g} \end{aligned}$$

### B.2.2 Perhitungan massa untuk koefisien partisi

#### a. Timokuinon

$$\begin{aligned} \text{BM } \text{C}_{10}\text{H}_{12}\text{O}_2\text{Br} &= 164,20 \text{ g/mol} \\ \text{M} &= \frac{\text{massa}}{\text{BM}} \times \frac{1000}{\text{mL}} \\ 10 \text{ mM} &= \frac{\text{massa}}{164,2 \text{ g/mol}} \times \frac{1000}{3 \text{ mL}} \\ 0,01 \text{ M} &= \frac{\text{massa}}{164,2 \text{ g/mol}} \times \frac{1000}{3 \text{ mL}} \end{aligned}$$

Massa = 4,93 mg

**b. Massa (5-(7-bromoheptil)-2-metil-1,4-benzokuinon)**

BM C<sub>14</sub>H<sub>17</sub>O<sub>2</sub>Br = 299,208 g/mol

$$M = \frac{\text{massa}}{\text{Mr} \left( \frac{\text{g}}{\text{mol}} \right)} \times \frac{1000}{\text{volume (mL)}}$$

$$10 \text{ mM} = \frac{\text{massa}}{299,208 \text{ g/mol}} \times \frac{1000}{3 \text{ mL}}$$

$$0,01 \text{ M} = \frac{\text{massa}}{299,208 \text{ g/mol}} \times \frac{1000}{3 \text{ mL}}$$

Massa = 8,9 mg

**c. Massa (5-(10-bromodesil)-2-metil-1,4-benzokuinon)**

BM C<sub>17</sub>H<sub>23</sub>O<sub>2</sub>Br = 341,289 g/mol

$$M = \frac{\text{massa}}{\text{Mr} \left( \frac{\text{g}}{\text{mol}} \right)} \times \frac{1000}{\text{volume (mL)}}$$

$$10 \text{ mM} = \frac{\text{massa}}{341,289 \text{ g/mol}} \times \frac{1000}{3 \text{ mL}}$$

$$0,01 \text{ M} = \frac{\text{massa}}{341,289 \text{ g/mol}} \times \frac{1000}{3 \text{ mL}}$$

Massa = 10,2 mg

### B.3 Rendemen produk bromoalkil-2-metil-1,4-benzokuinon

#### B.3.1 Rendemen produk (5-(7-bromoheptil)-2-metil-1,4-benzokuinon)

Massa produk = 0,07g

$$\begin{aligned} Yield &= \frac{\text{mol produk}}{\text{mol reaktan}} \times 100\% \\ &= \frac{\frac{\text{mol produk}}{\text{massa}}}{\frac{\text{Mr}}{4,1 \text{ mmol}}} \times 100\% \\ &= \frac{\frac{0,07 \text{ g}}{299,208 \text{ g/mol}}}{\frac{1}{4,1 \text{ mmol}}} \times 100\% \\ &= 5,71\% \end{aligned}$$

#### B.3.2 Rendemen produk (5-(10-bromodesil)-2-metil-1,4-benzokuinon)

Massa produk = 0,06 g

$$\begin{aligned}
 Yield &= \frac{\text{mol produk}}{\text{mol reaktan}} \times 100\% \\
 &= \frac{\underline{\text{Mr}}}{4,1 \text{ mmol}} \times 100\% \\
 &= \frac{0,06 \text{ g}}{\frac{341,289 \text{ g/mol}}{4,1 \text{ mmol}}} \times 100\% \\
 &= 4,29\%
 \end{aligned}$$

#### B.4. Perhitungan kelarutan

##### B.4.1 Perhitungan kelarutan timokuinon dalam n-oktanol-air (3:7)

$\lambda_{\text{maks}} = 254 \text{ nm}$

$$\begin{aligned}
 \log P &= \log \frac{A_o/V_o}{A_a/V_a} \\
 &= \log \frac{63970392/3}{920323/7} \\
 &= 2,21
 \end{aligned}$$

##### B.4.2 Perhitungan kelarutan produk (5-(7-bromoheptil)-2-metil-1,4-benzokuinon) dalam n-oktanol-air (3:7)

$\lambda_{\text{maks}} = 254 \text{ nm}$

$$\begin{aligned}
 \log P &= \log \frac{A_o/V_o}{A_a/V_a} \\
 &= \log \frac{1147524770/3}{4912910/7} \\
 &= 1,74
 \end{aligned}$$

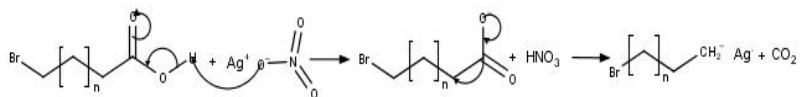
##### B.4.3 Perhitungan kelarutan produk (5-(10-bromodesil)-2-metil-1,4-benzokuinon) dalam n-oktanol-air (3:7)

$\lambda_{\text{maks}} = 254 \text{ nm}$

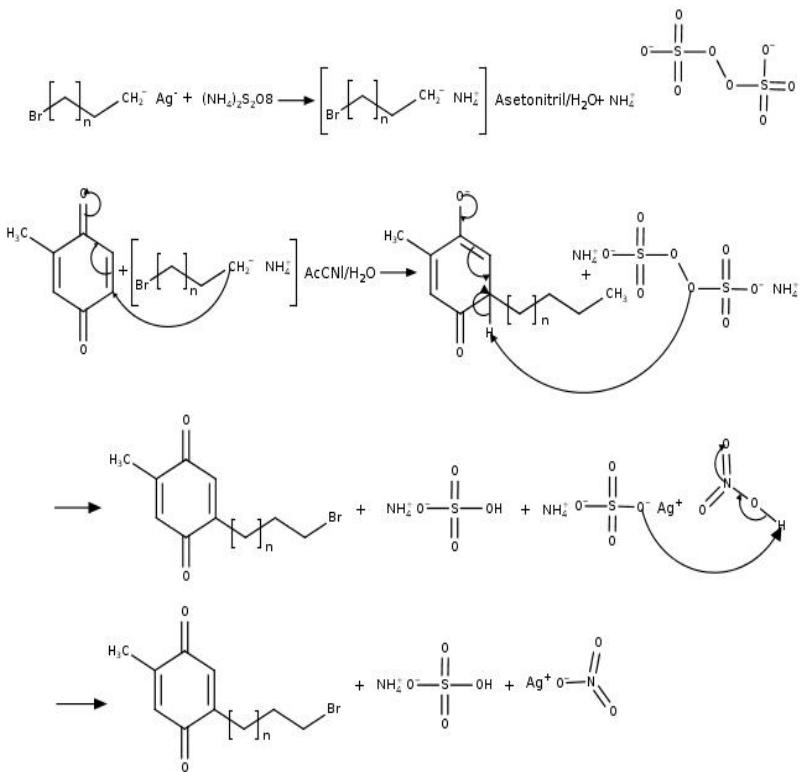
$$\begin{aligned}
 \log P &= \log \frac{A_o/V_o}{A_a/V_a} \\
 &= \log \frac{143181139/3}{5413222/7} \\
 &= 1,79
 \end{aligned}$$

## Lampiran C: Mekanisme Reaksi

### C.1 Reaksi dekarboksilasi



### C.2 Reaksi alkilasi



## Lampiran D: Dokumentasi

D.1 Rangkaian alat refluks



D.2 Ekstraksi dengan dietil eter



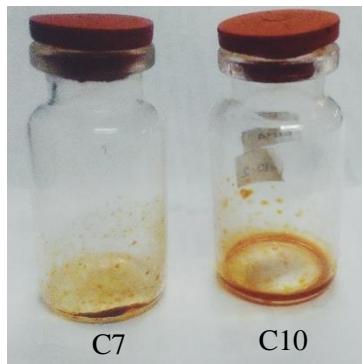
D.3 Crude product C7 dan C10



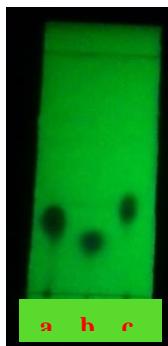
D.4 Pemurnian dengan komatografi kolom



#### D.5 Produk alkilasi C7 dan C10

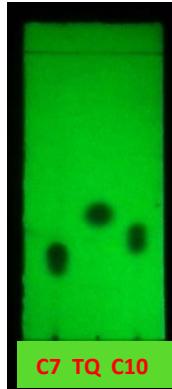


#### D.6 Hasil KLT Produk alkilasi C7, SM, dan C10



Keterangan:  
a= alkilasi C7  
b= *starting material*  
c= alkilasi C10

#### D.7 Hasil KLT Produk alkilasi C7, TQ, dan C10



Keterangan:  
C7= alkilasi C7  
TQ= Timokuinon  
C10= alkilasi C10