## LAMPIRAN 1. PERHITUNGAN PENELITIAN

### Perhitungan Deproteinasi

**Perbandingan 50 gram : 500 ml**

**Konsentrasi NaOH 0,5 M**

M = n NaOH x $\frac{1}{0{,}5\ L}$

0,5 M = $\frac{massa\ NaOH}{40}$ x $\frac{1}{0{,}5\ L}$

Massa NaOH = 0,5 x 40 x 0,5

Massa NaOH = 10 gram

**Konsentrasi NaOH 1 M**

M = n NaOH x $\frac{1}{0{,}5\ L}$

1 M = $\frac{massa\ NaOH}{40}$ x $\frac{1}{0{,}5\ L}$

Massa NaOH = 1 x 40 x 0,5

Massa NaOH = 20 gram

### Perhitungan Demineralisasi

Perhitungan (HCl 32%)

Berat jenis = 1,16 gr/ml (dilihat dari MSDS)

Mr HCl = 36,5

Pengenceran HCl

M1 x VI = M2 x V2

**Menentukan M1 terlebih dahulu :**

M = ( $\frac{\rho\ x\ \%\ x\ 1000}{BM}$)

M = ($\frac{1{,}16\ x\ 32\%\ x\ 1000)}{36{,}5}$

M = $\frac{(1{,}16\ x\ 32\ x\ 10)}{36{,}5}$

M = 10,169

M = 10,17

**Pengenceran HCl 0,5 M dengan 500 ml**

M1 x V1 = M2 x V2

10,17 x V1 = 0,5 M x 500 ml

V1 = $\frac{500\ x\ 0,5}{10,17}$

V1 = 24,58 ml

**Pengenceran HCl 1 M dengan 500 ml**

M1 x V1 = M2 x V2

10,17 x V1 = 1 M x 500 ml

V1 = $\frac{500\ x\ 1}{10,17}$

V1 = 49,16 ml

## Perhitungan Deasetilasi

**Perbandingan 50 gram : 500 ml**

**Konsentrasi NaOH 4 M**

M = n NaOH x $\frac{1}{0,5\ L}$

4 M = $\frac{massa\ NaOH}{40}$ x $\frac{1}{0,5\ L}$

Massa NaOH = 4 x 40 x 0,5

Massa NaOH = 80 gram

**Konsentrasi NaOH 6 M**

M = n NaOH x $\frac{1}{0,5\ L}$

6 M = $\frac{massa\ NaOH}{40}$ x $\frac{1}{0,5\ L}$

Massa NaOH = 6 x 40 x 0,5

Massa NaOH = 120 gram

**Kelarutan Kitosan Cangkang Kerang Darah**

CH3COOH 2% (Glasial) dengan perbandingan 1 gram : 100 ml

M1 x V1 = M2 x V2

98% x V1 = 2% x 100 ml

98% x V1 = 200

V1 = $\frac{200}{98}$

V1 = 2,04 ml

Ketidaklarutan (%) = $\frac{a-b}{c}$ $x$ 100%

Kelarutan (%) = 100% − Ketidaklarutan (%)

Keterangan :

a = Berat kertas saring + sampel

b = Berat kertas saring awal

c = Massa kitosan awal (gr)

**Kitosan NaOH 1 M; HCl 0,5 M; NaOH 4 M**

Ketidaklarutan (%) = $\frac{a-b}{c}$ $x$ 100%

= $\frac{0,82 - 0,77}{1\ gr}$ x 100%

= 0,05 x 100%

= 5 %

Kelarutan (%) = 100% - 5%

= 95%

**Kitosan NaOH 1 M; HCl 1 M; NaOH 4 M**

Ketidaklarutan (%) = $\frac{a-b}{c}$ $x$ 100%

= $\frac{0,84 - 0,78}{1\ gr}$ x 100%

= 0,06 x 100%

= 6 %

Kelarutan (%) = 100% - 6%

= 94%

**Kitosan NaOH 0,5 M; HCl 0,5 M; NaOH 4 M**

Ketidaklarutan (%) = $\frac{a-b}{c}$ $x$ 100%

= $\frac{0,82 - 0,77}{1\ gr}$ x 100%

= 0,05 x 100%

= 5 %

Kelarutan (%) = 100% - 5%

= 95%

**Kitosan NaOH 0,5 M; HCl 1 M; NaOH 4 M**

Ketidaklarutan (%) = $\frac{a-b}{c}$ $x$ 100%

= $\frac{0,84 - 0,77}{1\ gr}$ x 100%

= 0,07 x 100%

= 7 %

Kelarutan (%) = 100% - 7%

= 93%

**Kitosan NaOH 1 M; HCl 0,5 M; NaOH 6 M**

Ketidaklarutan (%) = $\frac{a-b}{c}$ $x$ 100%

= $\frac{0,85 - 0,78}{1\ gr}$ x 100%

= 0,07 x 100%

= 7 %

Kelarutan (%) = 100% - 7%

= 93%

**Kitosan NaOH 1 M; HCl 1 M; NaOH 6 M**

Ketidaklarutan (%) = $\frac{a-b}{c}$ $x$ 100%

= $\frac{0,87 - 0,77}{1\ gr}$ x 100%

= 0,1 x 100%

= 10 %

Kelarutan (%) = 100% - 10%

= 90%

**Kitosan NaOH 0,5 M; HCl 0,5 M; NaOH 6 M**

Ketidaklarutan (%) = $\frac{a-b}{c}$ $x$ 100%

= $\frac{0,86 - 0,77}{1\ gr}$ x 100%

= 0,09 x 100%

= 9 %

Kelarutan (%) = 100% - 9%

= 91%

**Kitosan NaOH 0,5 M; HCl 1 M; NaOH 6 M**

Ketidaklarutan (%) = $\frac{a-b}{c}$ $x$ 100%

= $\frac{0,87 - 0,77}{1\ gr}$ x 100%

= 0,1 x 100%

= 10 %

Kelarutan (%) = 100% - 10%

= 90%

**Perhitungan Kadar Amoniak**

**Biokoagulan Kitosan**

Kadar amonia (mg N/L) = C x fp

Keterangan

C = Kadar yang didapat dari hasil pengukuran (mg/L)

fp = Faktro pengenceran

- KB1,5T30

Kadar amoniak (mg N/L) = C x fp

= 0,103 x 10

= 1,03 mg N/L

Effisiensi (%) = $\frac{awal-akhir}{awal}$ x 100%

= $\frac{2,34-1,03}{2,34}$ x 100%

= 55,9%

- KB1,5T60

Kadar amoniak (mg N/L) = C x fp

= 0,11 x 10

= 1,1 mg N/L

Effisiensi (%) = $\frac{awal-akhir}{awal}$ x 100%

= $\frac{2,34-1,1}{2,34}$ x 100%

= 52,9%

- KB3T30

Kadar amoniak (mg N/L) = C x fp

= 0,101 x 10

= 1,01 mg N/L

Effisiensi (%) $= \frac{awal-akhir}{awal}$ x 100%

$= \frac{2,34-1,01}{2,34}$ x 100%

= 56,8%

- KB3T60

Kadar amoniak (mg N/L) = C x fp

= 0,099 x 10

= 0,99 mg N/L

Effisiensi (%) $= \frac{awal-akhir}{awal}$ x 100%

$= \frac{2,34-0,99}{2,34}$ x 100%

= 57,6%

**Perhitungan Kadar Amoniak**

**Biokoagulan CaO**

- CB1,5T30

Kadar amoniak (mg N/L) = C x fp

= 0,11 x 10

= 1,1 mg N/L

Effisiensi (%) $= \frac{awal-akhir}{awal}$ x 100%

$= \frac{2,34-1,1}{2,34}$ x 100%

= 52,9%

- CB1,5T60

Kadar amoniak (mg N/L) = C x fp

= 0,103 x 10

= 1,03 mg N/L

Effisiensi (%) $= \frac{awal-akhir}{awal}$ x 100%

$= \frac{2,34-1,03}{2,34}$ x 100%

= 55,9%

- CB3T30

Kadar amoniak (mg N/L) = C x fp

= 0,108 x 10

= 1,08 mg N/L

Effisiensi (%) $= \frac{awal-akhir}{awal}$ x 100%

$= \frac{2,34-1,08}{2,34}$ x 100%

= 53,8%

- CB3T60

Kadar amoniak (mg N/L) = C x fp

= 0,077 x 10

= 0,77 mg N/L

Effisiensi (%) $= \frac{awal-akhir}{awal}$ x 100%

$= \frac{2,34-0,77}{2,34}$ x 100%

= 67%

**Perhitungan Kadar TSS**

**Biokoagulan Kitosan**

Kadar TSS (mg/L) = $\frac{(A-B)x\ 1000}{\text{Volume contoh uji,mL}}$

Keterangan

A = Berat kertas saring + residu kering, mg

B = Berat kertas saring, mg

- KB1,5T30

Kadar TSS (mg/L) $= \frac{(\mathrm{A}-\mathrm{B})\mathrm{x}\ 1000}{\text{Volume contoh uji,mL}}$

$= \frac{(0{,}8043 - 0{,}8004)x\ 1000}{0{,}02\ L}$

= 195 mg/L

Effisiensi (%) $= \frac{awal-akhir}{awal}$ x 100%

$= \frac{370-195}{370}$ x 100%

= 47,30%

- KB1,5T60

Kadar TSS (mg/L) $= \frac{(\mathrm{A}-\mathrm{B})\mathrm{x}\ 1000}{\text{Volume contoh uji,mL}}$

$= \frac{(0{,}7861 - 0{,}7833)x\ 1000}{0{,}02\ L}$

= 140 mg/L

Effisiensi (%) $= \frac{awal-akhir}{awal}$ x 100%

$= \frac{370-140}{370}$ x 100%

= 62,16%

- KB3T30

Kadar TSS (mg/L) $= \frac{(\mathrm{A}-\mathrm{B})\mathrm{x}\ 1000}{\text{Volume contoh uji,mL}}$

$= \frac{(0{,}7889 - 0{,}7864)x\ 1000}{0{,}02\ L}$

= 125 mg/L

Effisiensi (%) $= \frac{awal-akhir}{awal}$ x 100%

$= \frac{370-125}{370}$ x 100%

= 66,22%

- KB3T60

Kadar TSS (mg/L) $= \frac{(\mathrm{A}-\mathrm{B})\mathrm{x}\ 1000}{\text{Volume contoh uji,mL}}$

$= \frac{(0{,}8130 - 0{,}8107)x\ 1000}{0{,}02\ L}$

= 115 mg/L

Effisiensi (%) $= \frac{awal-akhir}{awal}$ x 100%

$= \frac{370-115}{370}$ x 100%

= 68,92%

**Perhitungan Kadar TSS**

**Biokoagulan CaO**

- CB1,5T30

Kadar TSS (mg/L) $= \frac{(\mathrm{A}-\mathrm{B})\mathrm{x}\ 1000}{\text{Volume contoh uji,mL}}$

$= \frac{(0{,}7899 - 0{,}7878)x\ 1000}{0{,}02\ L}$

= 105 mg/L

Effisiensi (%) $= \frac{awal-akhir}{awal}$ x 100%

$= \frac{370-105}{370}$ x 100%

= 71,62%

- CB1,5T60

Kadar TSS (mg/L) $= \frac{(\mathrm{A}-\mathrm{B})\mathrm{x}\ 1000}{\text{Volume contoh uji,mL}}$

$= \frac{(0{,}7967 - 0{,}7949)x\ 1000}{0{,}02\ L}$

= 90 mg/L

Effisiensi (%) $= \frac{awal-akhir}{awal}$ x 100%

$= \frac{370-90}{370}$ x 100%

= 75,68%

- CB3T30

Kadar TSS (mg/L) $= \frac{(\mathrm{A}-\mathrm{B})\mathrm{x}\ 1000}{\text{Volume contoh uji,mL}}$

$= \frac{(0{,}8099 - 0{,}8084)x\ 1000}{0{,}02\ L}$

= 75 mg/L

Effisiensi (%) $= \frac{awal-akhir}{awal}$ x 100%

$= \frac{370-75}{370}$ x 100%

= 79,73%

- CB3T60

Kadar TSS (mg/L) $= \frac{(\mathrm{A}-\mathrm{B})\mathrm{x}\ 1000}{\text{Volume contoh uji,mL}}$

$= \frac{(0{,}7997 - 0{,}7984)x\ 1000}{0{,}02\ L}$

= 65 mg/L

Effisiensi (%) $= \frac{awal-akhir}{awal}$ x 100%

$= \frac{370-65}{370}$ x 100%

= 82,43%

**Perhitungan Kadar COD**

**Biokoagulan Kitosan**

Kadar COD (mg $O_2$/L) = C x f

Keterangan

C = Nilai COD contoh uji dinyatakan dalam (mg/L)

f = Faktro pengenceran

- KB1,5T30

Kadar COD (mg $O_2$/L) = C x f

= 0,226 x 10

= 2,26 mg/L

Effisiensi (%) = $\frac{awal-akhir}{awal}$ x 100%

= $\frac{3,96-2,26}{3,96}$ x 100%

= 42,9%

- KB1,5T60

Kadar COD (mg $O_2$/L) = C x f

= 0,209 x 10

= 2,09 mg/L

Effisiensi (%) = $\frac{awal-akhir}{awal}$ x 100%

= $\frac{3,96-2,09}{3,96}$ x 100%

= 47,2%

- KB3T30

Kadar COD (mg $O_2$/L) = C x f

= 0,205 x 10

= 2,05 mg/L

Effisiensi (%) = $\frac{awal-akhir}{awal}$ x 100%

= $\frac{3,96-2,05}{3,96}$ x 100%

= 48,2%

- KB3T60

Kadar COD (mg $O_2$/L) = C x f

= 0,202 x 10

= 2,02 mg/L

Effisiensi (%) = $\frac{awal-akhir}{awal}$ x 100%

= $\frac{3,96-2,02}{3,96}$ x 100%

= 48,9%

**Perhitungan Kadar COD**

**Biokoagulan CaO**

- CB1,5T30

Kadar COD (mg $O_2$/L) = C x f

= 0,268 x 10

= 2,68 mg/L

Effisiensi (%) = $\frac{awal-akhir}{awal}$ x 100%

= $\frac{3,96-2,68}{3,96}$ x 100%

= 32,3%

- CB1,5T60

Kadar COD (mg $O_2$/L) = C x f

= 0,226 x 10

= 2,26 mg/L

Effisiensi (%) = $\frac{awal-akhir}{awal}$ x 100%

= $\frac{3,96-2,26}{3,96}$ x 100%

= 42,9%

- CB3T30

Kadar COD (mg $O_2$/L) = C x f

= 0,212 x 10

= 2,12 mg/L

Effisiensi (%) = $\frac{awal-akhir}{awal}$ x 100%

= $\frac{3,96-2,12}{3,96}$ x 100%

= 46,4%

- CB3T60

Kadar COD (mg $O_2$/L) = C x f

= 0,207 x 10

= 2,07 mg/L

Effisiensi (%) = $\frac{awal-akhir}{awal}$ x 100%

= $\frac{3,96-2,07}{3,96}$ x 100%

= 47,7%

## LAMPIRAN 2. DOKUMENTASI PENELITIAN

Pencucian

Penjemuran

Penumbukan

Penghalusan

pengayakan

Proses kalsinasi 800 ℃ 4 jam dan 5 jam

Proses kalsinasi 900 ℃ 4 jam dan 5 jam

Penggerusan

Hasil proses kalsinasi (Produk CaO)

Melarutkan NaOH

Pengenceran NaOH

Penyaringan

Menimbang serbuk

Menimbang NaOH

Proses deproteinasi

Pembuatan larutan HCl 0,5 M dan 1 M

Proses demineralisasi

Hasil demineralisasi

Pembuatan larutan NaOH 4 M dan 6 M

Proses deasetilasi

Hasil deasetilasi (Produk kitosan)

Pembuatan larutan CH3COOH 2%

Uji kelarutan kitosan

Pengadukan 250 rpm 15 menit

Menimbang biokoagulan

Limbah batik

Proses Jartest aplikasi biokoagulan

Analisis Amoniak ($NH_3$)

Analisis Kadar Air

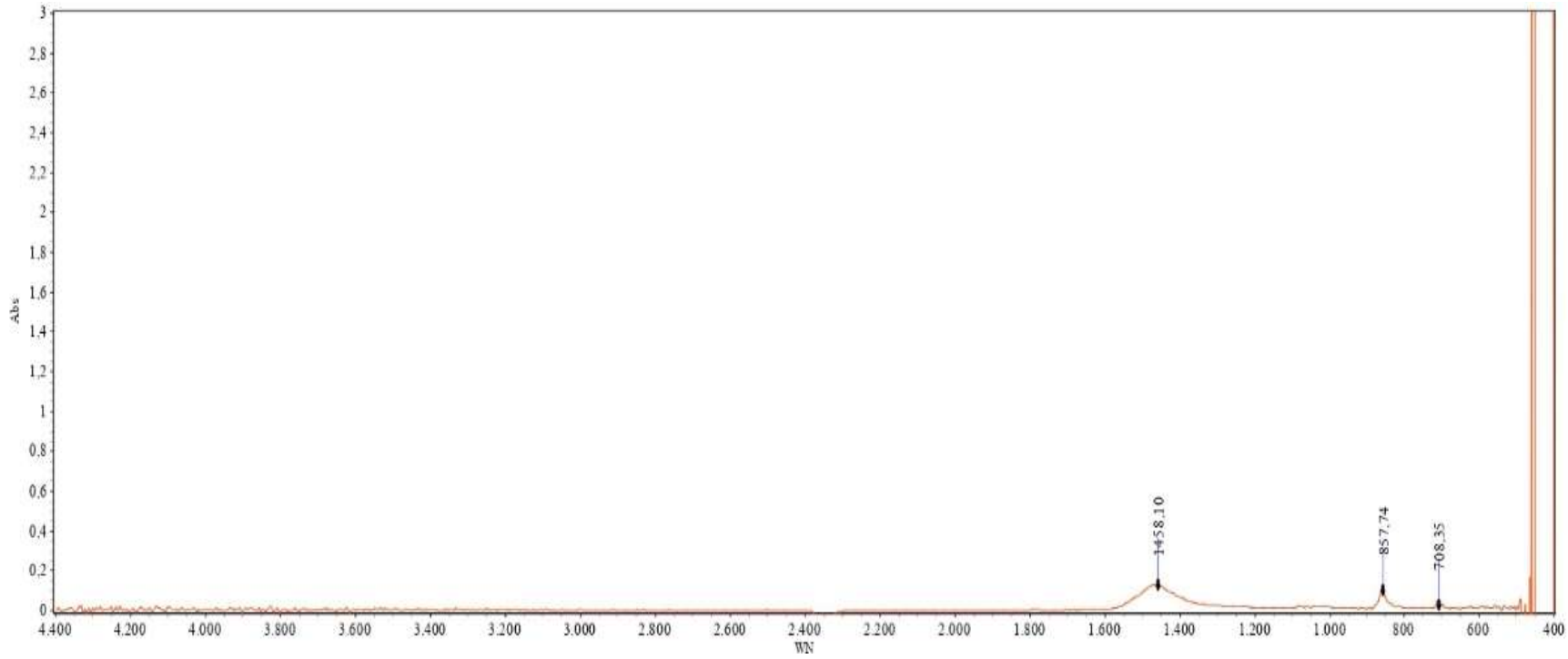
Analisis pH

Analisis COD

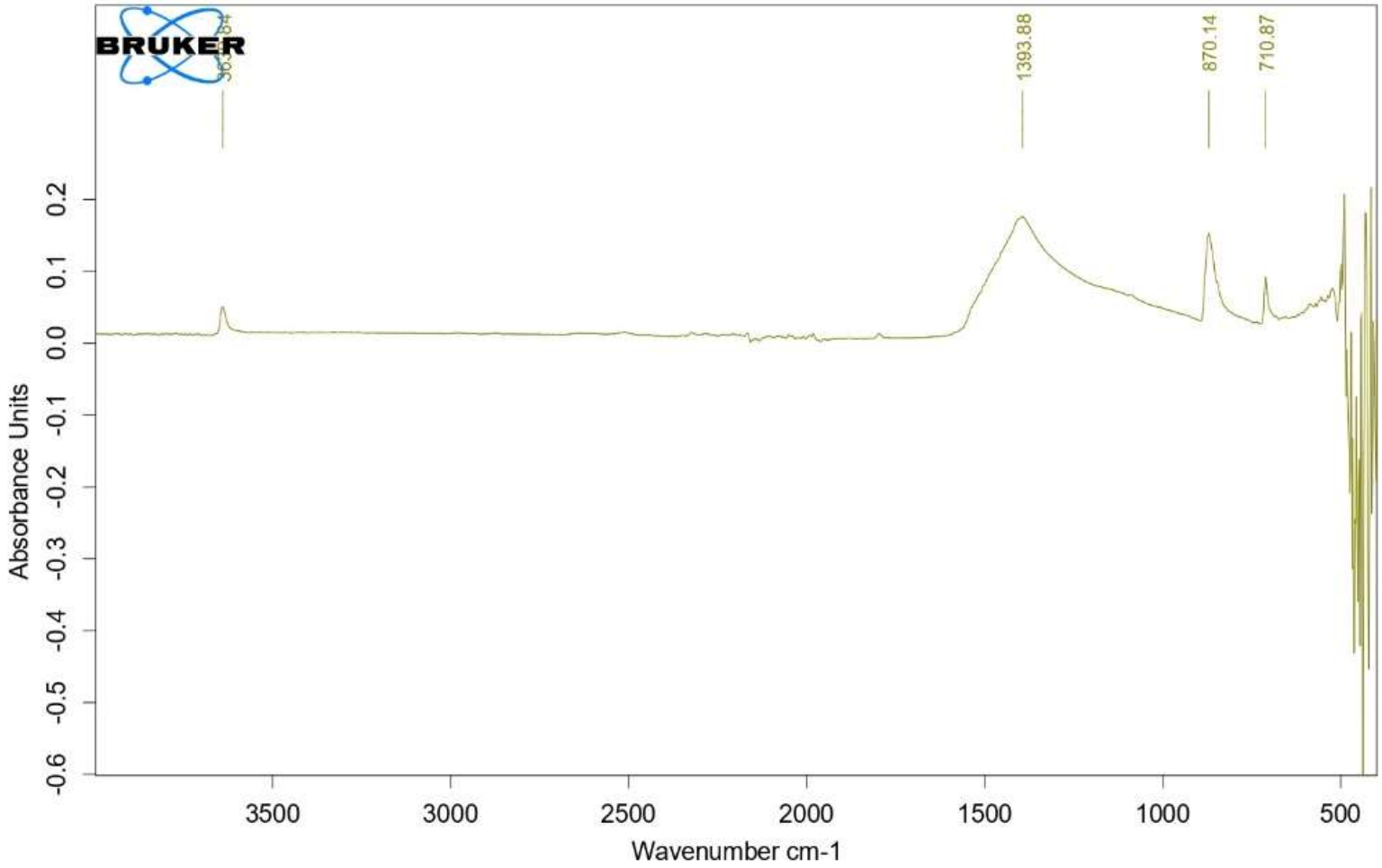
COD meter

Analisis TSS

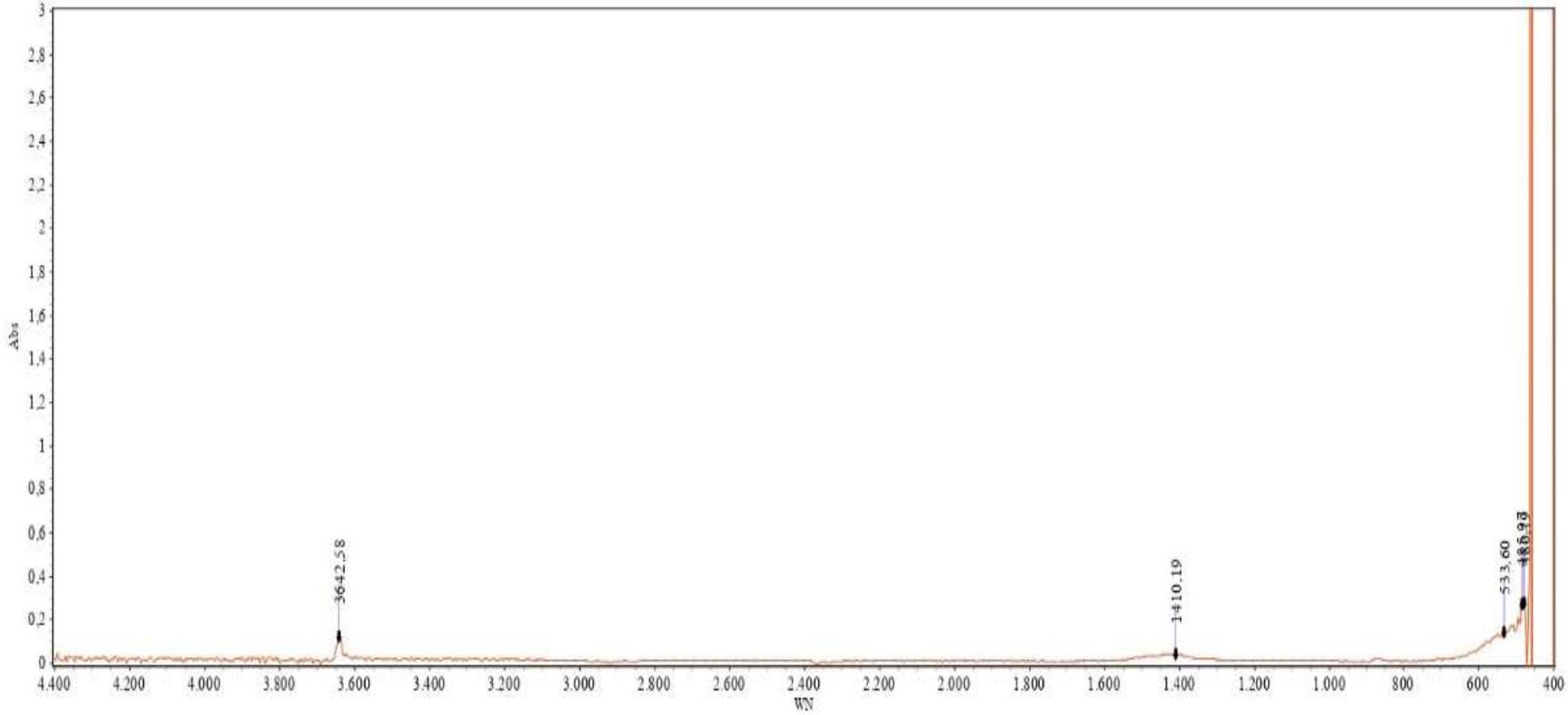
LAMPIRAN 3. HASIL ANALISIS FTIR




Hasil Spektrum Uji FTIR Biokoagulan Kitosan P0,5M0,5A4 dari Cangkang Kerang Darah (*Anadara Granosa*)




Hasil Spektrum Uji FTIR Biokoagulan Kalsium Oksida **(**CaO**)** menggunakan FTIR pada Variasi S8W5




Hasil Spektrum Uji FTIR Biokoagulan Kalsium Oksida (CaO**)** menggunakan FTIR pada Variasi S9W5

## LAMPIRAN 4. LABEL PRODUK BIOKOAGULAN


## LAMPIRAN 5. BIODATA PENULIS

| | |
|---|---|
| Nama | : Umi Khomsah Nurfadhilah |
| Tempat dan Tanggal Lahir | : Cilacap, 29 Mei 2001 |
| Alamat | : Jl. Nusantara No 250, Cilacap Utara |
| Telepon | : 0856-4304-0492 |
| Email | : umikhomsahnurfadhilah91237@gmail.com |
| Hobi | : Mendengarkan lagu, membaca novel |
| Motto | : Memulai dengan penuh keyakinan, menjalankan dengan penuh keikhlasan, dan menyeleseikan dengan penuh kebahagiaan. |

**Riwayat Pendidikan:**

1. SD NEGERI KARANGTALUN 04 : Tahun 2007 – 2013
2. SMP NEGERI 6 CILACAP : Tahun 2013 – 2016
3. SMA NEGERI 2 CILACAP : Tahun 2016 – 2019
4. POLITEKNIK NEGERI CILACAP : Tahun 2020 – 2024

Penulis telah mengikuti Sidang Tugas Akhir pada hari Rabu tanggal 17 Juli 2024, sebagai salah satu persyaratan untuk memperoleh gelar Sarjana Terapan (S.Tr)