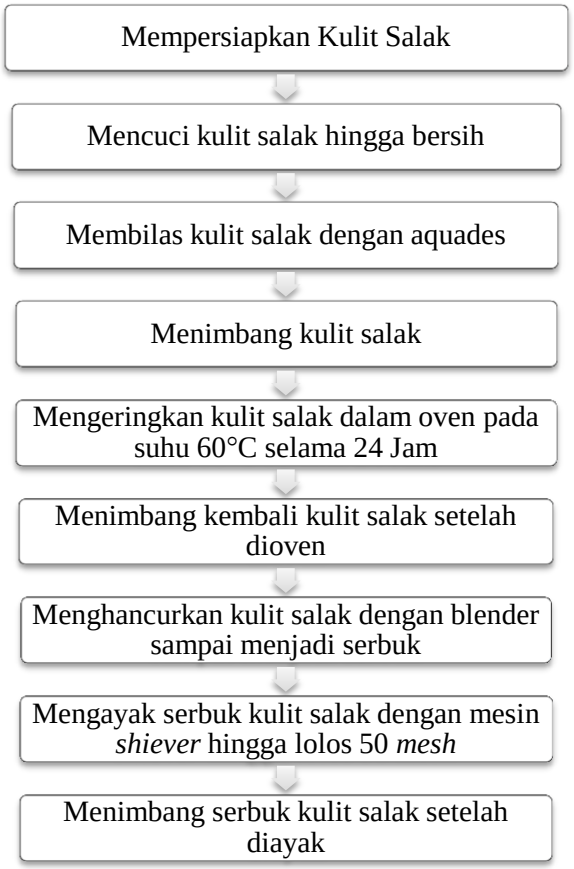
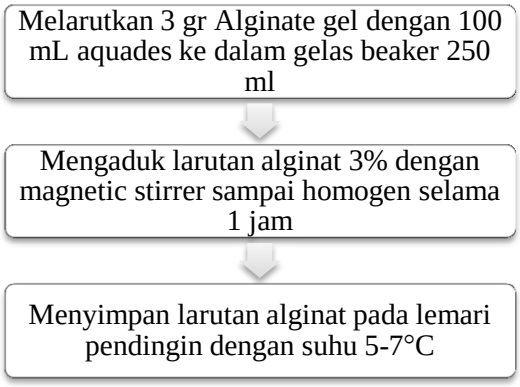
LAMPIRAN

Lampiran I Langkah Kerja Pengujian

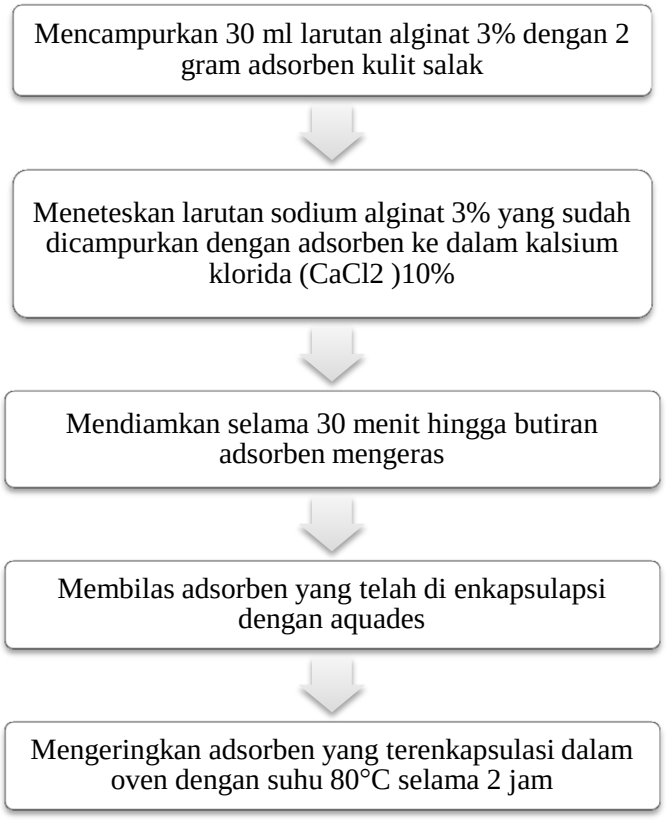
1. Preparasi Adsorben Serbuk Kulit Salak



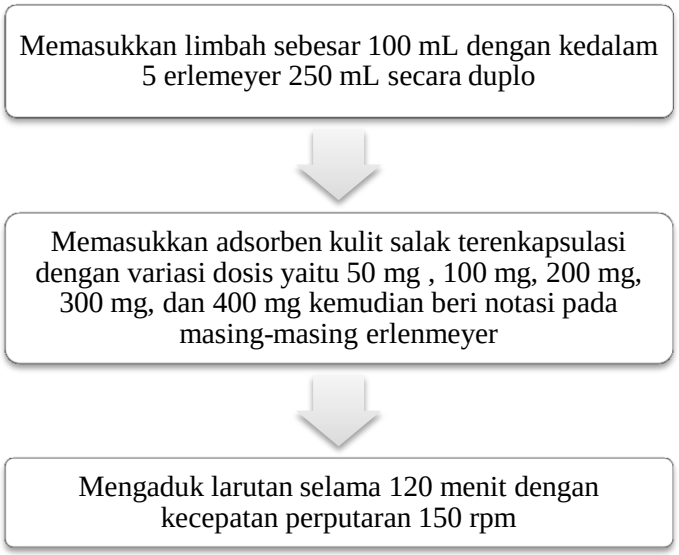
2. Pembuatan Larutan Alginate 3 %



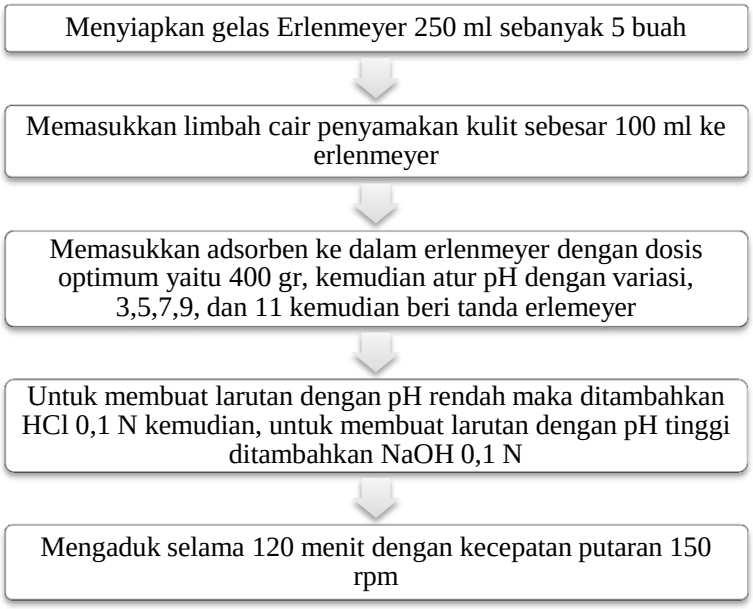
3. Pembuatan Adsorben yang dienkapsulasi dengan *Alginate Gel*



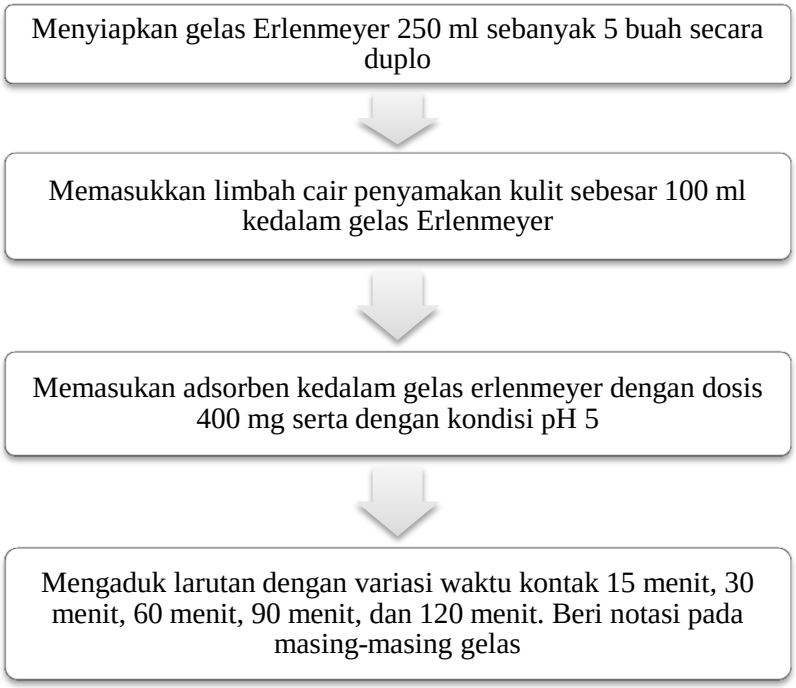
4. Variasi Massa Adsorben



5. Variasi pH



6. Variasi Waktu Kontak



Lampiran II Perhitungan

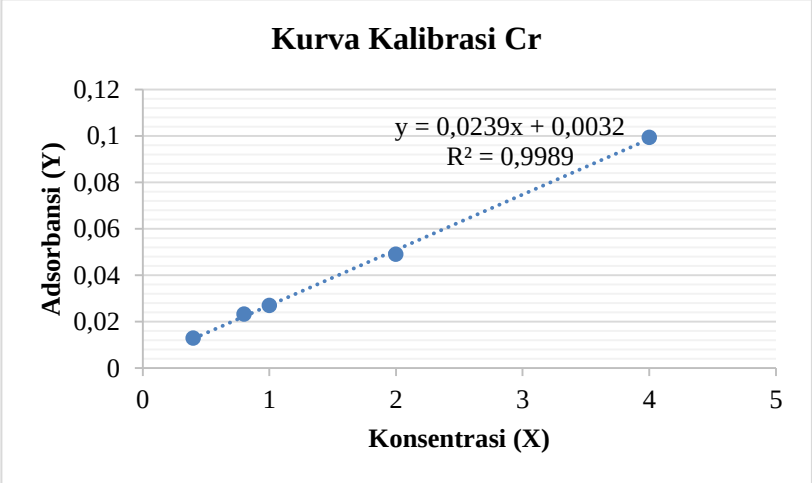
1. Pembuatan Kurva Kalibrasi Kromium (Cr)

Data Hasil Pembuatan Larutan Standar

No.	Konsentrasi (C)	Absorbansi (A)
1	0,4	0,0129
2	0,8	0,0233
3	1	0,0270
4	2	0,0490
5	4	0,0994

2. Persamaan Regresi Linier

x	y	xy	x^2	y^2
0,4	0,0129	0,00516	0,16	0,00016641
0,8	0,0233	0,01864	0,64	0,00054289
1,0	0,0270	0,02700	1,00	0,00072900
2,0	0,0490	0,09800	4,00	0,00240100
4,0	0,0994	0,14880	5,80	0,00988036
Σ= 8,2	0,2116	0,29760	11,60	0,04477456



Regresi Linear = y = 0,0239x + 0,0032 dengan R^2 = 0,9989

slope	0,0239x
intercept	0,0032

Maka dapat diperoleh nilai *slope* (b) sebagai berikut.

$$b = \frac{\sum xy - (\sum x \,.\, \sum y)/n}{\sum x^2 - ((\sum x)^2/n)}$$

$$b = \frac{0{,}29760 - (8{,}2\ x\ 0{,}2116)/5}{11{,}60 - (\frac{(8{,}2)^2}{5})} = 0{,}0239$$

Sementara itu nilai intercept (a) dapat dihitung sebagai berikut.

$$a = \frac{\sum y - (b\,.\sum x)}{n}$$

$$a = \frac{0{,}2116 - (0{,}0032\ x\ 8{,}2)}{5} = 0{,}0032$$

Sehingga, persamaan regresi linear adalah:

Y = bx + a

Y = 0,0239x + 0,0032

3. Perhitungan Sodium Alginate 3%

Diketahui :

Massa sodium alginate yang digunakan = 3 gram

Volume Aquades = 100 mL

$$\frac{3\ \text{gram}}{100\ mL} \times 100\% = 3\%$$

4. Perhitungan Massa Adsorben Kulit Salak Terenkapsulasi

Diketahui

- Data percobaan sebelum dioven :

  Massa serbuk kulit salak yang dipakai : 52 gram

  Larutan Sodium Alginate : 780 mL

  Berat Na-alginate dalam 780 ml alginate 3% = $\frac{3}{100} \times 780\ mL\ = 23{,}4\ gram$

  Berat Na-alginate + adsorben (basah) = 680 gr

- Data percobaan sesudah dioven :

  Massa adorben sesudah dioven = 52 gram

  Berat alginate + adsorben (kering) = 23,4 gram + 52 gram = 75,4 gram

  Kadar air = (75,4 gr / 680 gr) x 100% = 11,08 %

  Massa Adsorben yang dipakai :

Massa optimum adsorben yaitu 0,4 gram. Untuk mencari massa adsorben dengan massa 0,4 gram dilakukan pembagian dari adsorben yang dipakai yaitu 130 gram agar massa adsorben yang dipakai sebesar 0,4 gram.

52 gram adsorben : 130 = 0,4 gram

23,4 gram alginate : 130 = 0,187 gram

- Jadi, massa dalam bulir adsorben yang dipakai :

  0,4 gram + 0187 gram = 0,587 gram

- Jadi, dalam massa bulir adsorben serbuk salak+alginate yang dipakai :

  0,4 gr serbuk salak + 0,187 gr Alginate = 0,587 gram

Lampiran III Data Hasil Penelitian

1. Data Variasi Massa Kromium (Cr)

Massa (Mg)	Abs	pH awal		Rerata pH	Konsentrasi (Mg/L)		Rerata Konsentrasi (Mg/L)	Efisiensi Adsorpsi (%)
		Awal	Akhir		Awal	Akhir		
L0 0 mg kontrol (1)	0,0447	7	7	7	1,7404	1,6049	1,60	7,79%
L1 50 mg (1)	0,0328	7	7	7	1,7404	1,2430	1,12	35,68%
L1 50 mg (2)	0,0269	7	7			0,9957		
L2 100 mg (1)	0,0256	7	7	7	1,7404	0,9384	0,92	47,0%
L2 100 mg (2)	0,0248	7	7			0,9062		
L3 200 mg (1)	0,0245	7	7	7	1,7404	0,8937	0,87	49,7%
L3 200 mg (2)	0,0236	7	7			0,8559		
L4 300 mg (1)	0,0221	7	7	7	1,7404	0,7931	0,79	54,6%
L4 300 mg (2)	0,0220	7	7			0,7875		
L5 400 mg (1)	0,0200	7	7	7	1,7404	0,7064	0,65	62,4%
L5 400 mg (2)	0,0175	7	7			0,6016		

Contoh perhitungan konsentrasi Kromium (Cr)
Awal : L0 0 mg kontrol (1)

Y = bx + a

Y = 0,0239x + 0,0032

0,0447 = 0,0239x + 0,0032

0,0415 = 0,0239x

$$X = \frac{0,0415}{0,0239} = 1,7364 \text{ Mg/L}$$

Konsentrasi Sebenarnya

C_{total} COD = C x Fp

C = 1,7364 Mg/L x 10

C = 17,364 Mg/L

Efisiensi Removal : $\eta = \frac{C_0 - Ca}{C_0} \times 100\%$

$$\eta = \frac{1,60\ Mg/L - 1,12\ Mg/L}{1,60\ Mg/L} \times 100\% = 0,3\%$$

2. Data Variasi pH

Massa (mg)	pH Rencana	pH awal	Konsentrasi (Mg/L)		Rerata Konsentrasi (Mg/L)	Efisiensi Adsorpsi (%)
			Awal	Akhir		
400 mg	3	7	0,4198	0,2423	0,25	41,62%
400 mg	3	7		0,2479		
400 mg	5	7	0,4198	0,1697	0,20	52,10%
400 mg	5	7		0,2325		
400 mg	7	7	0,4198	0,2563	0,26	36,95%
400 mg	7	7		0,2731		
400 mg	9	7	0,4198	0,3359	0,35	16,98%
400 mg	9	7		0,3611		
400 mg	11	7	0,4198	0,3681	0,37	11,98%
400 mg	11	7		0,3709		
Blanko	7		0,4198	0,4085	0,41	2,69%

3. Data Variasi Waktu

Waktu Kontak (menit)	pH awal		Rerata pH	Konsentrasi (Mg/L)		Rerata Konsentrasi (Mg/L)	Efisiensi Adsorpsi (%)
	Awal	Akhir		Awal	Akhir		
L0 0 menit kontrol (1)	7	5	6	0,3398	0,3158	0,32	7,1%
L1 15 menit (1)	7	5	6	0,3398	0,2984	0,29	15,7%
L1 15 menit (2)	7	5			0,2742		
L2 30 menit(1)	7	5	6	0,3398	0,2680	0,26	23,1%
L2 30 menit (2)	7	5			0,2547		
L3 60 menit (1)	7	5	6	0,3398	0,2471	0,24	28,4%
L3 60 menit (2)	7	5			0,2394		
L4 90 menit (1)	7	5	6	0,3398	0,2170	0,20	41,5%
L4 90 menit (2)	7	5			0,1809		
L5 120 menit (1)	7	5	6	0,3398	0,1611	0,15	57,3%
L5 120 menit (2)	7	5			0,1290		

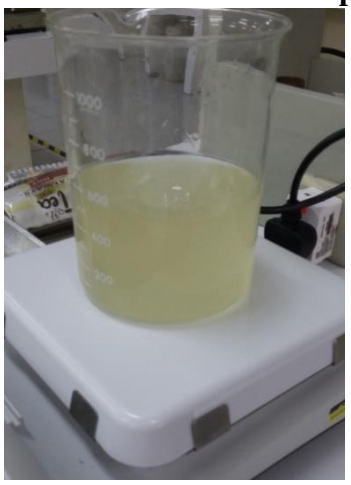
4. Data Hasil Proses Adsorpsi Kolom dan Fitoremediasi

Hari	Sampel	Suhu	pH	Konsentrasi (Mg/L)	Rerata (Mg/L)	Efisiensi (%)
Hari 1	Inlet (1)	26	7,8	0,710	0,74	0%
	Inlet (2)			0,776		
	hari 1Bak Kontrol (1)	26	7,7	0,652	0,63	15,48%
	Hari 1 Bak Kontrol (2)			0,604		
	Hari 1 Fitoremediasi (1)	25	7,6	0,554	0,52	30,35%
	Hari 1 Fitoremediasi (2)			0,481		
Hari 2	hari 1Bak Kontrol (1)	25	7,9	0,507	0,51	31,22%
	Hari 1 Bak Kontrol (2)			0,515		
	Hari 1 Fitoremediasi (1)	24	7,6	0,518	0,48	34,93%
	Hari 1 Fitoremediasi (2)			0,449		
Hari 3	hari 1Bak Kontrol (1)	26	7,7	0,509	0,45	39,43%
	Hari 1 Bak Kontrol (2)			0,391		
	Hari 1 Fitoremediasi (1)	25	7,6	0,353	0,35	53,23%
	Hari 1 Fitoremediasi (2)			0,342		
Hari 4	hari 1Bak Kontrol (1)	26	7,7	0,417	0,41	45,04%
	Hari 1 Bak Kontrol (2)			0,400		
	Hari 1 Fitoremediasi (1)	25	7,6	0,319	0,35	52,42%
	Hari 1 Fitoremediasi (2)			0,388		
Hari 5	hari 1Bak Kontrol (1)	26	7,9	0,396	0,39	48,18%
	Hari 1 Bak Kontrol (2)			0,374		
	Hari 1 Fitoremediasi (1)	24	7,6	0,311	0,35	53,57%
	Hari 1 Fitoremediasi (2)			0,379		
Hari 6	hari 1Bak Kontrol (1)	25	7,8	0,409	0,40	45,90%
	Hari 1 Bak Kontrol (2)			0,395		
	Hari 1 Fitoremediasi (1)	24	7,7	0,219	0,30	59,49%
	Hari 1 Fitoremediasi (2)			0,383		
Hari 7	hari 1Bak Kontrol (1)	26	7,9	0,387	0,39	47,17%
	Hari 1 Bak Kontrol (2)			0,398		
	Hari 1 Fitoremediasi (1)	24	7,7	0,276	0,32	57,13%
	Hari 1 Fitoremediasi (2)			0,361		
Hari 8	hari 1Bak Kontrol (1)	26	7,8	0,394	0,39	47,44%
	Hari 1 Bak Kontrol (2)			0,387		
	Hari 1 Fitoremediasi (1)	25	7,7	0,177	0,25	66,49%
	Hari 1 Fitoremediasi (2)			0,321		
Hari 9	hari 1Bak Kontrol (1)	26	7,8	0,389	0,39	47,51%
	Hari 1 Bak Kontrol (2)			0,391		
	Hari 1 Fitoremediasi (1)	23,5	7,6	0,186	0,24	67,23%

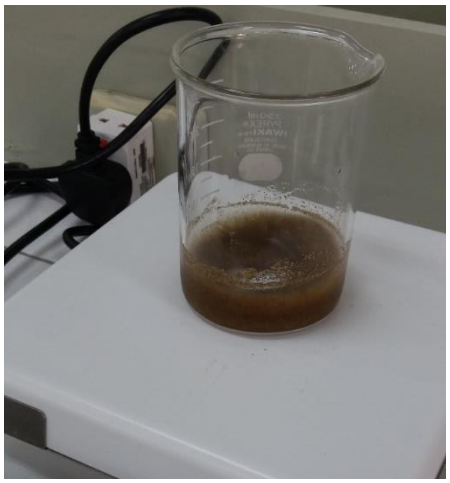
	Hari 1 Fitoremediasi (2)			0,301		
Hari 10	hari 1Bak Kontrol (1)	26	7,8	0,384	0,37	50,67%
	Hari 1 Bak Kontrol (2)			0,349		
	Hari 1 Fitoremediasi (1)	24	7,5	0,241	0,23	69,11%
	Hari 1 Fitoremediasi (2)			0,218		
Hari 11	hari 1Bak Kontrol (1)	26	7,8	0,375	0,38	49,33%
	Hari 1 Bak Kontrol (2)			0,378		
	Hari 1 Fitoremediasi (1)	24	7,6	0,219	0,19	73,96%
	Hari 1 Fitoremediasi (2)			0,168		
Hari 12	hari 1Bak Kontrol (1)	26	7,8	0,359	0,36	51,14%
	Hari 1 Bak Kontrol (2)			0,367		
	Hari 1 Fitoremediasi (1)	25	7,5	0,172	0,17	77,05%
	Hari 1 Fitoremediasi (2)			0,169		
Hari 13	hari 1Bak Kontrol (1)	25	7,8	0,347	0,35	53,10%
	Hari 1 Bak Kontrol (2)			0,350		
	Hari 1 Fitoremediasi (1)	23	7,5	0,143	0,15	79,68%
	Hari 1 Fitoremediasi (2)			0,159		
Hari 14	hari 1Bak Kontrol (1)	25	7,7	0,324	0,32	56,39%
	Hari 1 Bak Kontrol (2)			0,324		
	Hari 1 Fitoremediasi (1)	24	7,5	0,138	0,14	81,16%
	Hari 1 Fitoremediasi (2)			0,142		

Lampiran IV Dokumentasi

1. Dokumentasi Proses Enkapsulasi Adsorben Kulit Salak



Preparasi Larutan Sodium Alginate 3%



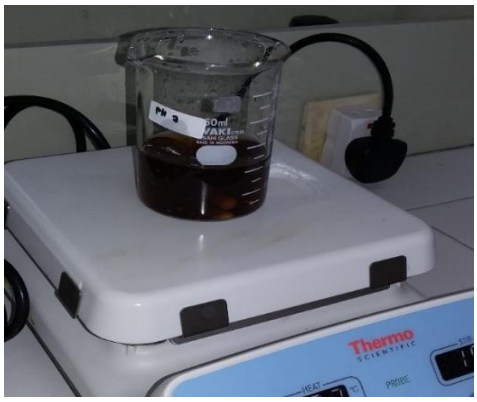
Campuran Larutan Sodium Alginate 3% dengan serbuk kulit salak

Adsorben terenkapsulasi dalam larutan $CaCl_2$

Adsorben setelah dibilas akuades

Adsorben Setelah dioven

2. Dokumentasi Percobaan Adsorpsi dan Pengujian Parameter



Proses Adsorpsi

Pengujian Kromium Total (Cr)

Pembacaan Nilai Konsentrasi Logam Kromium Total (Cr) menggunakan alat SSA (Spektrofotometer Serapan Atom)

Proses destruksi larutan pada lemari asam

3. Dokumentasi Reaktor Adsorpsi Kolom dan Fitoremediasi

Rangkaian Reaktor Adsorpsi Kolom dan Fitoremediasi

Reaktor Fitoremediasi

Reaktor Adsorpsi Kolom

Perbandingan Effluen Adsorpsi Kolom dan Fitoremediasi

4. Dokumentasi Kondisi Tanaman Eceng Gondok pada Proses Fitoremediasi

(a)

(b)

(c)

(d)

(e)

(f)

Lampiran V Hasil Uji SEM

1. Enkapsulasi Adsorben Sebelum Adsorbsi

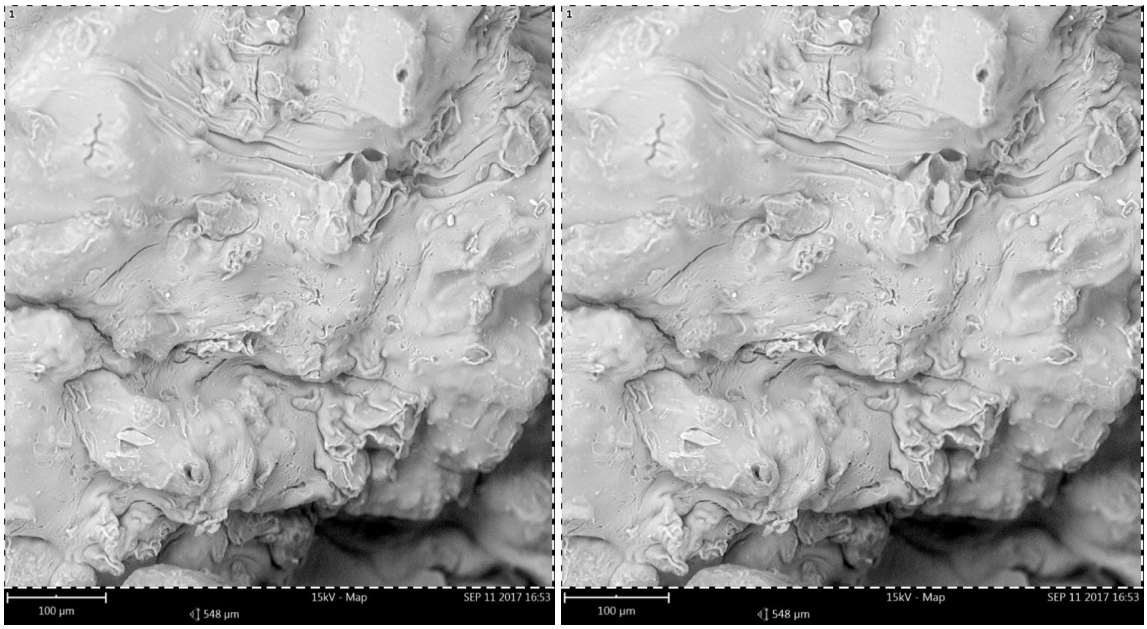
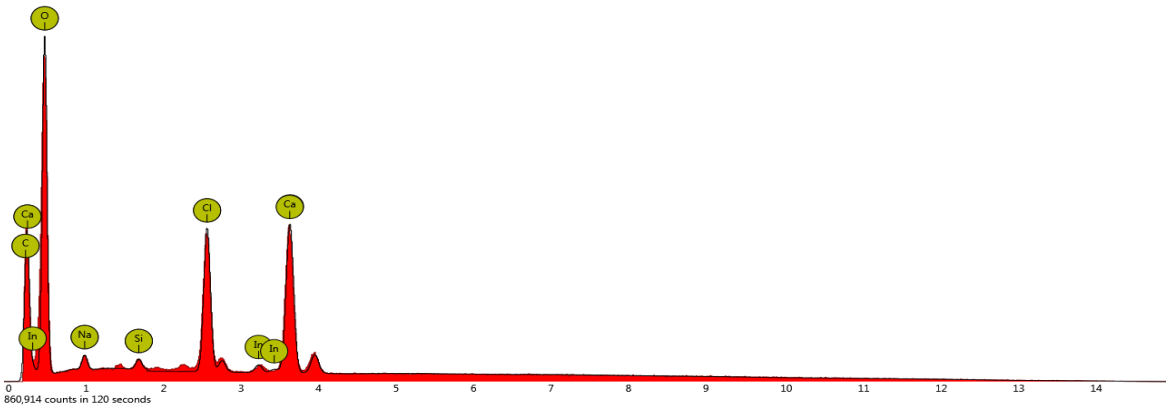


Image 1 1. region



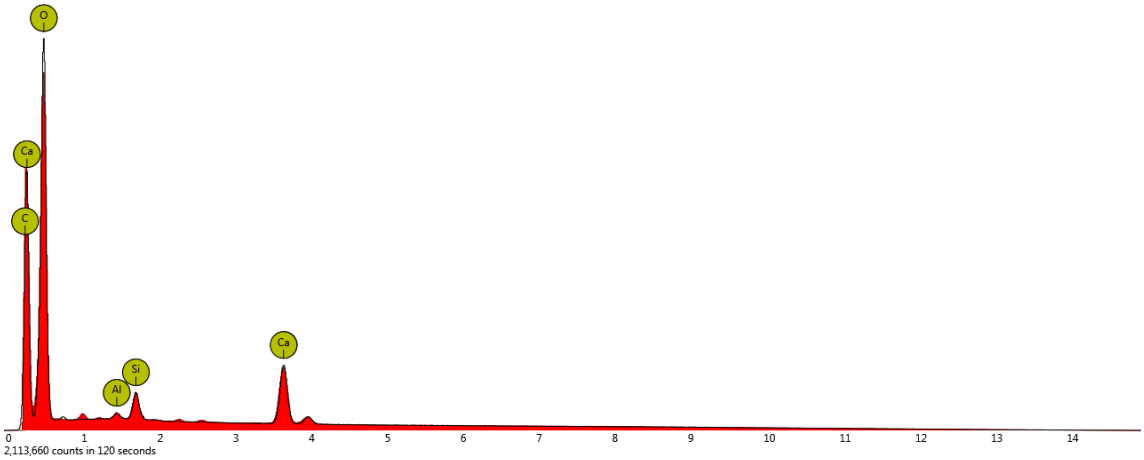
Disabled elements: B, I, Po, Pu, Ru, Sb

Element Number	Element Symbol	Element Name	Atomic Concentration	Error
8	O	Oxygen	80.7	0.3
20	Ca	Calcium	6.1	0.2
17	Cl	Chlorine	4.9	0.1
6	C	Carbon	5.8	0.7
11	Na	Sodium	1.9	0.1
14	Si	Silicon	0.3	0.4
49	In	Indium	0.3	0.1

2. Enkapsulasi Adsorben Setelah Adsorbsi

Image 1

1. region



Disabled elements: B

Element Number	Element Symbol	Element Name	Atomic Concentration	Error
8	O	Oxygen	85.5	0.2
6	C	Carbon	9.5	0.8
20	Ca	Calcium	3.5	0.2
14	Si	Silicon	1.1	0.0
13	Al	Aluminium	0.3	0.0

3. RAW Kulit Salak

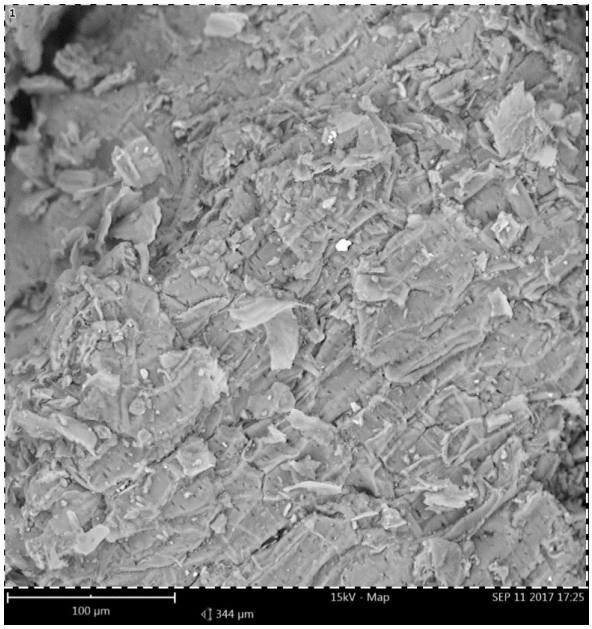
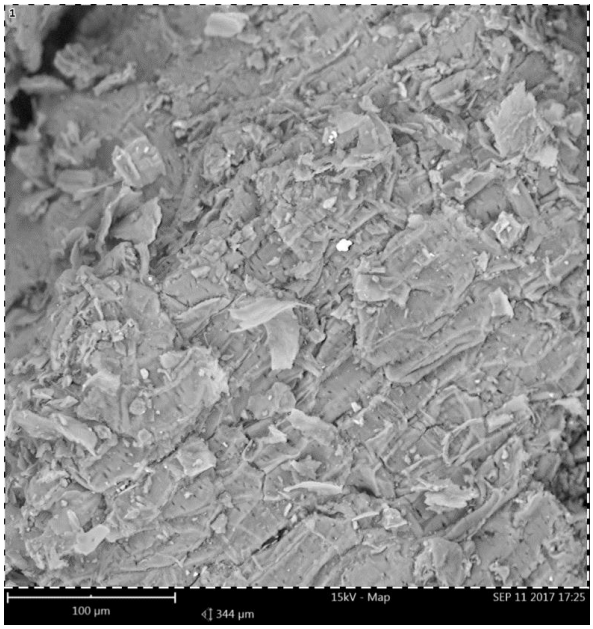
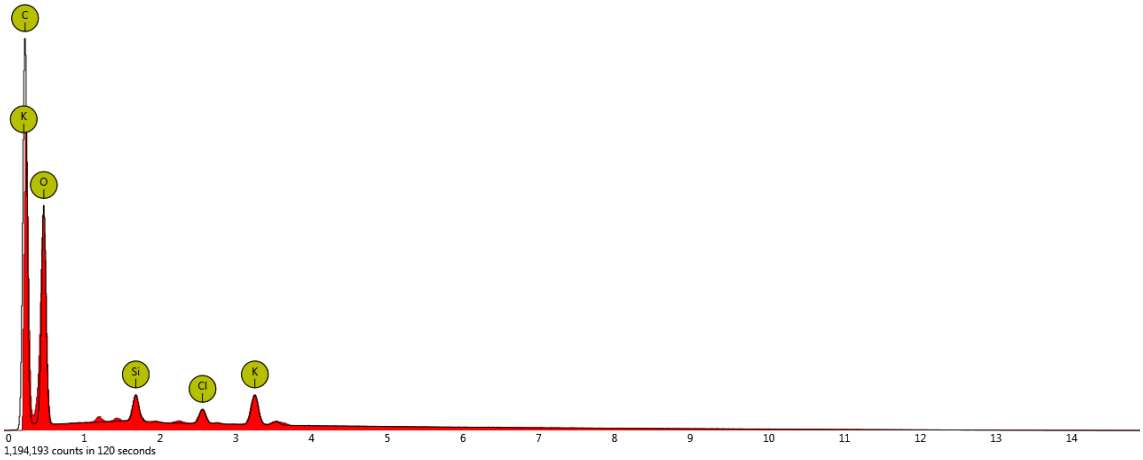


Image 1



1. region



Disabled elements: B, In

Element Number	Element Symbol	Element Name	Atomic Concentration	Error
6	C	Carbon	17.2	0.7
8	O	Oxygen	77.7	0.2
19	K	Potassium	2.4	0.1
14	Si	Silicon	1.6	0.0
17	Cl	Chlorine	1.1	0.0

Lampiran VI Hasil Uji FTIR

1. Tabel Korelasi Gugus Fungsi

Range (cm^{-1}) and Intensity[a]	Group and Class	Assignment and Remarks
3700–3600 (s)	—OH in alcohols and phenols	OH stretch (dil soln)
3520–3320 (m–s)	—NH_2 in aromatic amines, primary amines and amides	NH stretch (dil soln)
3420–3250 (s)	—OH in alcohols and phenols	OH stretch (solids & liquids)
3360–3340 (m)	—NH_2 in primary amides	NH_2 antisym stretch (solids)
3320–3250 (m)	—OH in oximes	O—H stretch
3300–3250 (m–s)	≡CH in acetylenes	≡CH—H stretch
3300–3280 (s)	—NH in secondary amides	NH stretch (solids); also in polypeptides and proteins
3200–3180 (s)	—NH_2 in primary amides	NH_2 sym stretch (solids)
3200–3000 (v br)	—NH_3^+ in amino acids	NH_3^+ antisym stretch
3100–2400 (v br)	—OH in carboxylic acids	H-bonded OH stretch
3100–3000 (m)	=CH in aromatic and unsaturated hydrocarbons	=C—H stretch
2990–2850 (m–s)	—CH_3 and —CH_2— in aliphatic compounds	CH antisym and sym stretching
2850–2700 (m)	—CH_3 attached to O or N	CH stretching modes
2750–2650 (w–m)	—CHO in aldehydes	overtone of CH bending (Fermi resonance)
2750–2350 (br)	—NH_3^+ in amine hydrohalides	NH stretching modes
2720–2560 (m)	—OH in phosphorus oxyacids	associated OH stretching
2600–2540 (w)	—SH in alkyl mercaptans	S—H stretch; strong in Raman
2410–2280 (m)	—PH in phosphines	P—H stretch; sharp peak
2300–2230 (m)	N≡N in diazonium salts	N≡N stretch, aq soln
2285–2250 (s)	N=C=O in isocyanates	N=C=O antisym stretch
2260–2200 (m–s)	C≡N in nitriles	C≡N stretch
2260–2190 (w–m)	C≡C in alkynes (disubst)	C≡C stretch; strong in Raman
2190–2130 (m)	C≡N in thiocyanates	C≡N stretch
2175–2115 (s)	N≡C in isonitriles	N≡C stretch
2160–2080 (m)	$N=\overset{+}{N}=\overset{-}{N}$ in azides	N=N=N antisym stretch
2140–2100 (w–m)	C≡C in alkynes (monosubst)	C≡C stretch
2000–1650 (w)	substituted benzene rings	several bands from overtone and combination bands
1980–1950 (s)	C=C=C in allenes	C=C=C antisym stretch
1870–1650 (vs)	C=O in carbonyl compounds	C=O stretch
1870–1830 (s)	C=O in β-lactones	C=O stretch
1870–1790 (vs)	C=O in anhydrides	C=O antisym stretch; part of doublet
1820–1800 (s)	C=O in acid halides	C=O stretch; lower for aromatic acid halides
1780–1760 (s)	C=O in γ-lactones	C=O stretch
1765–1725 (vs)	C=O in anhydrides	C=O sym stretch; part of doublet
1760–1740 (vs)	C=O in α-keto esters	C=O stretch; enol form
1750–1730 (s)	C=O in δ-lactones	C=O stretch
1750–1740 (vs)	C=O in esters	C=O stretch; 20 cm^{-1} lower if unsaturated
1740–1720 (s)	C=O in aldehydes	C=O stretch; 30 cm^{-1} lower if unsaturated
1720–1700 (s)	C=O in ketones	C=O stretch; 20 cm^{-1} lower if unsaturated
1710–1690 (s)	C=O in carboxylic acids	C=O stretch; fairly broad
1690–1640 (s)	C=N in oximes	C=N stretch; also imines
1680–1620 (s)	C=O and NH_2 in primary amides	two bands from C=O stretch and NH_2 deformation
1680–1635 (s)	C=O in ureas	C=O stretch; broad band
1680–1630 (m–s)	C=C in alkenes, etc.	C=C stretch
1680–1630 (vs)	C=O in secondary amides	C=O stretch (Amide I band)

[a] v = very, s = strong, m = medium, w = weak, br = broad.

TABLE 7-3 (Continued)

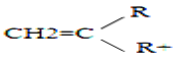
Range (cm^{-1}) and Intensity[a]	Group and Class	Assignment and Remarks
1670–1640 (s–vs)	C=O in benzophenones	C=O stretch
1670–1650 (vs)	C=O in primary amides	C=O stretch (Amide I band)
1670–1630 (vs)	C=O in tertiary amides	C=O stretch
1655–1635 (vs)	C=O in β-ketone esters	C=O stretch; enol form
1650–1620 (w–m)	N—H in primary amides	NH deformation (Amide II band)
1650–1580 (m–s)	NH_2 in primary amines	NH_2 deformation
1640–1580 (s)	NH_3^+ in amino acids	NH_3 deformation
1640–1580 (vs)	C=O in β-diketones	C=O stretch; enol form
1620–1610 (s)	C=C in vinyl ethers	C=C stretch; doublet due to rotational isomerism
1615–1590 (m)	benzene ring in aromatic compounds	ring stretch; sharp peak
1615–1565 (s)	pyridine derivatives	ring stretch; doublet
1610–1580 (s)	NH_2 in amino acids	NH_2 deformation; broad band
1610–1560 (vs)	COO^- in carboxylic acid salts	$-C(=O)-O^-$ antisym stretch
1590–1580 (m)	NH_2 primary alkyl amide	NH_2 deformation (Amide II band)
1575–1545 (vs)	NO_2 in aliphatic nitro compounds	NO_2 antisym stretch
1565–1475 (vs)	NH in secondary amides	NH deformation (Amide II band)
1560–1510 (s)	triazine compounds	ring stretch; sharp band
1550–1490 (s)	NO_2 in aromatic nitro compounds	NO_2 antisym stretch
1530–1490 (s)	NH_3^+ in amino acids or hydrochlorides	NH_3^+ deformation
1530–1450 (m–s)	N=N—O in azoxy compounds	N=N—O antisym stretch
1515–1485 (m)	benzene ring in aromatic compounds	ring stretch, sharp band
1475–1450 (vs)	CH_2 in aliphatic compounds	CH_2 scissors vibration
1465–1440 (vs)	CH_3 in aliphatic compounds	CH_3 antisym deformation
1440–1400 (m)	OH in carboxylic acids	in-plane OH bending
1420–1400 (m)	C—N in primary amides	C—N stretch (Amide III band)
1400–1370 (m)	*t*-butyl group	CH_3 deformations (two bands)
1400–1310 (s)	COO^- group in carboxylic acid salts	$C(=O)-O^-$ sym stretch; broad band
1390–1360 (vs)	SO_2 in sulfonyl chlorides	SO_2 antisym stretch
1380–1370 (s)	CH_3 in aliphatic compounds	CH_3 sym deformation
1380–1360 (m)	isopropyl group	CH_3 deformations (two bands)
1375–1350 (s)	NO_2 in aliphatic nitro compounds	NO_2 sym stretch
1360–1335 (vs)	SO_2 in sulfonamides	SO_2 antisym stretch
1360–1320 (vs)	NO_2 in aromatic nitro compounds	NO_2 sym stretch
1350–1280 (m–s)	N=N—O in azoxy compounds	N=N—O sym stretch
1335–1295 (vs)	SO_2 in sulfones	SO_2 antisym stretch
1330–1310 (m–s)	CF_3 attached to a benzene ring	CF_3 antisym stretch
1300–1200 (vs)	$\overset{+}{N}-\overset{-}{O}$ in pyridine *N*-oxides	N—O stretch
1300–1175 (vs)	P=O in phosphorus oxyacids and phosphates	P=O stretch
1300–1000 (vs)	C—F in aliphatic fluoro compounds	C—F stretch
1285–1240 (vs)	Ar—O in alkyl aryl ethers	C—O stretch
1280–1250 (vs)	Si—CH_3 in silanes	CH_3 sym deformation
1280–1240 (m–s)	C—C in epoxides (O)	C—O stretch
1280–1180 (s)	C—N in aromatic amines	C—N stretch
1280–1150 (vs)	C—O—C in esters, lactones	C—O—C antisym stretch

TABLE 7-3 (Continued)

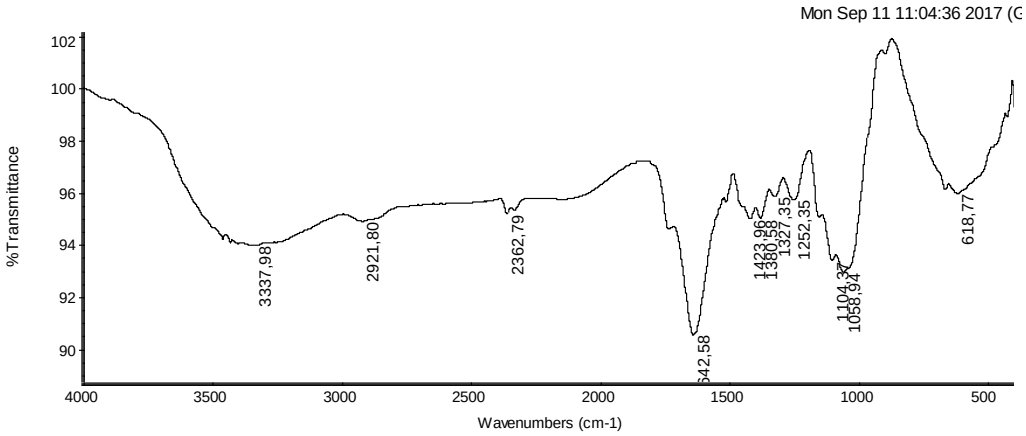
Range (cm^{-1}) and Intensity[a]	Group and Class	Assignment and Remarks
1255–1240 (m)	*t*-butyl in hydrocarbons	skeletal vibration; second band near 1200 cm^{-1}
1245–1155 (vs)	SO_3H in sulfonic acids	S=O stretch
1240–1070 (s–vs)	C—O—C in ethers	C—O—C stretch; also in esters
1230–1100 (s)	C—C—N in amines	C—C—N bending
1225–1200 (s)	C—O—C in vinyl ethers	C—O—C antisym stretch
1200–1165 (s)	SO_2Cl in sulfonyl chlorides	SO_2 sym stretch
1200–1015 (vs)	C—OH in alcohols	C—O stretch
1170–1145 (s)	SO_2NH_2 in sulfonamides	SO_2 sym stretch
1170–1140 (s)	SO_2— in sulfones	SO_2 sym stretch
1160–1100 (m)	C=S in thiocarbonyl compounds	C=S stretch; strong in Raman
1150–1070 (vs)	C—O—C in aliphatic ethers	C—O—C antisym stretch
1120–1080 (s)	C—O—H in secondary or tertiary alcohols	C—O stretch
1120–1030 (s)	C—NH_2 in primary aliphatic amines	C—N stretch
1100–1000 (vs)	Si—O—Si in siloxanes	Si—O—Si antisym stretch
1080–1040 (s)	SO_3H in sulfonic acids	SO_3 sym stretch
1065–1015 (s)	CH—O—H in cyclic alcohols	C—O stretch
1060–1025 (vs)	CH_2—O—H in primary alcohols	C—O stretch
1060–1045 (vs)	S=O in alkyl sulfoxides	S=O stretch
1055–915 (vs)	P—O—C in organophosphorus compounds	P—O—C antisym stretch
1030–950 (w)	carbon ring in cyclic compounds	ring breathing mode; strong in Raman
1000–950 (s)	CH=CH_2 in vinyl compounds	=CH out-of-plane deformation
980–960 (vs)	CH=CH— in trans disubstituted alkenes	=CH out-of-plane deformation
950–900 (vs)	CH=CH_2 in vinyl compounds	CH_2 out-of-plane wag
900–865 (vs)	$CH_2=C(R)(R')$ in vinylidenes	CH_2 out-of-plane wag
890–805 (vs)	1,2,4-trisubst benzenes	CH out-of-plane deformation (two bands)
860–760 (vs, br)	R—NH_2 primary amines	NH_2 wag
860–720 (vs)	Si—C in organosilicon compounds	Si—C stretch
850–830 (vs)	1,3,5-trisubst benzenes	CH out-of-plane deformation
850–810 (vs)	Si—CH_3 in silanes	Si—CH_3 rocking
850–790 (m)	$CH=C(R)(R')$ in trisubst alkenes	CH out-of-plane deformation
850–550 (m)	C—Cl in chloro compounds	C—Cl stretch
830–810 (vs)	*p*-disubst benzenes	CH out-of-plane deformation
825–805 (vs)	1,2,4-trisubst benzenes	CH out-of-plane deformation
820–800 (s)	triazines	CH out-of-plane deformation
815–810 (s)	CH=CH_2 in vinyl ethers	CH_2 out-of-plane wag
810–790 (vs)	1,2,3,4-tetrasubst benzenes	CH out-of-plane deformation
800–690 (vs)	*m*-disubst benzenes	CH out-of-plane deformation (two bands)
785–680 (vs)	1,2,3-trisubst benzenes	CH out-of-plane deformation (two bands)
775–650 (m)	C—S in sulfonyl chlorides	C—S stretch; strong in Raman
770–690 (vs)	monosubst benzenes	CH out-of-plane deformation (two bands)
760–740 (s)	*o*-disubst benzenes	CH out-of-plane deformation
760–510 (s)	C—Cl alkyl chlorides	C—Cl stretch
740–720 (w–m)	$-(CH_2)_n-$ in hydrocarbons	CH_2 rocking in methylene chains; intensity depends on chain length
730–665 (s)	CH=CH in cis disubst alkenes	CH out-of-plane deformation
720–600 (s, br)	Ar—OH in phenols	OH out-of-plane deformation

Range (cm^{-1}) and Intensity[a]	Group and Class	Assignment and Remarks
710–570 (m)	C—S in sulfides	C—S stretch; strong in Raman
700–590 (s)	O—C=O in carboxylic acids	O—C=O bending
695–635 (s)	C—C—CHO in aldehydes	C—C—CHO bending
680–620 (s)	C—OH in alcohols	C—O—H bending
680–580 (s)	C≡C—H in alkynes	C≡C—H bending
650–600 (w)	S—C≡N in thiocyanates	S—C stretch; strong in Raman
650–600 (s)	NO_2 in aliphatic nitro compounds	NO_2 deformation
650–500 (s)	Ar—CF_3 in aromatic trifluoro-methyl compounds	CF_3 deformation (two or three bands)
650–500 (s)	C—Br in bromo compounds	C—Br stretch
645–615 (m–s)	naphthalenes	in-plane ring deformation
645–575 (s)	O—C—O in esters	O—C—O bend
640–630 (s)	$=CH_2$ in vinyl compounds	$=CH_2$ twisting
635–605 (m–s)	pyridines	in-plane ring deformation
630–570 (s)	N—C=O in amides	N—C=O bend
630–565 (s)	C—CO—C in ketones	C—CO—C bend
615–535 (s)	C=O in amides	C=O out-of-plane bend
610–565 (vs)	SO_2 in sulfonyl chlorides	SO_2 deformation
610–545 (m–s)	SO_2 in sulfones	SO_2 scissoring
600–465 (s)	C—I in iodo compounds	C—I stretch
580–530 (m–s)	C—C—CN in nitriles	C—C—CN bend
580–520 (m)	NO_2 in aromatic nitro compounds	NO_2 deformation
580–430 (s)	ring in cycloalkanes	ring deformation
580–420 (m–s)	ring in benzene derivatives	in-plane and out-of-plane ring deformations (two bands)
570–530 (vs)	SO_2 in sulfonyl chlorides	SO_2 rocking
565–520 (s)	C—C=O in aldehydes	C—C=O bend
565–440 (w–m)	C_nH_{2n+1} in alkyl groups	chain deformation modes (two bands)
560–510 (s)	C—C=O in ketones	C—C=O bend
560–500 (s)	 – in amino acids	 – rocking
555–545 (s)	$=CH_2$ in vinyl compounds	$=CH_2$ twisting
550–465 (s)	C—C=O in carboxylic acids	C—C=O bend
545–520 (s)	naphthalenes	in-plane ring deformation
530–470 (m–s)	NO_2 in nitro compounds	NO_2 rocking
520–430 (m–s)	C—O—C in ethers	C—O—C bend
510–400 (s)	C—N—C in amines	C—N—C bend
490–465 (variable)	naphthalenes	out-of-plane ring bending
440–420 (s)	Cl—C=O in acid chlorides	Cl—C=O in-plane deformation
405–400 (s)	S—C≡N in thiocyanates	S—C≡N bend

2. Gugus Fungsi yang Terbaca pada Adsorben Kulit Salak

Range Frekuensi (cm^{-1})	Range Frekuensi Kulit Salak (cm^{-1})	Range Frekuensi kulit Salak Terenkapsulasi (cm^{-1})	Range Frekuensi Kulit Salak Terenkapsulasi Stlh Adsorpsi (cm^{-1})	Gugus	Senyawa
3520 - 3320	3371,98	3410,32	3432,79	NH_2	Aromatic amines, primary amines, & amides
3420 - 3250				O-H	Alcohol & phenols
3360 - 3340		-	-	NH_2	Primary amides
2990-2850	2921,80			CH_3 & CH_2	Aliphatic compounds
2750-2350	2362,79	2362,17	-	NH_3^+	Amine hydrohalides
2410-2280		2334,27	-	PH	Phosphines
1680-1620	1642,58	1635,20	1636,78	C=O &NH_2	Primary amides
1680-1635				C=O	Ureas
1680-1630				C=C	Alkenes, etc
1680-1630				C=O	Secondary amides
1670-1640				C=O	Benzophenones
1670-1630				C=O	Tertiary amides
1655-1635				C=O	*B*-ketones ester
1650-1620				N-H	Primary amides
1650-1580				NH_2	Primary amides
1640-1580	-			NH_3^+	Amino acids
1640-1580				C=O	*B*-diketones
1560-1510	-	1515,37	1512,74	Triazine compound	Triazine compound
1550-1490				NO_2	Aromatic nitro compounds
1530-1450				NH_3^+	Amino acids/hydrochlorides
1530-1450				N=N-O	Azoxy compounds
1440-1400	1423,96	1427,09	1424,55	OH	Carboxylic acids
1400-1370	1380,58	1382,88	1382,64	t-butyl group	-
1390-1360				COO^-	Carboxylic acids salts
1400-1310	1327,35			SO_2	Sulfonyl chlorides
1360-1320		-	-	NO_2	Aromatic nitro compounds
1350-1280				N=N-O	Aroxy compounds
1335-1295				SO_2	Sulfones
1330-1310				CF_2	Benzene ring
1300-1200	1252,35	1258,84	1257,29	N-O	Pyridine *N*-oxides
1285-1240				Ar-O	Alkyl aryl ethers
1280-1250				Si-CH_3	Silanes
1280-1240					Exposides
1280-1180				C – N	Aromatic amines
1280-1150				C – O –C	Esters, lactones
1255-1240		-	-	t – butyl	Hydrocarbons
1160-1100	1104,37	-	-	C – S	Thiocarbonyl compounds
1150-1070				C – O – C	Aliphatic ethers
1120-1080				C – O – H	Secondary/tertiary alcohols
1120-1030		1038,35	1039,65	C – NH_2	Primary aliphatic amines
1100-1000	1058,94			Si – O – Si	siloxanes
1080-1040		-	-	SO_3H	Sulfonic acids
1065-1025		1038,35	1039,65	CH_2 – O – H	Prymary alchohols
1060-1045		-	-	S – O	Alkyl sulfoxines
1055-915	-	1038,35	1039,65	P – O – C	Organophosphorus
900-865	-	-	895,12		vinylidenes
775-650	-	667,94	-	C – S	Sulfonyl chlorides
730-665				CH = CH	Alkenes

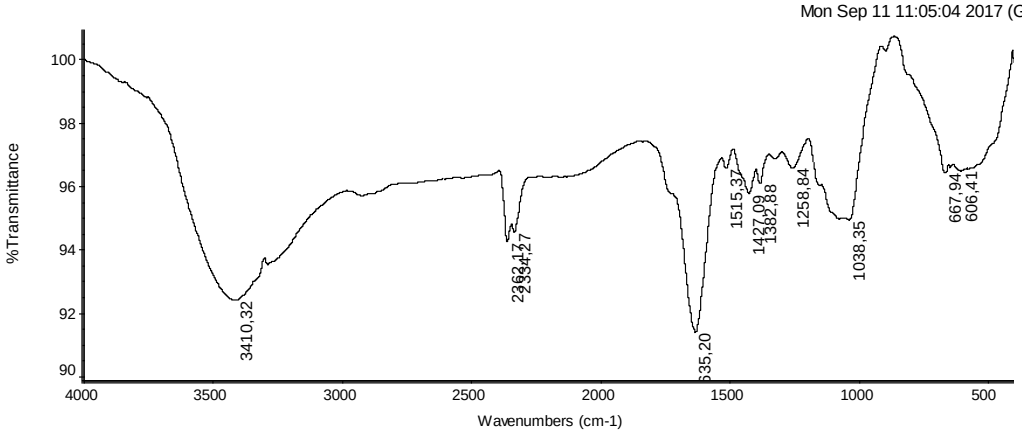
760-510				C – Cl	Alkyl Chlorides
		606,41	-		
720-600		-		Ar – OH	Phenols
710-570				C - S	Sulfides
700-590				O – C = O	Carboxylic acids
680-580				C≡C – H	Alkynes
650-600	618,77			S – C = N	Thiocyanates
650-600				NO_2	Aliphatic nitro compounds
650-500				Ar – CF_3	Aromatic trifluoro-methyl compounds
645-615				napthalenes	-
645-575		606,41		O – C - O	Esters
635-605				Pyridines	-
630-570				N – C = O	Amides
630-565				C – CO – C	Ketones
615-535	-			C = O	Amides
610-565				SO_2	Sulfonys chlorides
610-545				SO_2	Sulfones
600-465		-	473,15	C - I	Iodio compounds
580-430				Ring in cycloalkanes	-
580-420				Ring in benzene derivatives	-
565-440				C_nH_{2n+1} in alkyl groups	
530-470				NO_2	Nitro compounds
520-430				C – O – C	Ethers
510-400				C – N – C	Amines
490-465				napthalenes	-



Collection time: Mon Sep 11 08:01:40 2017 (GMT+0

Mon Sep 11 11:04:34 2017 (GMT+07:00)
FIND PEAKS:
Spectrum: **1195-1 Raw Kulit Salak
Region: 4000,00 400,00
Absolute threshold: 102,273
Sensitivity: 60
Peak list:

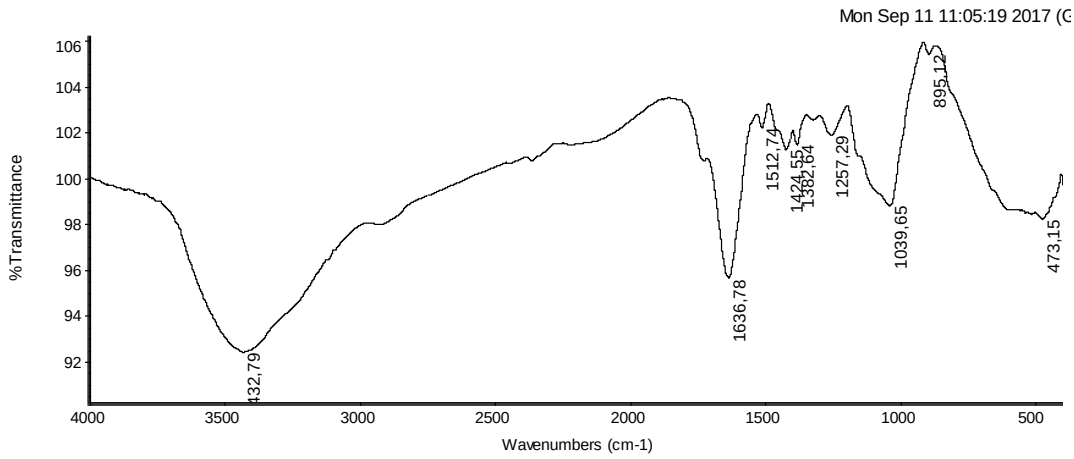
Position:	1642,58	Intensity:	90,499
Position:	1058,94	Intensity:	92,915
Position:	1104,37	Intensity:	93,341
Position:	3337,98	Intensity:	93,934
Position:	2921,80	Intensity:	94,857
Position:	1423,96	Intensity:	94,957
Position:	1380,58	Intensity:	94,968
Position:	2362,79	Intensity:	95,148
Position:	1252,35	Intensity:	95,700
Position:	1327,35	Intensity:	95,818
Position:	618,77	Intensity:	95,941



Collection time: Mon Sep 11 08:08:54 2017 (GMT+0

Mon Sep 11 11:05:02 2017 (GMT+07:00)
FIND PEAKS:
Spectrum: **1195-2 Ekapsulasi Sebelum Ads
Region: 4000,00 400,00
Absolute threshold: 100,977
Sensitivity: 60
Peak list:

Position:	1635,20	Intensity:	91,345
Position:	3410,32	Intensity:	92,371
Position:	2362,17	Intensity:	94,197
Position:	2334,27	Intensity:	94,491
Position:	1038,35	Intensity:	94,891
Position:	1427,09	Intensity:	95,720
Position:	1382,88	Intensity:	96,048
Position:	667,94	Intensity:	96,388
Position:	606,41	Intensity:	96,440
Position:	1515,37	Intensity:	96,532
Position:	1258,84	Intensity:	96,538



Collection time: Mon Sep 11 08:16:10 2017 (GMT+0

Mon Sep 11 11:05:18 2017 (GMT+07:00)
FIND PEAKS:
Spectrum: **1195-3 Enkapsulasi Setelah Ads
Region: 4000,00 400,00
Absolute threshold: 106,301
Sensitivity: 60
Peak list:

Position:	3432,79	Intensity:	92,352
Position:	1636,78	Intensity:	95,583
Position:	473,15	Intensity:	98,169
Position:	1039,65	Intensity:	98,740
Position:	1424,55	Intensity:	101,203
Position:	1382,64	Intensity:	101,425
Position:	1257,29	Intensity:	101,844
Position:	1512,74	Intensity:	102,174
Position:	895,12	Intensity:	105,340