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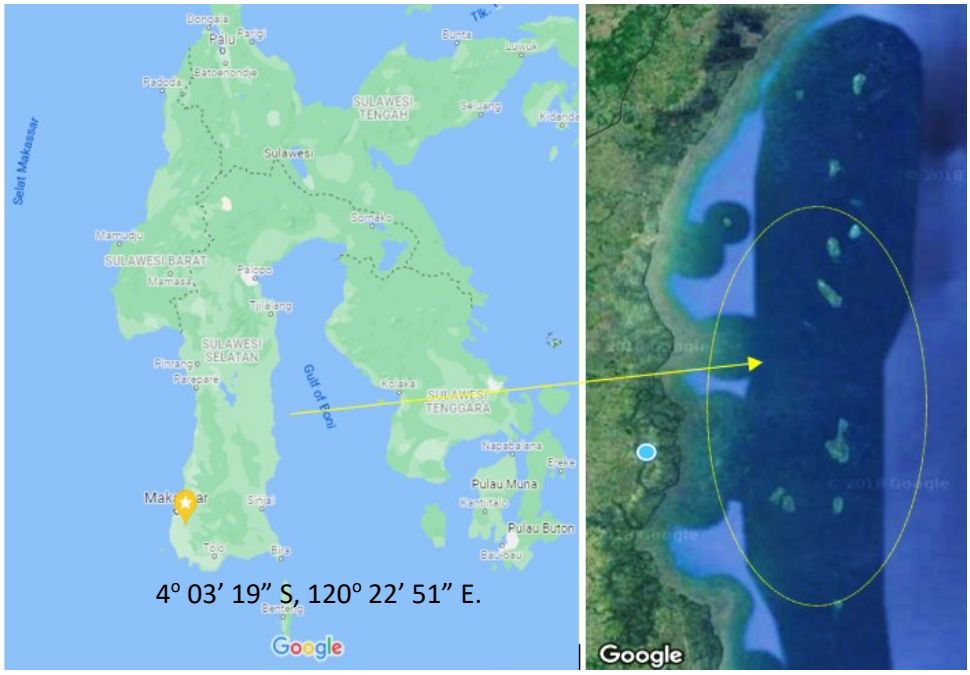
Lampiran 1. Peta Lokasi dan sampel penelitian



Lokasi sampel

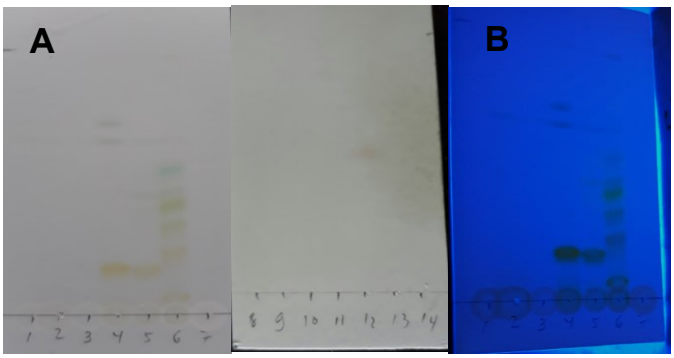
Halimeda cilindracea Decaisne

Caulerpa racemosa (Forskal) J. Agardh.

Lampiran 2. 14 spesies makroalga yang ditemukan di Teluk Bone

14 sampel spesis makroalga

Mserasi sampel dengan methanol



Profil spot pada TLC 14 ekstrak methanol makroalga; **(A)** sinar tampak, **(B)** pada sinar UV 354 nm.

Spot 4 kromatogram ekstrak metanol (*C. racemose* (Forsskal) J.Agardh
spot 6 kromatogram ekstrak metanol (*H. cilindracea* Decaisne).

Lampiran 3. Hasil Identifikasi spesimen sampel makroalga

LEMBAGA ILMU PENGETAHUAN INDONESIA
(INDONESIAN INSTITUTE OF SCIENCES)
PUSAT PENELITIAN OSEANOGRAFI LIPI
(RESEARCH CENTRE FOR OCEANOGRAPHY)
Jl. Pasir Putih I, Ancol Timur, P.O. Box 4801/JKTF Jakarta 11048
Telp. (021) 64713850 Fax. No. 64711948
Homepage : http://www.oseanografi.lipi.go.id E-mail : p2o@oseanografi.lipi.go.id

SURAT KETERANGAN
Nomor : B-7435/IPK.2/IF.07/XI/2019

Yang bertanda tangan di bawah ini :

Nama	: Irfan Kampono, S.T., M.M.Tr.
NIP	: 197507081998031003
Jabatan	: Plh. Kepala Pusat Penelitian Oseanografi LIPI
Alamat	: Jl. Pasir Putih I, Ancol Timur, Jakarta Utara

Dengan ini menerangkan bahwa :

Nama	: Iwan Dini
NIM	: H013171003
Program Studi	: Kimia FMIPA
Fakultas	: Matematika dan Ilmu Pengetahuan Alam
Universitas	: Universitas Hasanuddin

Telah selesai melakukan kegiatan identifikasi sampel **Makroalga** dibantu oleh staf Peneliti kami Sdri. Tri Handayani, M.Si. di Pusat Penelitian Oseanografi LIPI, dengan hasil sebagai berikut :

Halimeda cilindracea Decaisne dan Caulerpa racemosa (Forsskål) J.Agardh

1. Filum/Divisio : Chlorophyta
   Kelas/Class : Ulvophyceae
   Bangsa/Ordo : Bryopsidales
   Suku/Famili : Halimedaceae
   Marga/Genus : *Halimeda*
   Jenis/Species : *Halimeda cilindracea* Decaisne

2. Filum/Divisio : Chlorophyta
   Kelas/Class : Ulvophyceae
   Bangsa/Ordo : Bryopsidales
   Suku/Famili : Caulerpaceae
   Marga/Genus : *Caulerpa*
   Jenis/Species : *Caulerpa racemosa* (Forsskål) J.Agardh

Demikian surat keterangan ini kami buat untuk dapat dipergunakan sebagaimana mestinya, atas perhatian dan kerjasama Saudara kami ucapkan terima kasih.

Jakarta, 06 November 2019

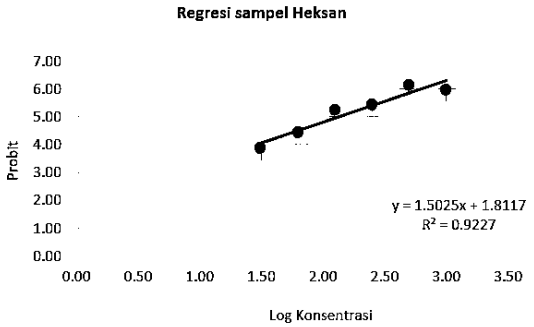
Plh. Kepala
Pusat Penelitian Oseanografi LIPI

Irfan Kampono, S.T., M.M.Tr.

Lampiran 4A. Hasil Uji sitotoksik BSLT Ekstrak dan Isolat dari *H. cilindracea* Decaisne dan *C. racemose* (Forskal) J. Agardh.

Data uji BSLT Ekstrak heksan *H. cylindraceae* Decaisne

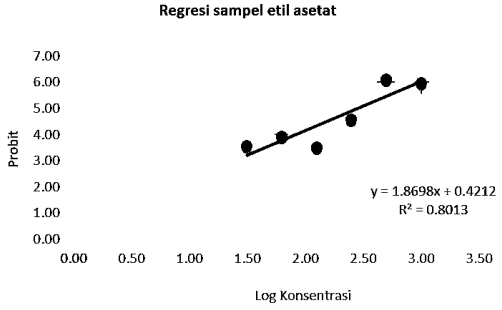
Konsentrasi ekstrak (µg/mL)	Log konsentrasi	% rata2 kematian benur		% kematian	Nilai probit	LC_{50} (µg/mL)
		Sample	control			
31.25	1.49	16.67	4.00	12.67	3.87	
62.50	1.80	33.33	4.17	29.17	4.45	
125.00	2.10	73.91	13.64	60.28	5.25	**134.90**
250.00	2.40	84.00	17.39	66.61	5.44	
500.00	2.70	100.00	13.04	86.96	6.13	
1000.00	3.00	100.00	16.00	84.00	5.99	



5= 1,50x + 1,81
x= 2,13
LC50 = inv log 2,13
LC_{50}= **134.90**

Data uji BSLT Ekstrak etil asetat *H. cylindraceae* Decaisne

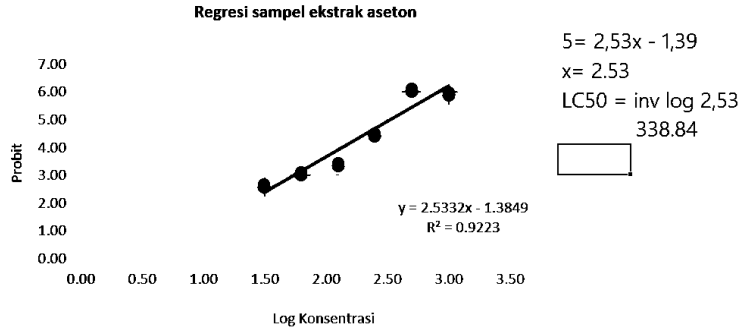
Konsentrasi ekstrak (µg/mL)	Log konsentrasi	% rata2 kematian benur		% kematian	Nilai probit	LC_{50} (µg/mL)
		Sample	control			
31.25	1.49	12.00	4.00	8.00	3.59	
62.50	1.80	18.52	4.17	14.35	3.92	
125.00	2.10	20.83	13.64	7.20	3.52	
250.00	2.40	51.85	17.39	34.46	4.59	**281.84**
500.00	2.70	100.00	13.04	86.96	6.13	
1000.00	3.00	100.00	16.00	84.00	5.99	



5= 1,87x + 0,42
x= 2.45
LC50 = inv log 2.45
281.84

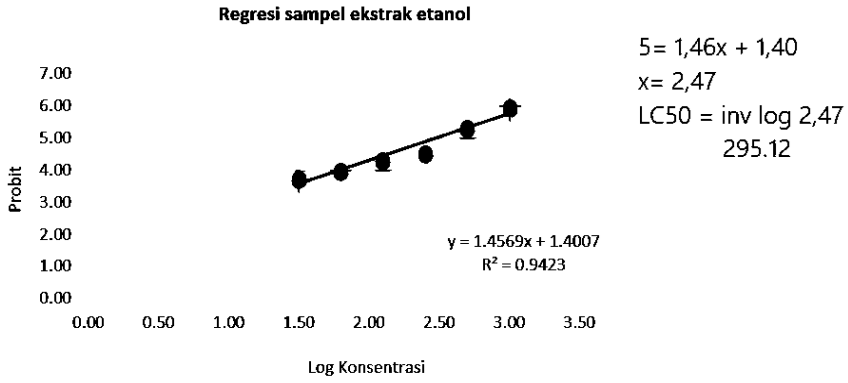
Data uji BSLT Ekstrak aseton *H. cylindraceae* Decaisne

Konsentrasi ekstrak (µg/mL)	Log konsentrasi	% rata2 kematian benur		% kematian	Nilai probit	LC_{50} (µg/mL)
		Sample	control			
31.25	1.49	5.00	4.00	1.00	2.67	
62.50	1.80	7.41	4.17	3.24	3.12	
125.00	2.10	20.00	13.64	6.36	3.44	**338.84**
250.00	2.40	48.15	17.39	30.76	4.50	
500.00	2.70	100.00	13.04	86.96	6.13	
1000.00	3.00	100.00	16.00	84.00	5.99	



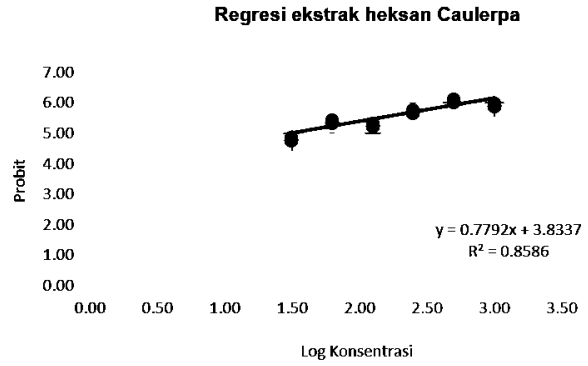
Data uji BSLT Ekstrak etanol *H. cylindraceae* Decaisne

Konsentrasi ekstrak (µg/mL)	Log konsentrasi	% rata2 kematian benur		% kematian	Nilai probit	LC_{50} (µg/mL)
		Sample	control			
31.25	1.49	15.00	4.00	11.00	3.77	
62.50	1.80	20.00	4.17	15.83	4.01	
125.00	2.10	40.00	13.64	26.36	4.36	**295.12**
250.00	2.40	50.00	17.39	32.61	4.56	
500.00	2.70	76.92	13.04	63.88	5.36	
1000.00	3.00	100.00	16.00	84.00	5.99	



Data uji BSLT Ekstrak heksan *C. racemosa* (Forskal) J. Agardh.

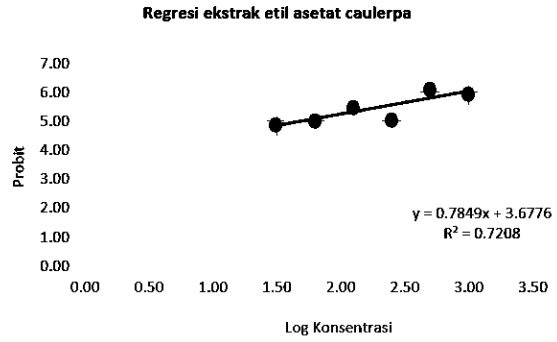
Konsentrasi ekstrak (µg/mL)	Log konsentrasi	% rata2 kematian benur		% kematian	Nilai probit	LC_{50} (µg/mL)
		Sample	control			
31.25	1.49	47.62	4.00	43.62	4.85	**31.62**
62.50	1.80	71.43	4.17	67.26	5.44	
125.00	2.10	76.92	13.64	63.29	5.33	
250.00	2.40	95.45	17.39	78.06	5.77	
500.00	2.70	100.00	13.04	86.96	6.13	
1000.00	3.00	100.00	16.00	84.00	5.99	



5= 0,78x + 3,83
x= 1,50
LC50 = inv log 1,50
31.62

Data uji BSLT Ekstrak etil asetat *C. racemosa* (Forskal) J. Agardh.

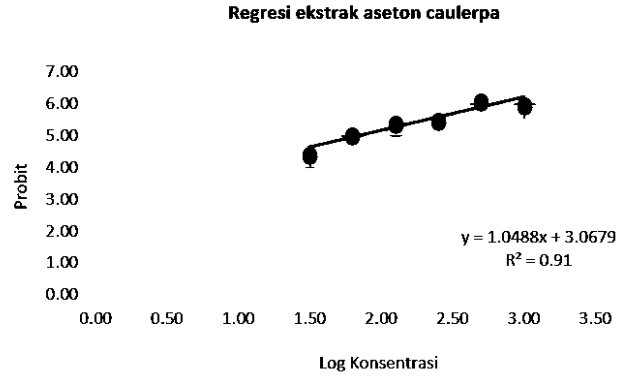
Konsentrasi ekstrak (µg/mL)	Log konsentrasi	% rata2 kematian benur		% kematian	Nilai probit	LC_{50} (µg/mL)
		Sample	control			
31.25	1.49	50.00	4.00	46.00	4.90	**46.77**
62.50	1.80	56.52	4.17	52.36	5.05	
125.00	2.10	82.61	13.64	68.97	5.50	
250.00	2.40	70.83	17.39	53.44	5.08	
500.00	2.70	100.00	13.04	86.96	6.13	
1000.00	3.00	100.00	16.00	84.00	5.99	



5= 0,79x + 3,68
x= 1,67
LC50 = inv log 1,67
46.77

Data uji BSLT Ekstrak aseton *C. racemosa* (Forskal) J. Agardh.

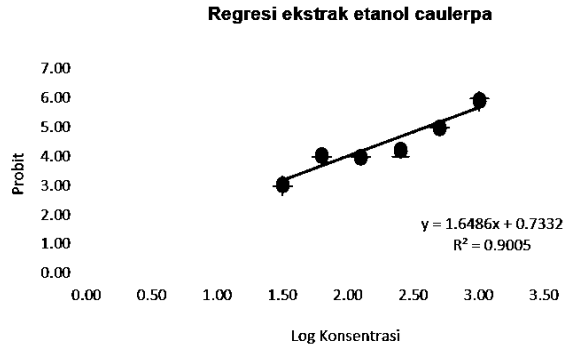
Konsentrasi ekstrak (µg/mL)	Log konsentrasi	% rata2 kematian benur		% kematian	Nilai probit	LC_{50} (µg/mL)
		Sample	control			
31.25	1.49	33.33	4.00	29.33	4.45	**69,18**
62.50	1.80	56.52	4.17	52.36	5.05	
125.00	2.10	80.00	13.64	66.36	5.41	
250.00	2.40	87.50	17.39	70.11	5.52	
500.00	2.70	100.00	13.04	86.96	6.13	
1000.00	3.00	100.00	16.00	84.00	5.99	



5= 1,05x + 3,07
x= 1,84
LC50 = inv log 1,84
69.18

Data uji BSLT Ekstrak aseton *C. racemosa* (Forskal) J. Agardh.

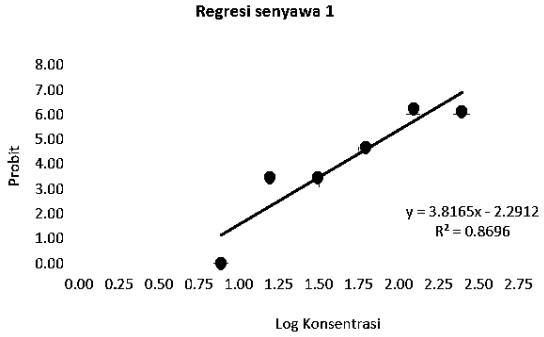
Konsentrasi ekstrak (µg/mL)	Log konsentrasi	% rata2 kematian benur		% kematian	Nilai probit	LC_{50} (µg/mL)
		Sample	control			
31.25	1.49	7.41	4.00	3.41	3.12	**389,05**
62.50	1.80	22.73	4.17	18.56	4.12	
125.00	2.10	31.82	13.64	18.18	4.06	
250.00	2.40	41.67	17.39	24.28	4.29	
500.00	2.70	65.38	13.04	52.34	5.05	
1000.00	3.00	100.00	16.00	84.00	5.99	



5= 1,65x + 0,73
x= 2,59
LC50 = inv log 2,59
389.05

Data uji BSLT senyawa **1**(bisindolalakloid)

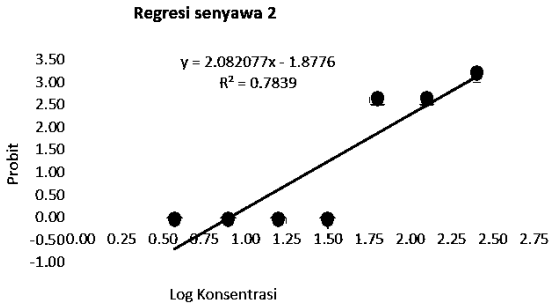
Konsentrasi ekstrak (µg/mL)	Log konsentrasi	% rata2 kematian benur		% kematian	Nilai probit	LC_{50} (µg/mL)
		Sample	control			
3.69	0.57	0.00	0.33	0	0.00	
7.81	0.89	5.56	5.88	0	0.00	
15.63	1.19	5.56	0.00	6	3.45	
31.25	1.49	6.25	0.00	6	3.45	**81.28**
62.50	1.80	47.06	10.53	37	4.67	
125.00	2.10	100.00	11.11	89	6.23	
250.00	2.40	100.00	13.33	87	6.13	



Subtitut Y = 5
5= 3,8165x - 2,2912
X = 1,91
LC50 = inv log 1,91
81.28

Data uji BSLT senyawa **2** (β-sitosterol)

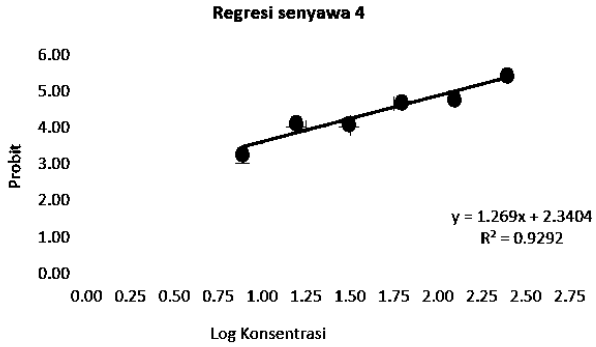
Konsentrasi ekstrak (µg/mL)	Log konsentrasi	% rata2 kematian benur		% kematian	Nilai probit	LC_{50} (µg/mL)
		Sample	control			
3.69	0.57	0.00	0.33	-0.33	0.00	
7.81	0.89	0.00	5.88	-5.88	0.00	
15.63	1.19	0.00	0.00	0.00	0.00	
31.25	1.49	0.00	0.00	0.00	0.00	**2010,20**
62.50	1.80	12.00	10.53	1.47	2.67	
125.00	2.10	12.00	11.11	0.89	2.67	
250.00	2.40	17.00	13.33	3.67	3.25	



5= 2.082077x - 1.8776
X = 3.3032
LC50 = inv log 3,3032
2010.20

Data uji BSLT senyawa **4** (Halimedatrial)

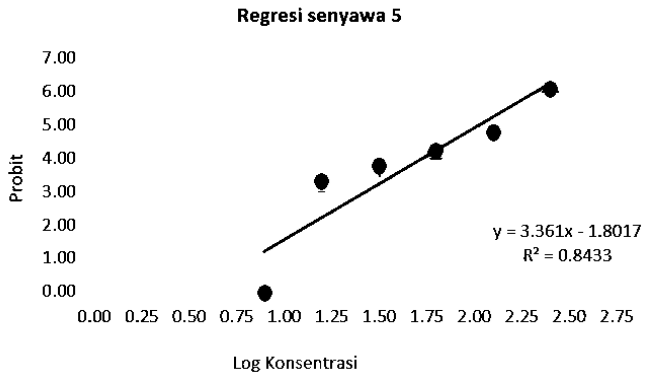
Konsentrasi ekstrak (µg/mL)	Log konsentrasi	% rata2 kematian benur		% kematian	Nilai probit	LC_{50} (µg/mL)
		Sample	control			
3.69	0.57	0.00	0.33	0.33	0.00	
7.81	0.89	10.53	5.88	4.64	3.30	
15.63	1.19	20.00	0.00	20.00	4.16	
31.25	1.49	18.75	0.00	18.75	4.12	**124,45**
62.50	1.80	50.00	10.53	39.47	4.72	
125.00	2.10	52.94	11.11	41.83	4.80	
250.00	2.40	80.95	13.33	67.62	5.47	



5= 1,269x + 2,3404
X = 2,09
LC50 = inv log 2,09
124.45

Data uji BSLT senyawa **5** (asam kaulerpenoat)

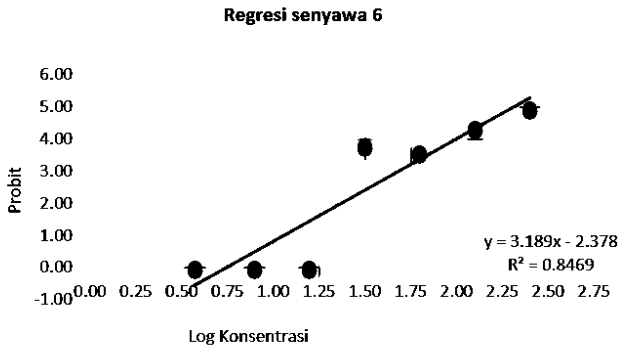
Konsentrasi ekstrak (µg/mL)	Log konsentrasi	% rata2 kematian benur		% kematian	Nilai probit	LC_{50} (µg/mL)
		Sample	control			
3.69	0.57	0.00	0.33	0.00	0.00	
7.81	0.89	5.88	5.88	0.00	0.00	
15.63	1.19	5.26	0.00	5.26	3.36	
31.25	1.49	11.76	0.00	11.76	3.82	**104,71**
62.50	1.80	33.33	10.53	22.81	4.26	
125.00	2.10	52.94	11.11	41.83	4.80	
250.00	2.40	100.00	13.33	86.67	6.13	



5= 3,361x - 1,8017
X = 2,02
LC50 = inv log 2,02
104.71

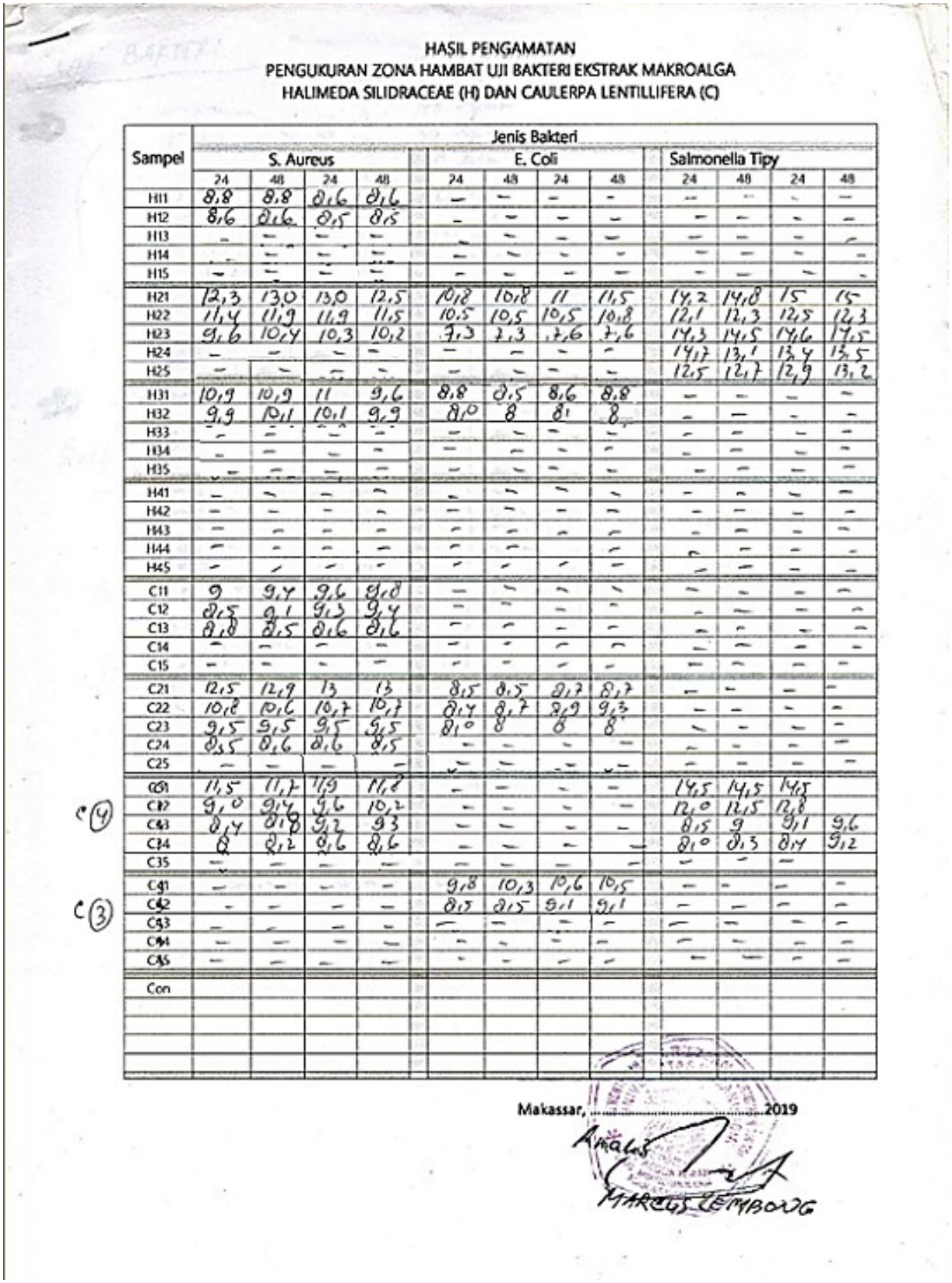
Data uji BSLT senyawa **6** (ester β-sitosterol)

Konsentrasi ekstrak (µg/mL)	Log konsentrasi	% rata2 kematian benur		% kematian	Nilai probit	LC_{50} (µg/mL)
		Sample	control			
3.69	0.57	0.00	0.33	0.00	0.00	
7.81	0.89	0.00	5.88	0.00	0.00	
15.63	1.19	0.00	0.00	0.00	0.00	
31.25	1.49	11.76	0.00	11.76	3.82	**205,85**
62.50	1.80	18.75	10.53	8.22	3.59	
125.00	2.10	36.84	11.11	25.73	4.36	
250.00	2.40	62.50	13.33	49.17	4.98	



5= 3,189x - 2.378
X = 2.3136
LC50 = inv log 2,3136
205.85

Lampiran 4B. Data Uji aktivitas anti bakteri ekstrak *H. cilindracea* Decaisne dan *C. racemose* (Forskal) J. Agardh.



HASIL PENGAMATAN
PENGUKURAN ZONA HAMBAT UJI BAKTERI EKSTRAK MAKROALGA
HALIMEDA SILIDRACEAE (H) DAN CAULERPA LENTILLIFERA (C)

Sampel	Jenis Bakteri											
	S. Aureus				E. Coli				Salmonella Tipy			
	24	48	24	48	24	48	24	48	24	48	24	48
H11	8,8	8,8	8,6	8,6	-	-	-	-	-	-	-	-
H12	8,6	8,6	8,5	8,5	-	-	-	-	-	-	-	-
H13	-	-	-	-	-	-	-	-	-	-	-	-
H14	-	-	-	-	-	-	-	-	-	-	-	-
H15	-	-	-	-	-	-	-	-	-	-	-	-
H21	12,3	13,0	13,0	12,5	10,8	10,8	11	11,5	14,2	14,8	15	15
H22	11,4	11,9	11,9	11,5	10,5	10,5	10,5	10,8	12,1	12,3	12,5	12,3
H23	9,6	10,4	10,3	10,2	7,3	7,3	7,6	7,6	14,3	14,5	14,6	14,5
H24	-	-	-	-	-	-	-	-	14,7	13,1	13,4	13,5
H25	-	-	-	-	-	-	-	-	12,5	12,7	12,9	13,2
H31	10,9	10,9	11	9,6	8,8	8,5	8,6	8,8	-	-	-	-
H32	9,9	10,1	10,1	9,9	8,0	8	8	8	-	-	-	-
H33	-	-	-	-	-	-	-	-	-	-	-	-
H34	-	-	-	-	-	-	-	-	-	-	-	-
H35	-	-	-	-	-	-	-	-	-	-	-	-
H41	-	-	-	-	-	-	-	-	-	-	-	-
H42	-	-	-	-	-	-	-	-	-	-	-	-
H43	-	-	-	-	-	-	-	-	-	-	-	-
H44	-	-	-	-	-	-	-	-	-	-	-	-
H45	-	-	-	-	-	-	-	-	-	-	-	-
C11	9	9,4	9,6	9,8	-	-	-	-	-	-	-	-
C12	8,5	9,1	9,3	9,4	-	-	-	-	-	-	-	-
C13	8,8	8,5	8,6	8,6	-	-	-	-	-	-	-	-
C14	-	-	-	-	-	-	-	-	-	-	-	-
C15	-	-	-	-	-	-	-	-	-	-	-	-
C21	12,5	12,9	13	13	8,5	8,5	8,7	8,7	-	-	-	-
C22	10,8	10,6	10,7	10,7	8,4	8,7	9,9	9,3	-	-	-	-
C23	9,5	9,5	9,5	9,5	8,0	8	8	8	-	-	-	-
C24	8,5	8,6	8,6	8,5	-	-	-	-	-	-	-	-
C25	-	-	-	-	-	-	-	-	-	-	-	-
C31	11,5	11,7	11,9	11,8	-	-	-	-	14,5	14,5	14,5	
C32	9,0	9,4	9,6	10,2	-	-	-	-	12,0	12,5	12,8	
C33	8,4	8,8	9,2	9,3	-	-	-	-	8,5	9	9,1	9,6
C34	8	8,2	8,6	8,6	-	-	-	-	8,0	8,3	8,4	9,2
C35	-	-	-	-	-	-	-	-	-	-	-	
C41	-	-	-	-	9,8	10,3	10,6	10,5	-	-	-	-
C42	-	-	-	-	8,3	8,5	9,1	9,1	-	-	-	-
C43	-	-	-	-	-	-	-	-	-	-	-	-
C44	-	-	-	-	-	-	-	-	-	-	-	-
C45	-	-	-	-	-	-	-	-	-	-	-	-
Con												

Makassar, ...2019

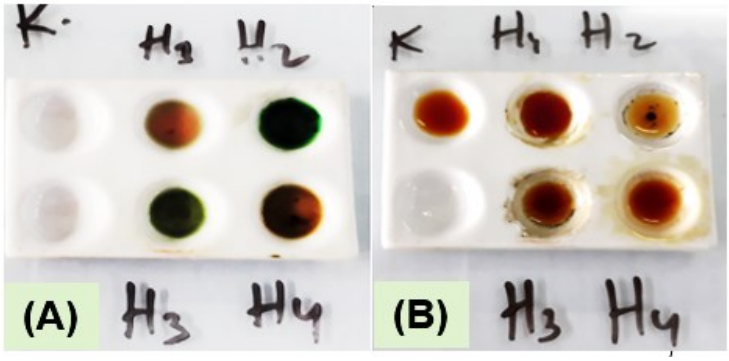
MARCUS LEMBONG

Lampiran 5. Data Hasil Uji Fitokimia

Tabel dan Gambar Hasil Uji Fitokimia Ekstrak *H. cilindracea* Decaisne

Ekstrak	Uji Gologan Senyawa		
	Alkaloid	steroid	terpenoid
n-heksan (H1)	+	+	+++
etilasetat (H2)	++	+++	+
Aseton (H3)	+	++	+
Etanol (H4)	-	-	++

Keterangan
+++; intensitas kuat
++; intensitas sedang
+; intensitas lemah
-; tidak terdeteksi

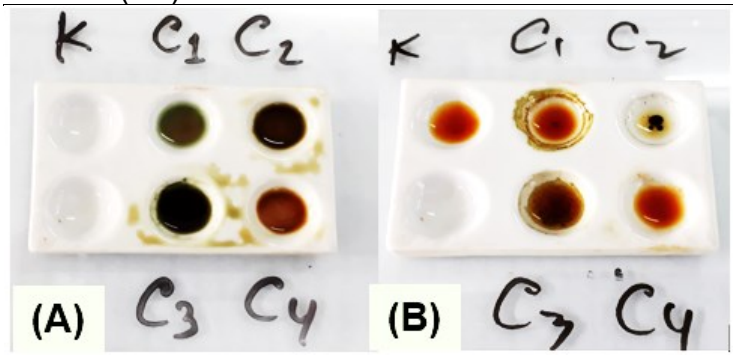


Dengan pereaksi LB (A) dan dengan pereaksi Wagner (B).

Tabel dan Gambar Hasil Uji Fitokimia Ekstrak *C. racemose* (Forsskal) J. Agardh

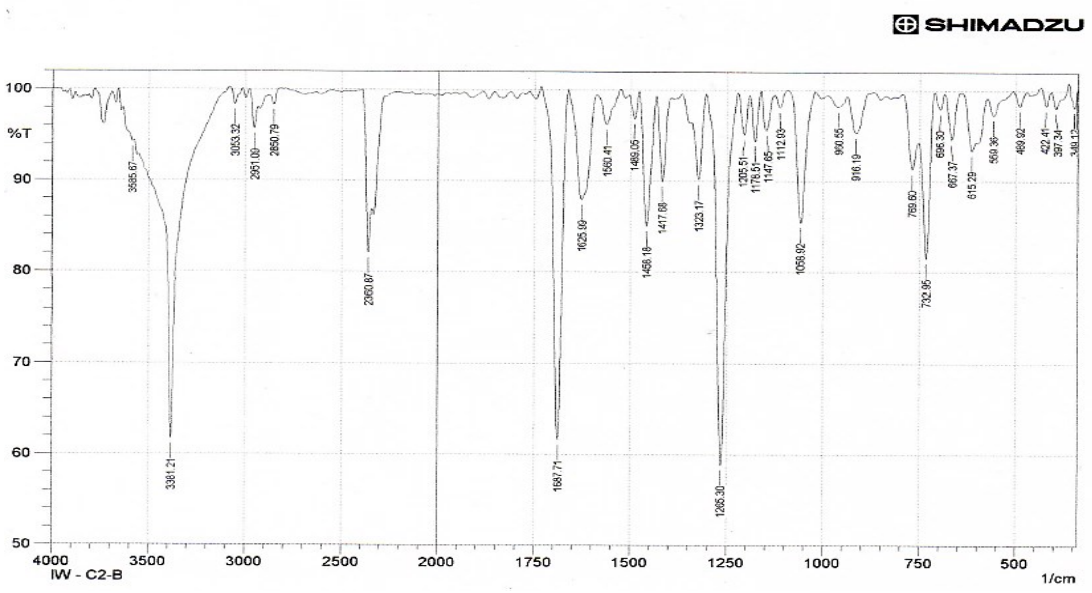
Ekstrak	Uji Gologan Senyawa		
	Alkaloid	steroid	terpenoid
n-heksan (C1)	+	+	+++
etilasetat (C2)	+++	++	+++
Aseton (C3)	++	+	-
Etanol (C4)	-	-	++

Keterangan
+++; intensitas kuat
++; intensitas sedang
+; intensitas lemah
-; tidak terdeteksi

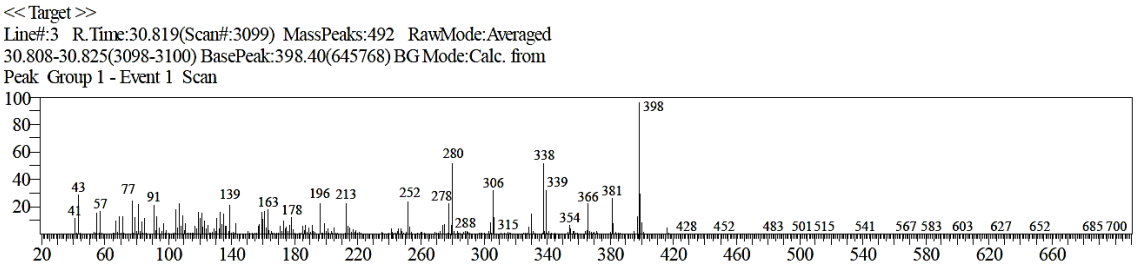


Dengan pereaksi LB (A) dan dengan pereaksi Wagner (B).

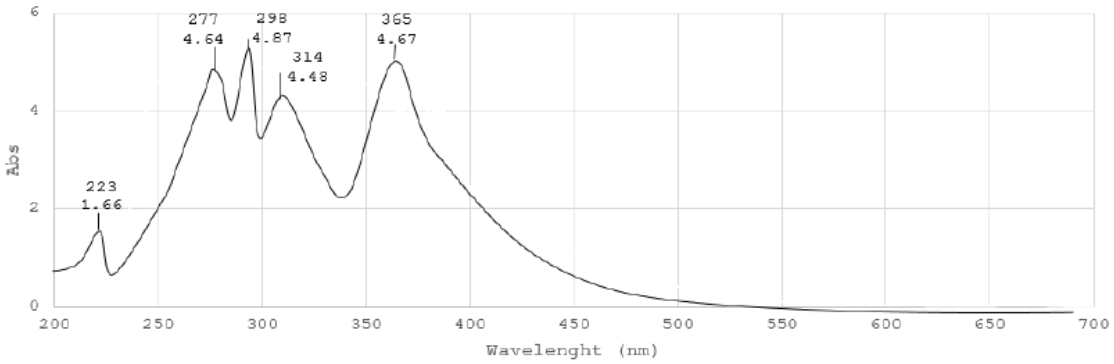
Lampiran 6. Spektrum FT-IR, MS dan UV-vis senyawa **(1)**



Spektrum FT-IR senyawa **1**

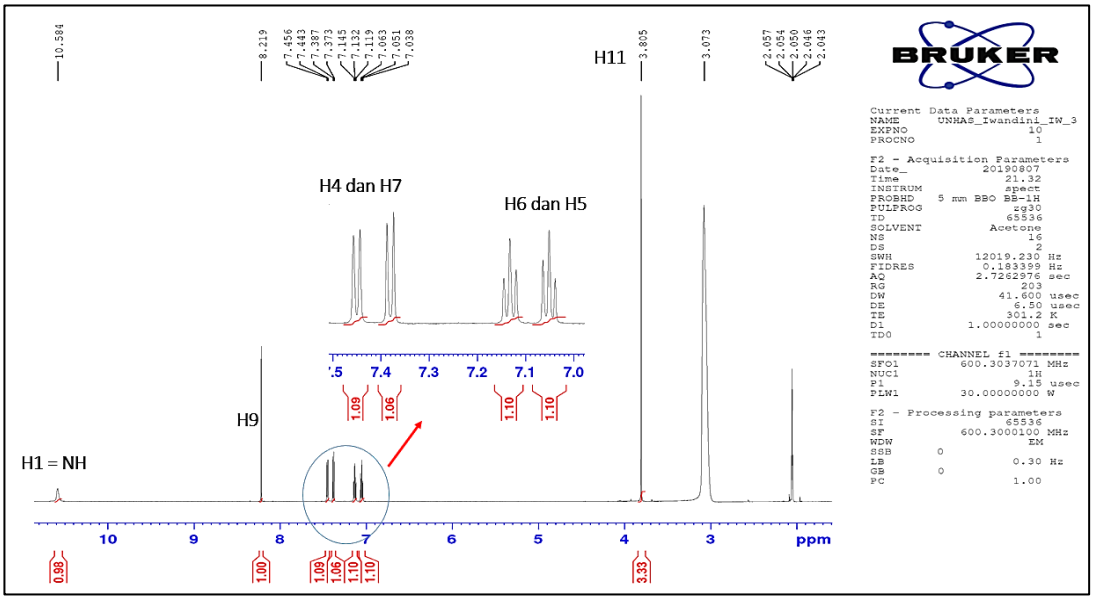


Spektrum MS senyawa **1**

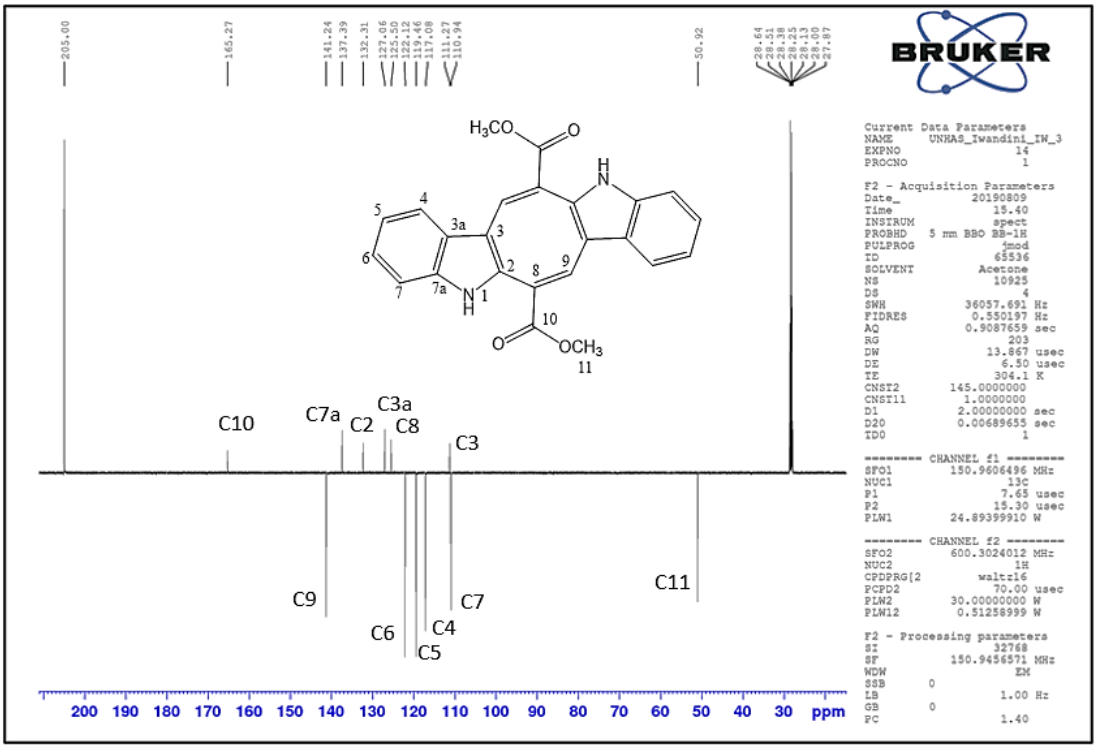


Spektrum UV-vis senyawa **1**

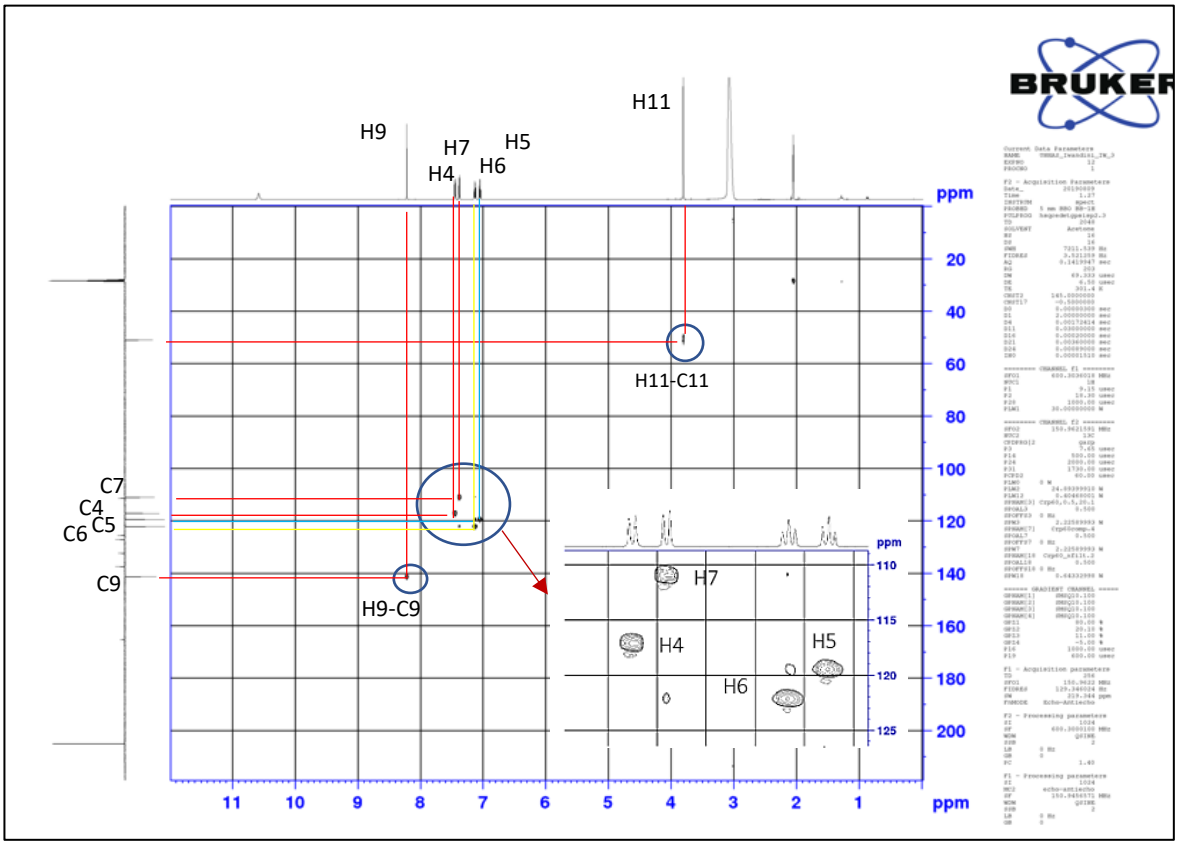
Lampiran 7. Spektrum NMR senyawa (**1**)



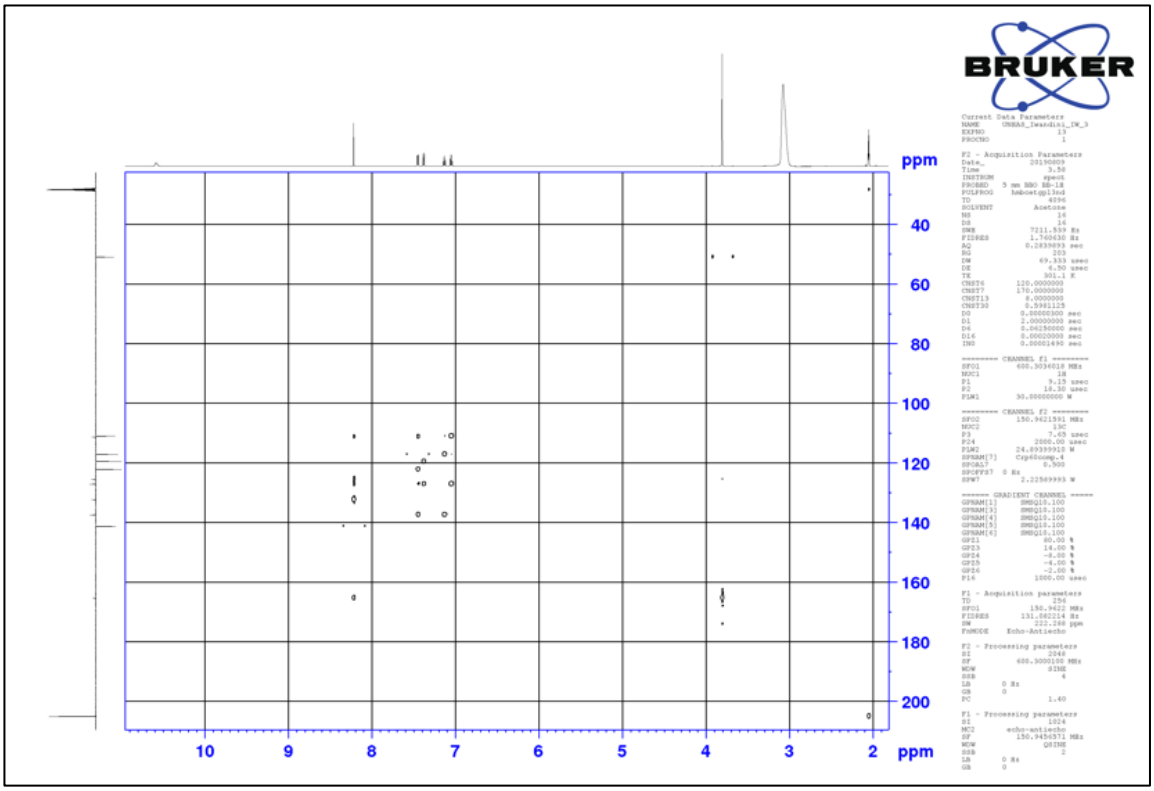
Spektrum ^{1}H NMR senyawa 1



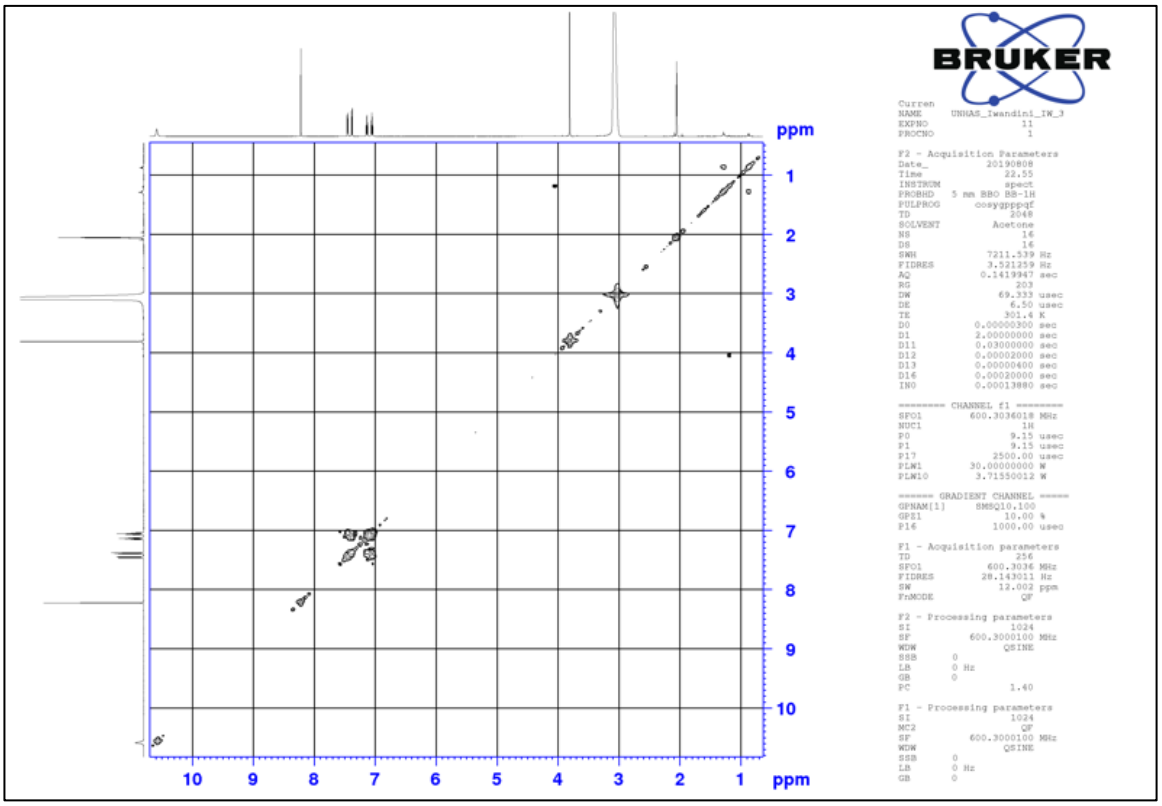
Spektrum APT ^{13}C NMR senyawa 1



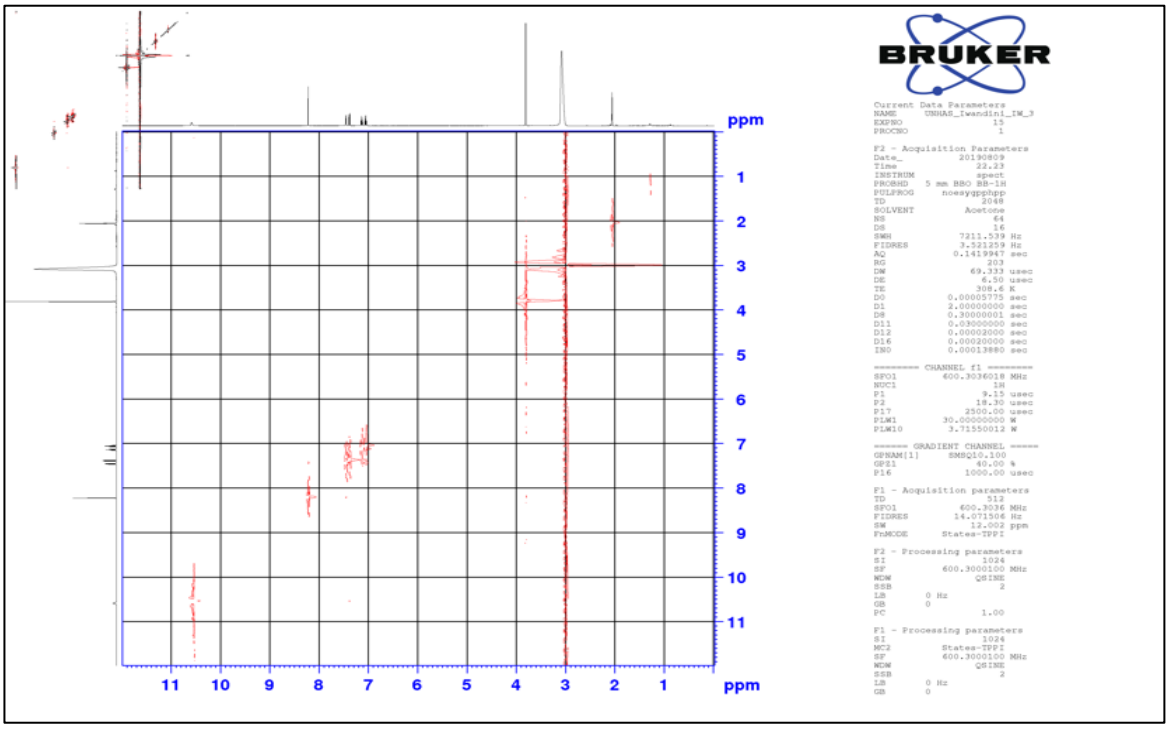
Spektrum HSQC senyawa 1



Spektrum HMBC senyawa 1

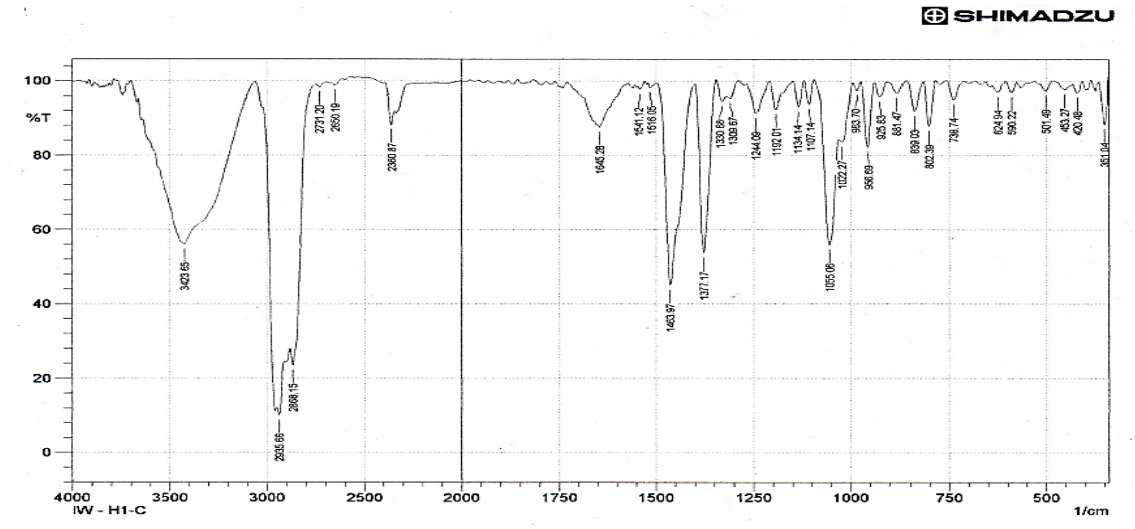


Spektrum COSY senyawa 1

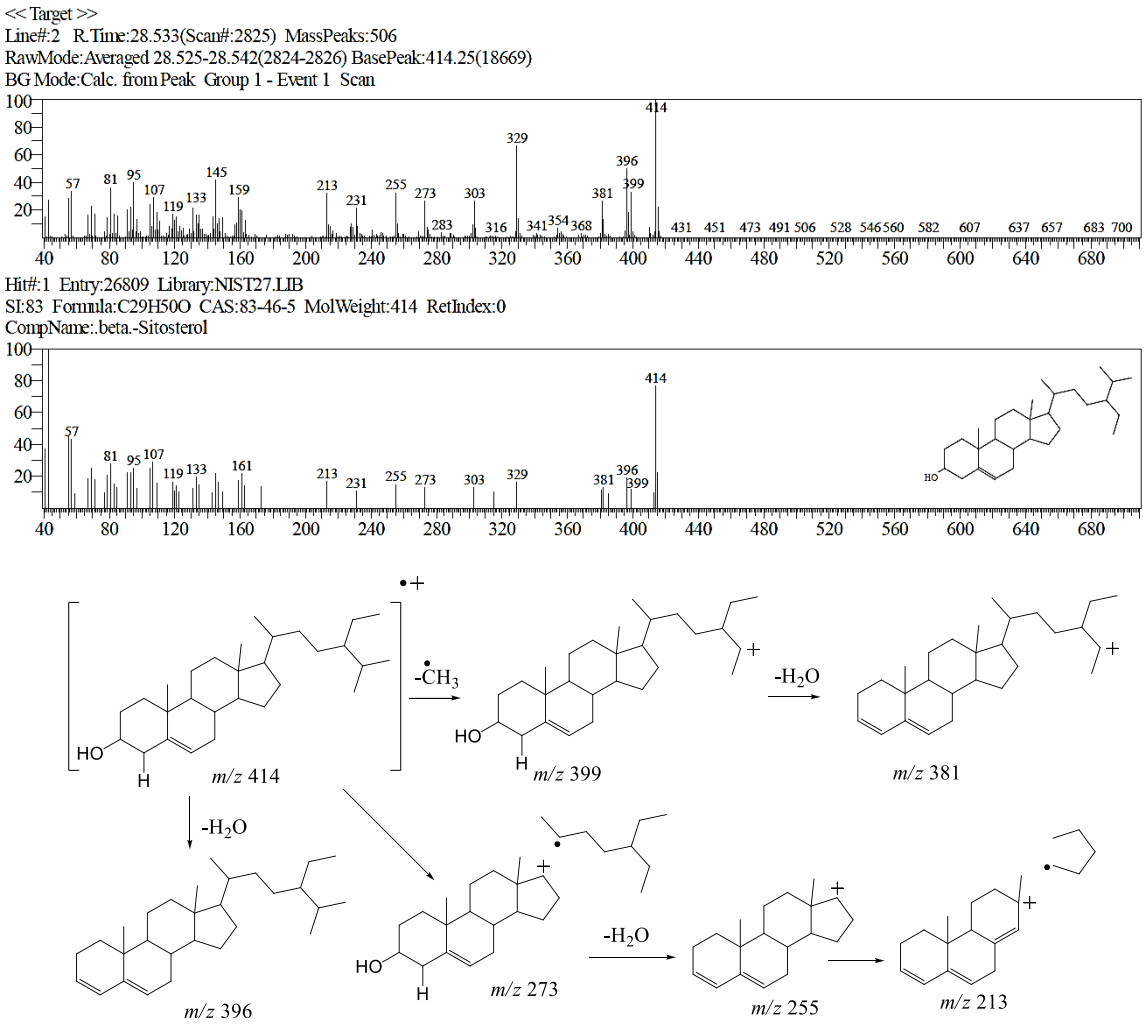


Spektrum NOESY senyawa 1

Lampiran 8. Spektrum FT-IR dan spektrum MS senyawa (**2**)

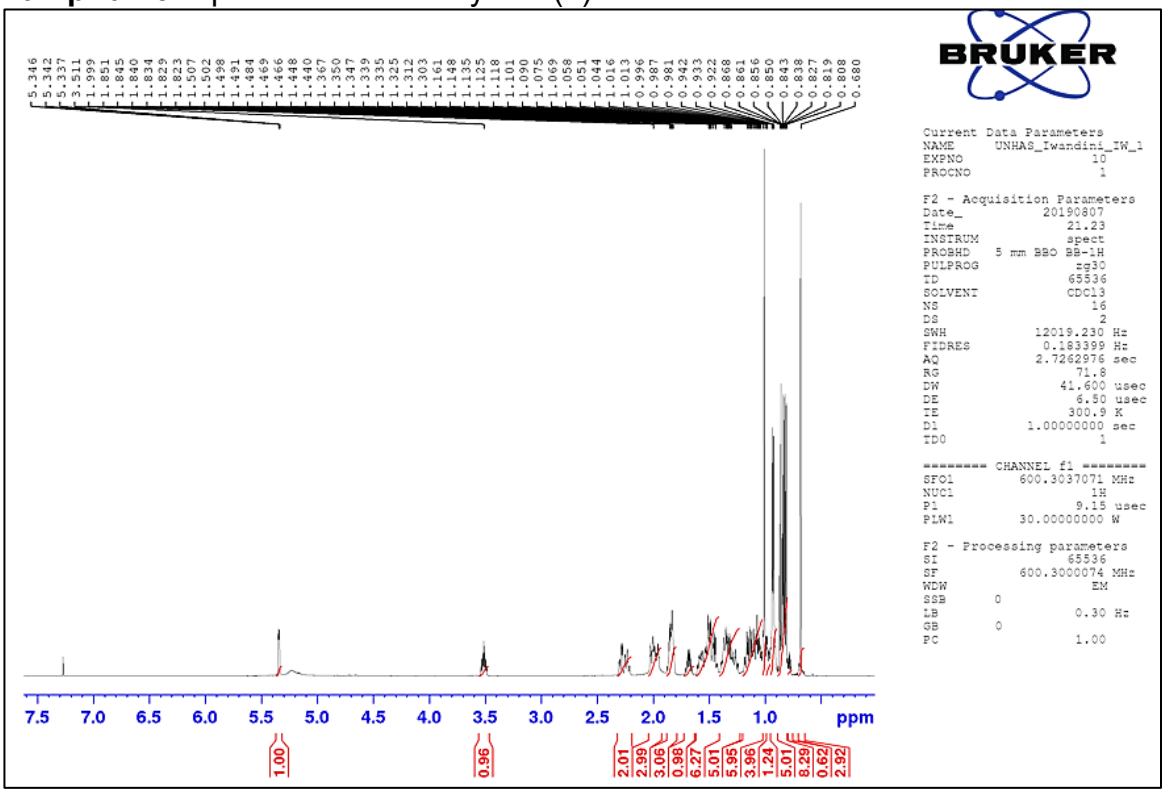


Spektrum FT-IR senyawa **2**

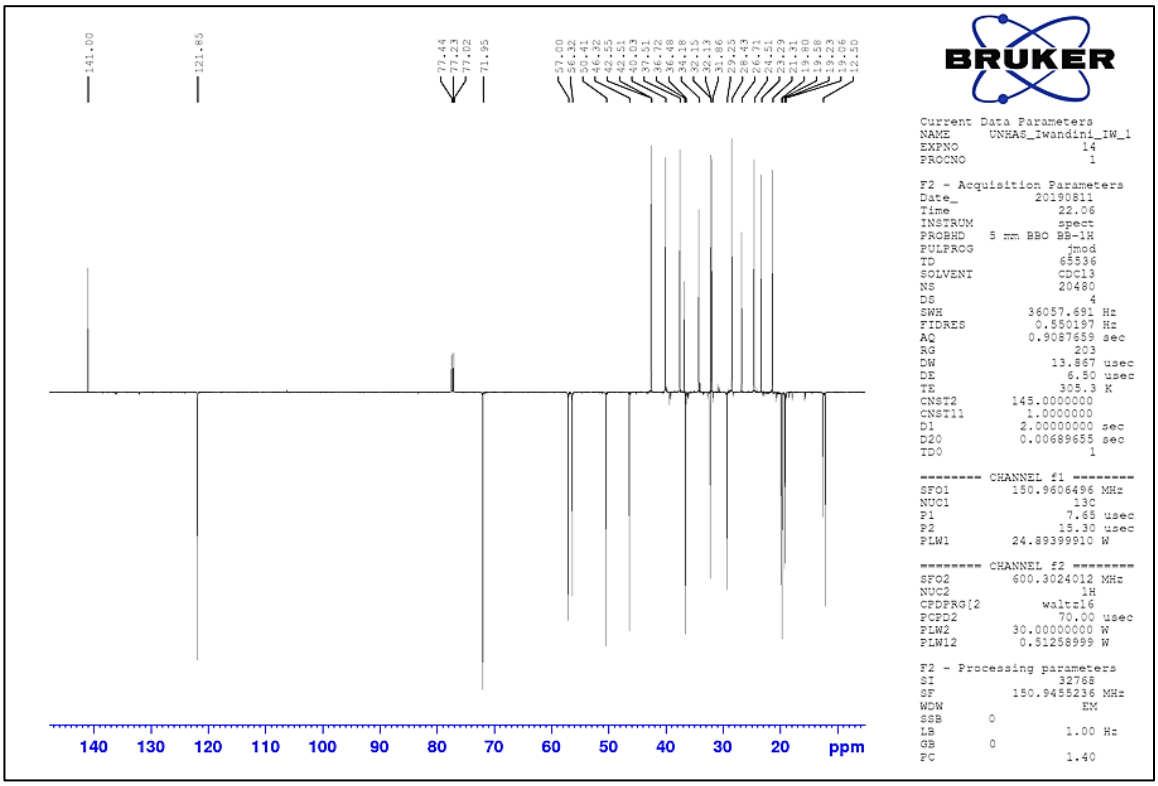


Spektrum MS dan perkiraan pola fragmentasi massa senyawa **2**

Lampiran 9. Spektrum NMR senyawa (**2**)

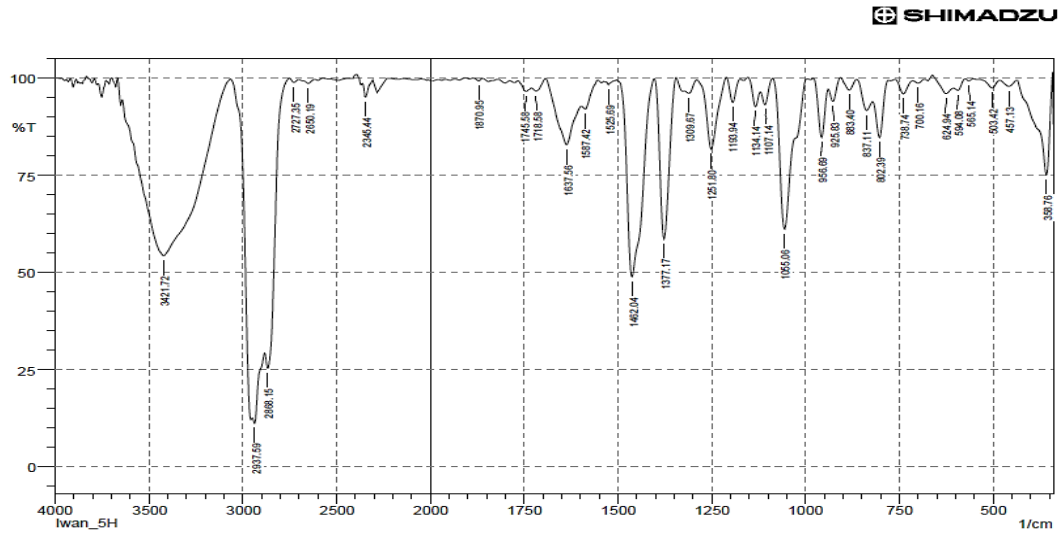


Spektrum ^{1}H NMR senyawa **2**

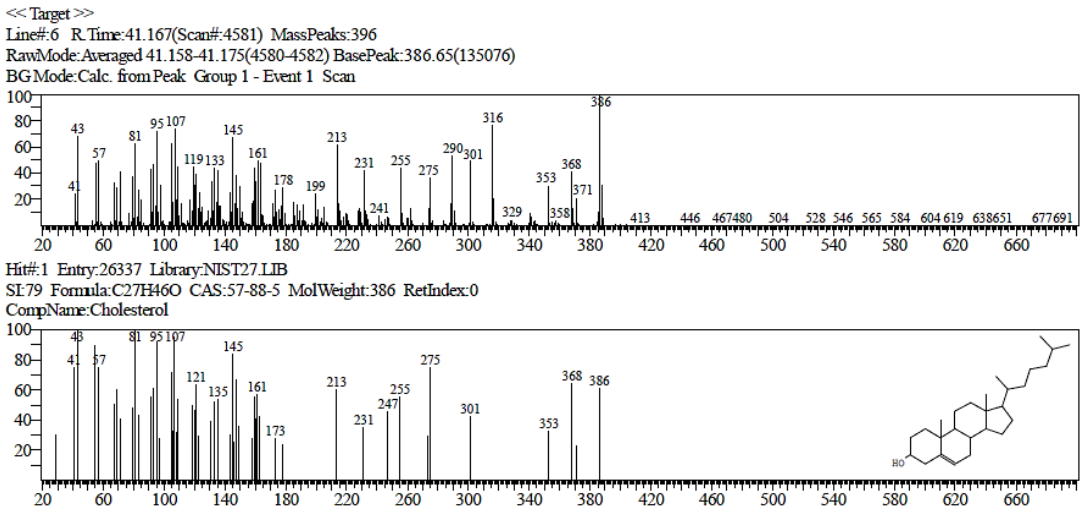


Spektrum APT ^{13}C NMR senyawa **2**

Lampiran 10. Spektrum FT-IR dan spektrum MS senyawa (**3**)

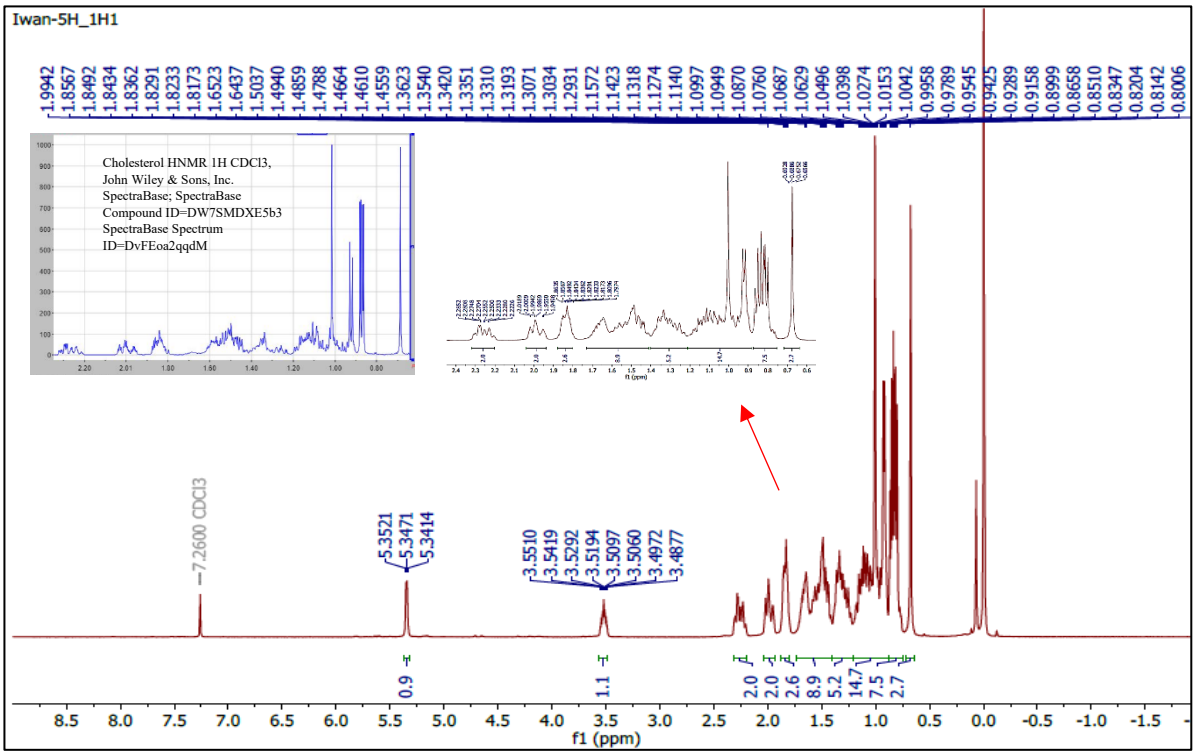


Spektrum FT-IR senyawa **3**

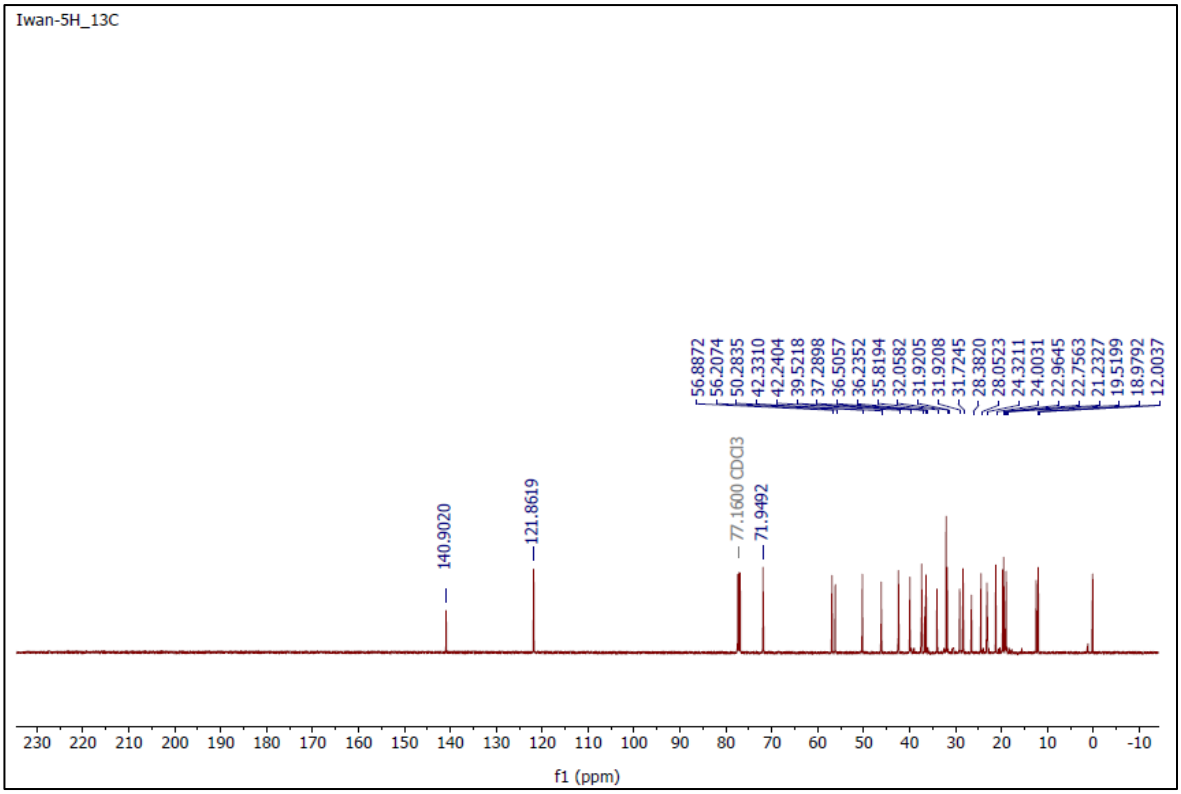


Spektrum MS senyawa **3**

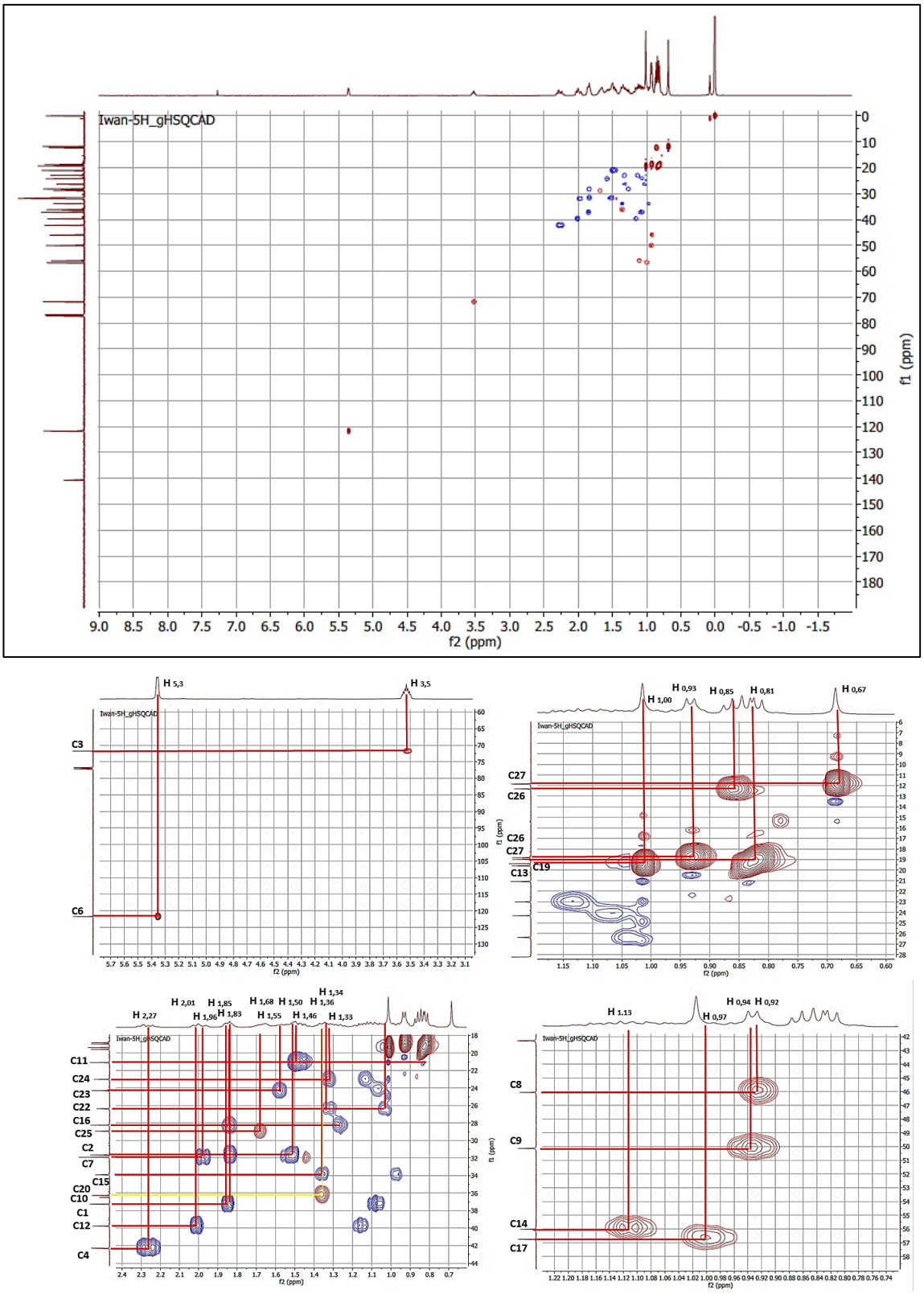
Lampiran 11. Spektrum NMR senyawa (**3**)



Spektrum ^{1}H-NMR senyawa **3**

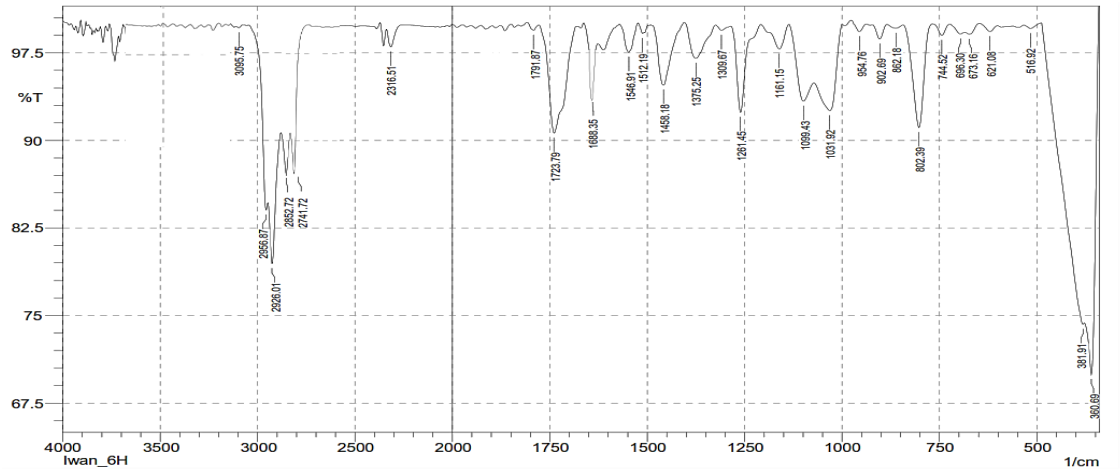


Spektrum ^{13}C-NMR senyawa **3**



Spektrum HSQC senyawa **3**

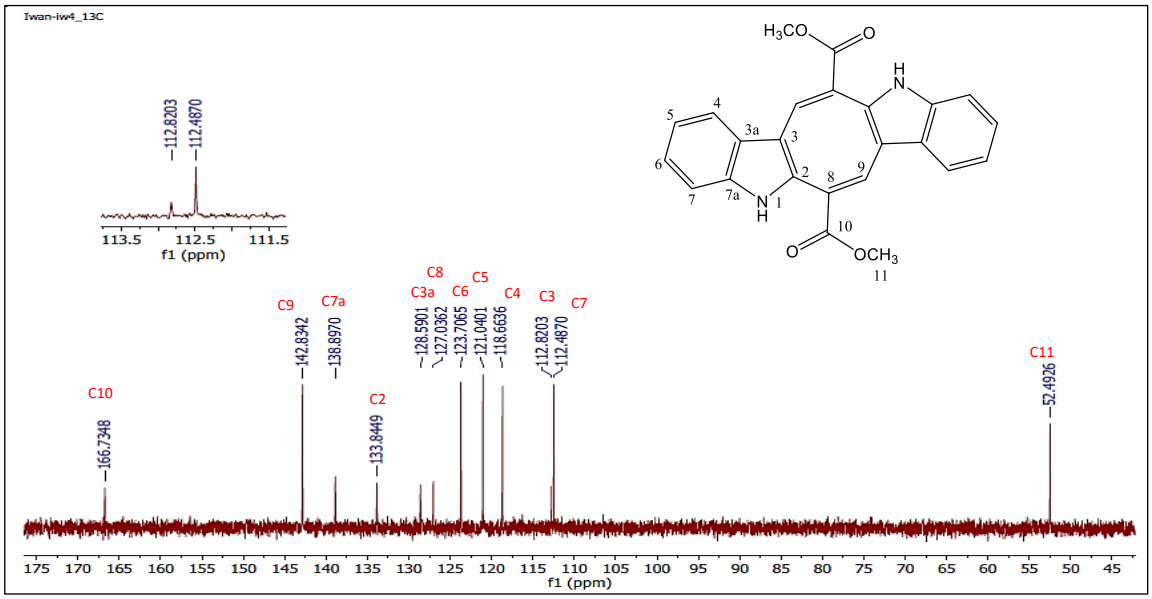
Lampiran 12. Spektrum FT-IR dan spektrum MS senyawa (**4**)



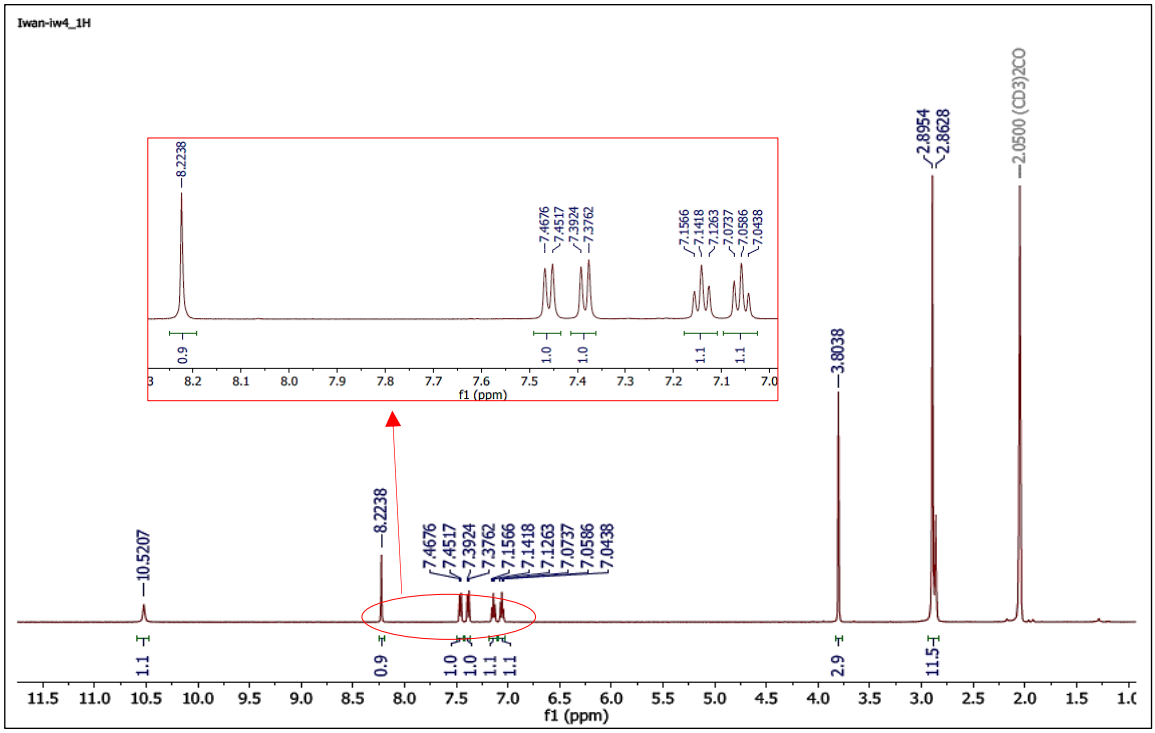
Spektrum FT-IR senyawa **4**

Lampiran 13. Spektrum NMR senyawa (**4**)

Lampiran 14. Spektrum NMR senyawa (**1**)

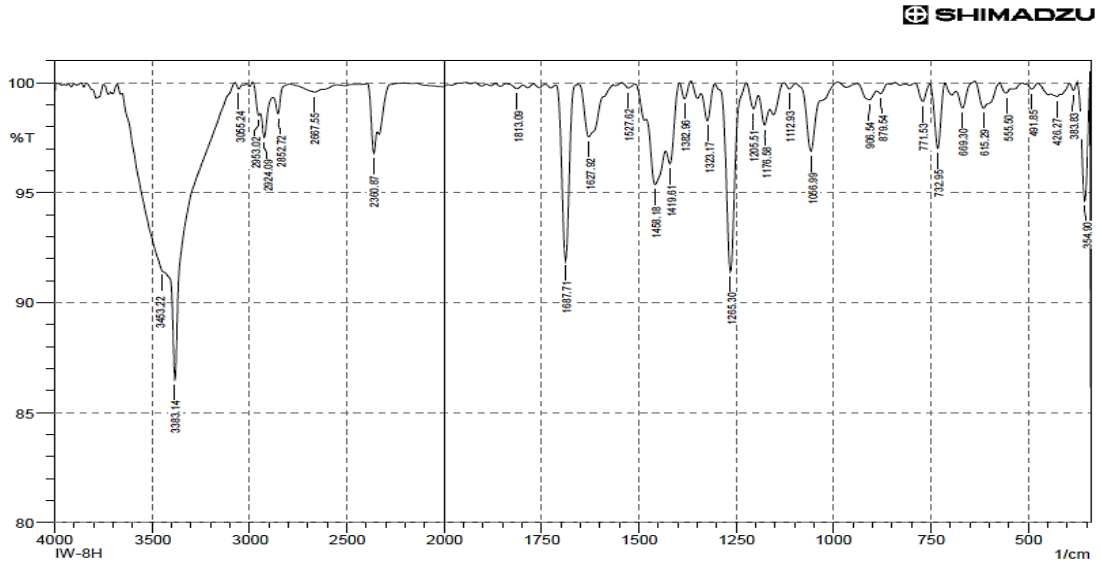


Spektrum ^{13}C NMR senyawa **1**

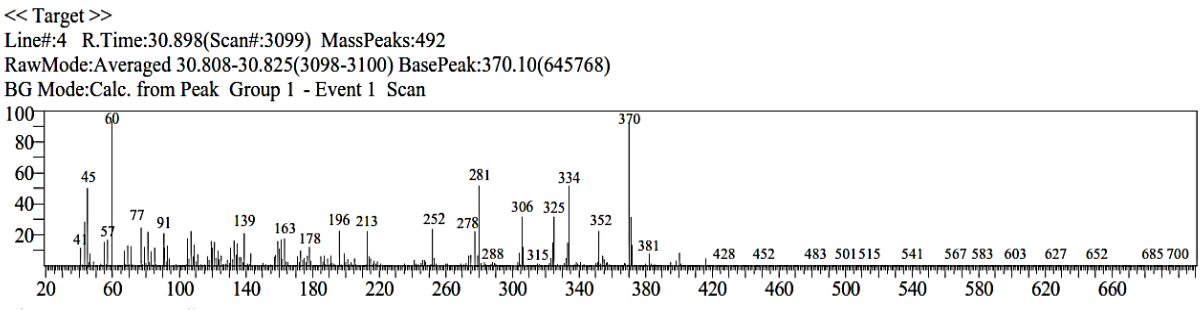


Spektrum ^{1}H NMR senyawa **1**

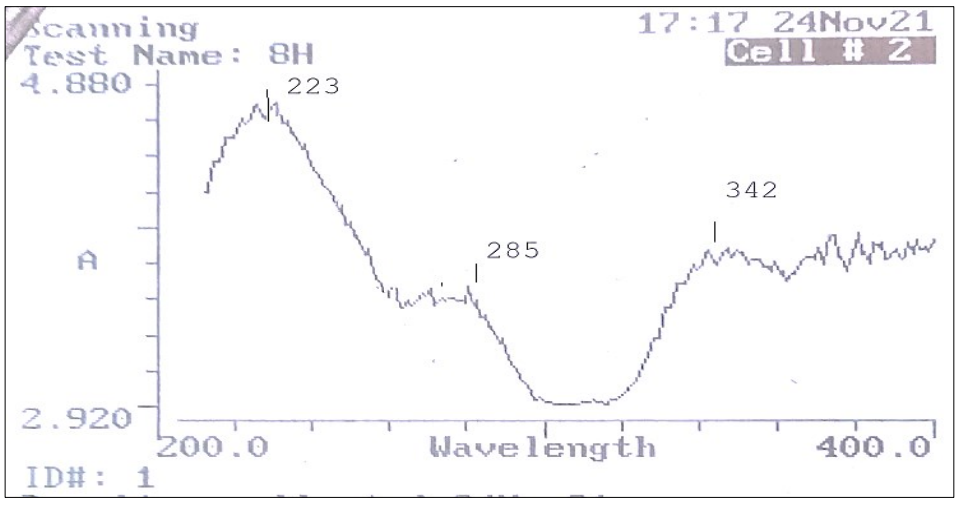
Lampiran 15. Spektrum FT-IR, spektrum MS, dan UV senyawa (**5**)



Spektrum FT-IR senyawa **5**

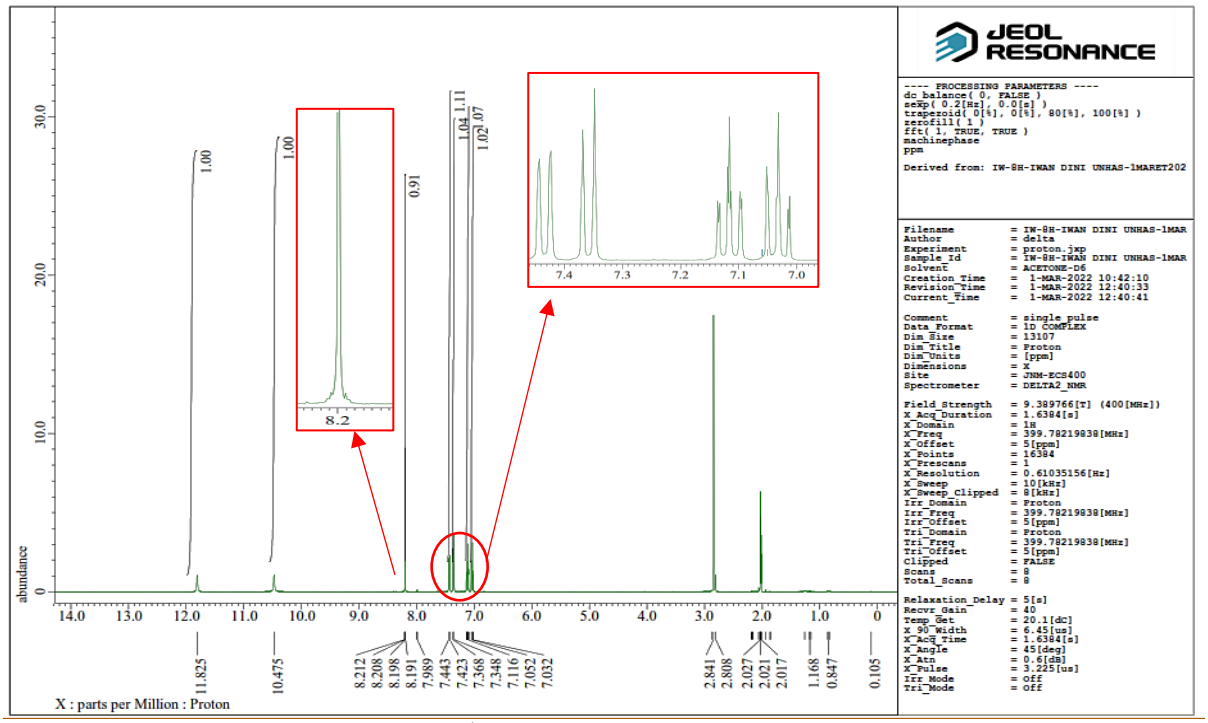


Spektrum MS senyawa **5**

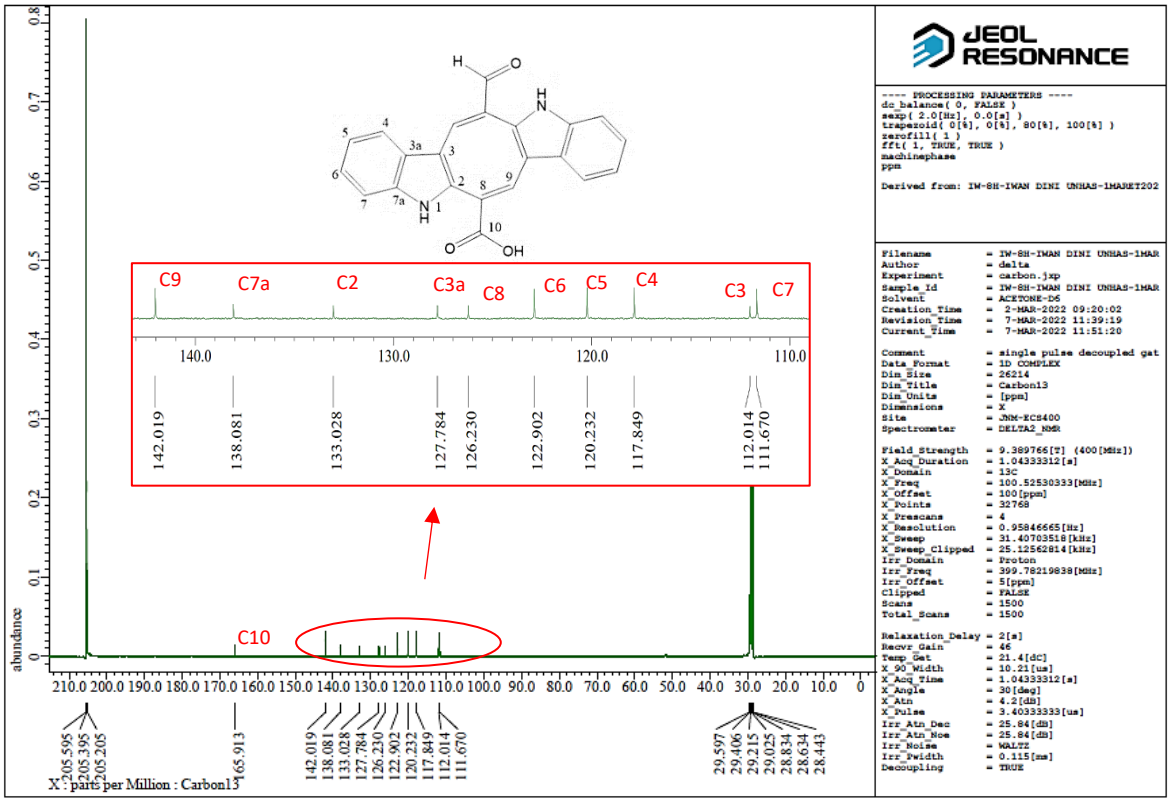


Spektrum UV senyawa **5**

Lampiran 16. Spektrum NMR senyawa (**5**)

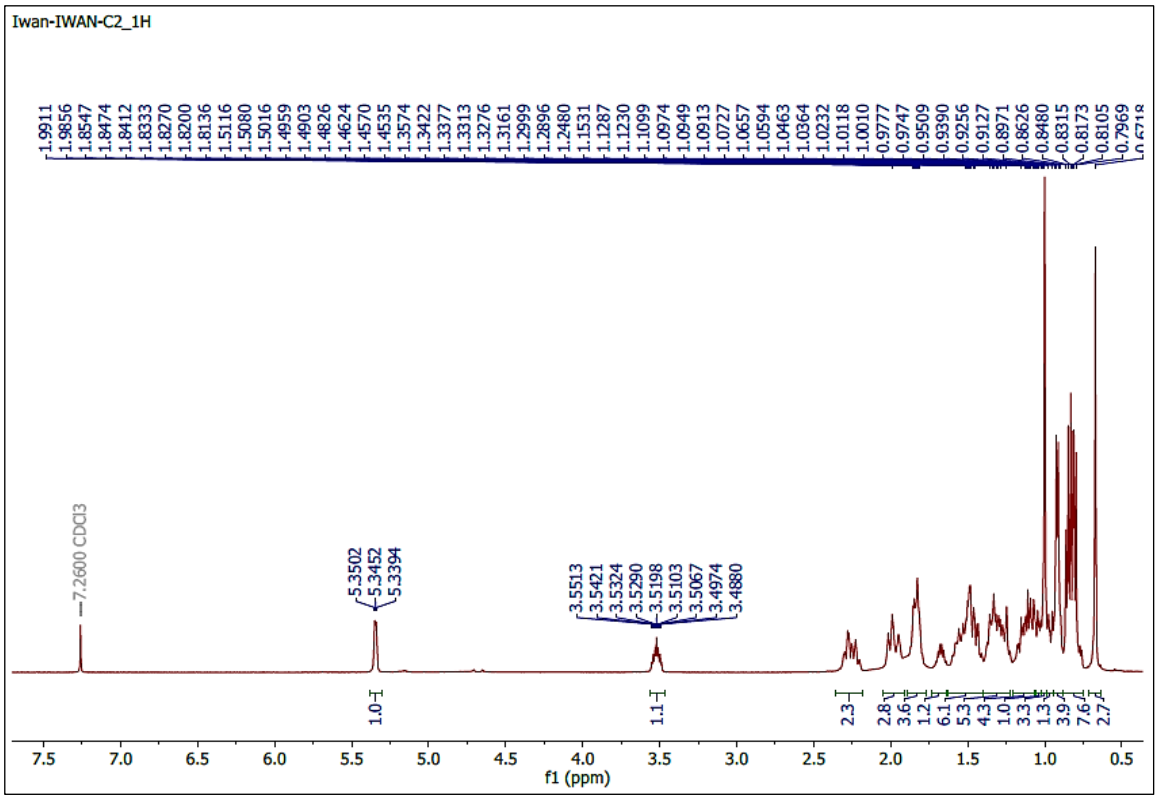


Spektrum ^{1}H-NMR senyawa **5**

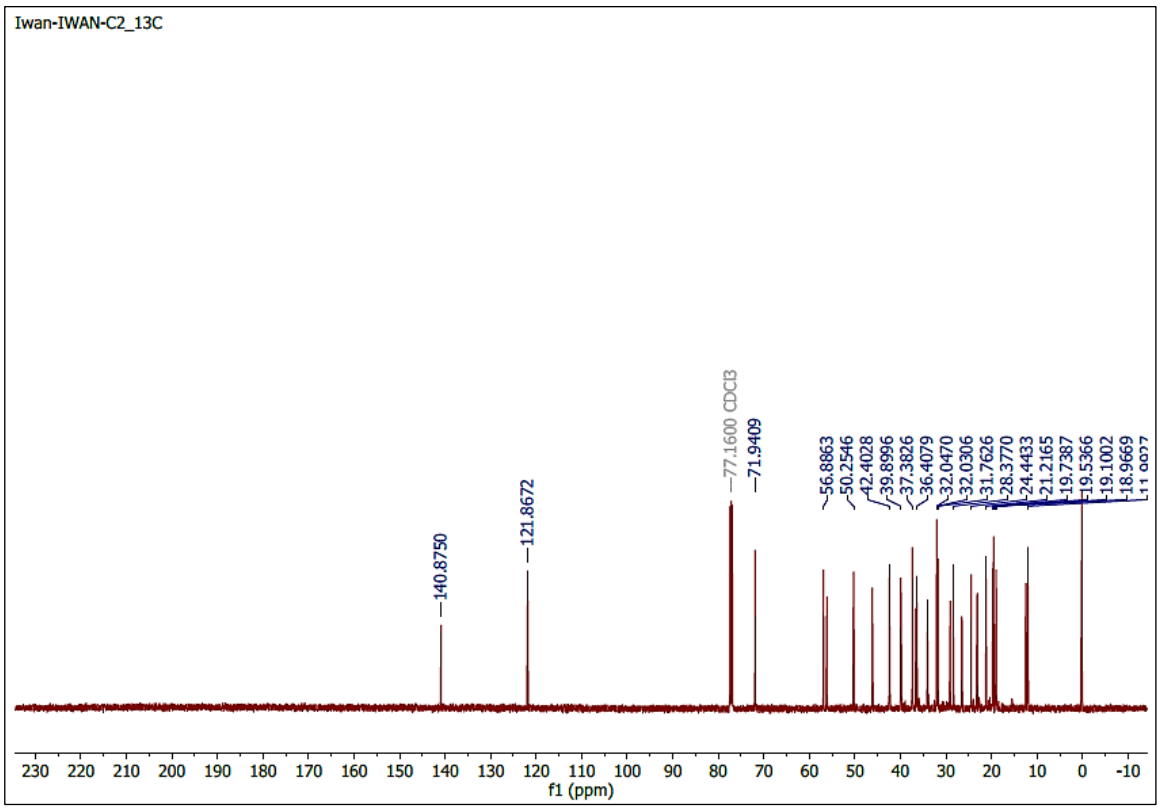


Spektrum ^{13}C-NMR senyawa **5**

Lampiran 18. Spektrum NMR senyawa (**2**)



Spektrum ^{1}H-NMR senyawa **2**



Spektrum ^{13}C-NMR senyawa **2**

Lampiran 19. Konversi Nilai satuan IC_{50} dari μg/mL ke μM

Senyawa 1, IC_{50} 15,42 μg/mL

IC_{50} =15,42 μg/mL = 15,42 x 10^{-6} g/ 10^{-3} L = 15,42 x 10^{-3} g/L

$$= \frac{(15{,}42 \times 10^{-3})\ g/L}{(BM = 398)}$$

= 38,74 x 10^{-6} Molar

= 38,74 μM

Senyawa	BM	μg/mL	g/L	Molar	μM
1	398	15.42	0.01542	0.00003874	38.74
2	414	2079.74	2.07974	0.00502353	5023.53
4	314	42.66	0.04266	0.00013586	135.86
5	370	22.96	0.02296	0.00006205	62.05
6	627	55.54	0.05554	0.00008858	88.58