ISOLASI SENYAWA BAHAN ALAM DARI TUMBUHAN

SRI ATUN
JURUSAN PENDIDIKAN KIMIA, FMIPA,
UNIVERSITAS NEGERI YOGYAKARTA
2010

Kimia Organik Bahan Alam ?

Makhluk Hidup/ Organisme

(Hewan; Tumbuhan, Mikrorganisme yang hidup di darat, laut, dan udara)

Proses metabolisme

Metabolit Primer

(Karbohidrat; lemak, protein, asam nukleat), merupakan molekul dengan BM tinggi, struktur sama utk setiap organisme, dan digunakan sbg penghasil energi/ kelangsungan hidup organisme

Banyak dipelajari di bidang Biokimia

Metabolit Sekunder

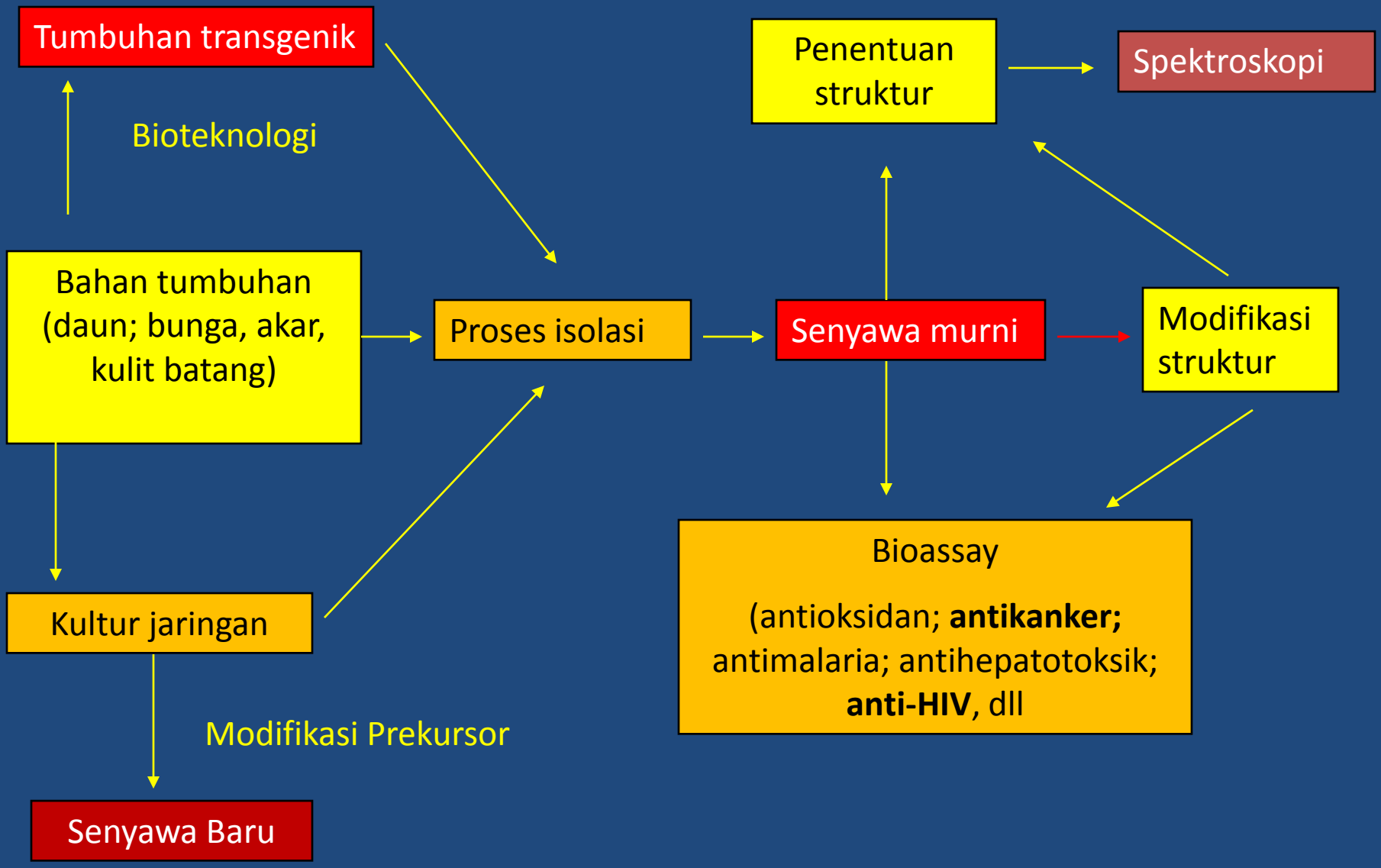
(golongan senyawa dengan struktur bervariasi dan khas untuk setiap organisme, BM relatif kecil, ditemukan dalam jumlah minor, berfungsi untuk pertahanan diri organisme, melawan penyakit, pertumbuhan, atau hormon

Bidang Kimia organik bahan alam

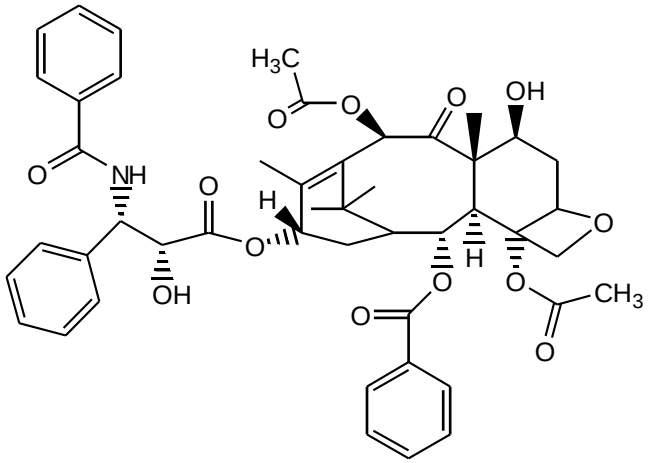
Peran Ekologis senyawa bahan alam:

- ❖Melindungi tumbuhan dari serangan herbivora dan infeksi mikroba
- ❖Penarik serangga atau hewan penyerbuk dan penebar biji
- ❖Agen alelopati yg berperan dlm kompetisi antar spesies tumbuhan.

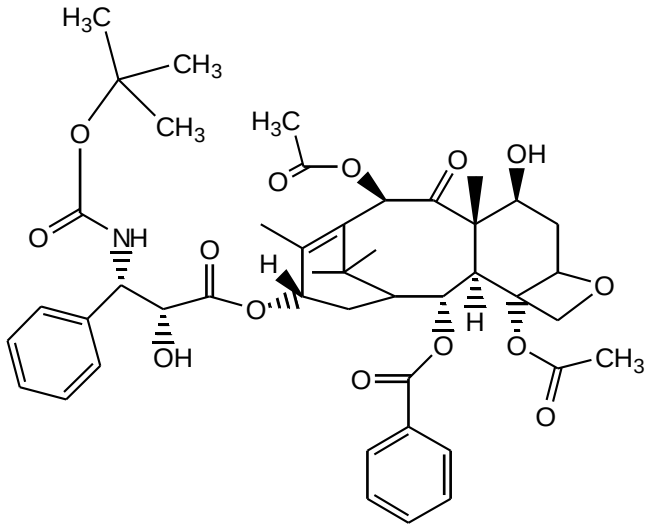
EKSPLORASI SENYAWA KIMIA ORGANIK BAHAN ALAM



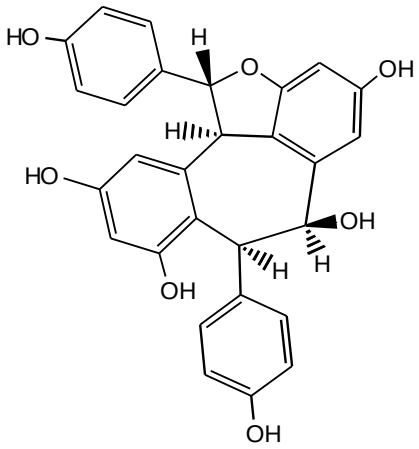
Beberapa penemuan obat dari senyawa alam



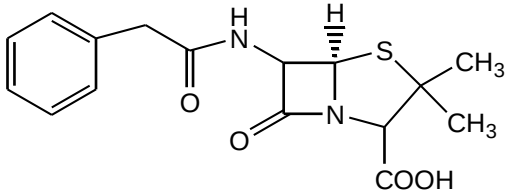
Taxol (*Taxus brevifolia*) Obat kanker



Taxotere (derivat taxol) obat kanker



Balanokarpol (*Hopea*) anti-HIV



Penicillin G (*Penicillium notatum*) sbg antibiotik ditemukan th 1928 oleh Alexander fleming

Tahapan penelitian bahan alam

1. Tahap seleksi tumbuhan

- Tumbuhan yang masih jarang diteliti
- Seleksi pendekatan kemotaksonomi (keanekaragaman struktur senyawa dari kelompok tumbuhan tertentu)
- Seleksi secara etnofarmakologi (penggunaan atas dasar informasi secara turun-temurun)

2.Tahap isolasi dan pemurnian (sampel sebanyak 5-10 Kg)

3. Elusidasi struktur molekul

- **spektroskopi (UV), (IR), ('H NMR; ^{13}C NMR ID dan 2D); (MS)**

4. Uji aktivitas (antioksidan; antikanker, dll)

POTENSI KEKAYAAN ALAM INDONESIA

HUTAN TROPIKA INDONESIA

Temulawak

Kunyit

Mengkudu

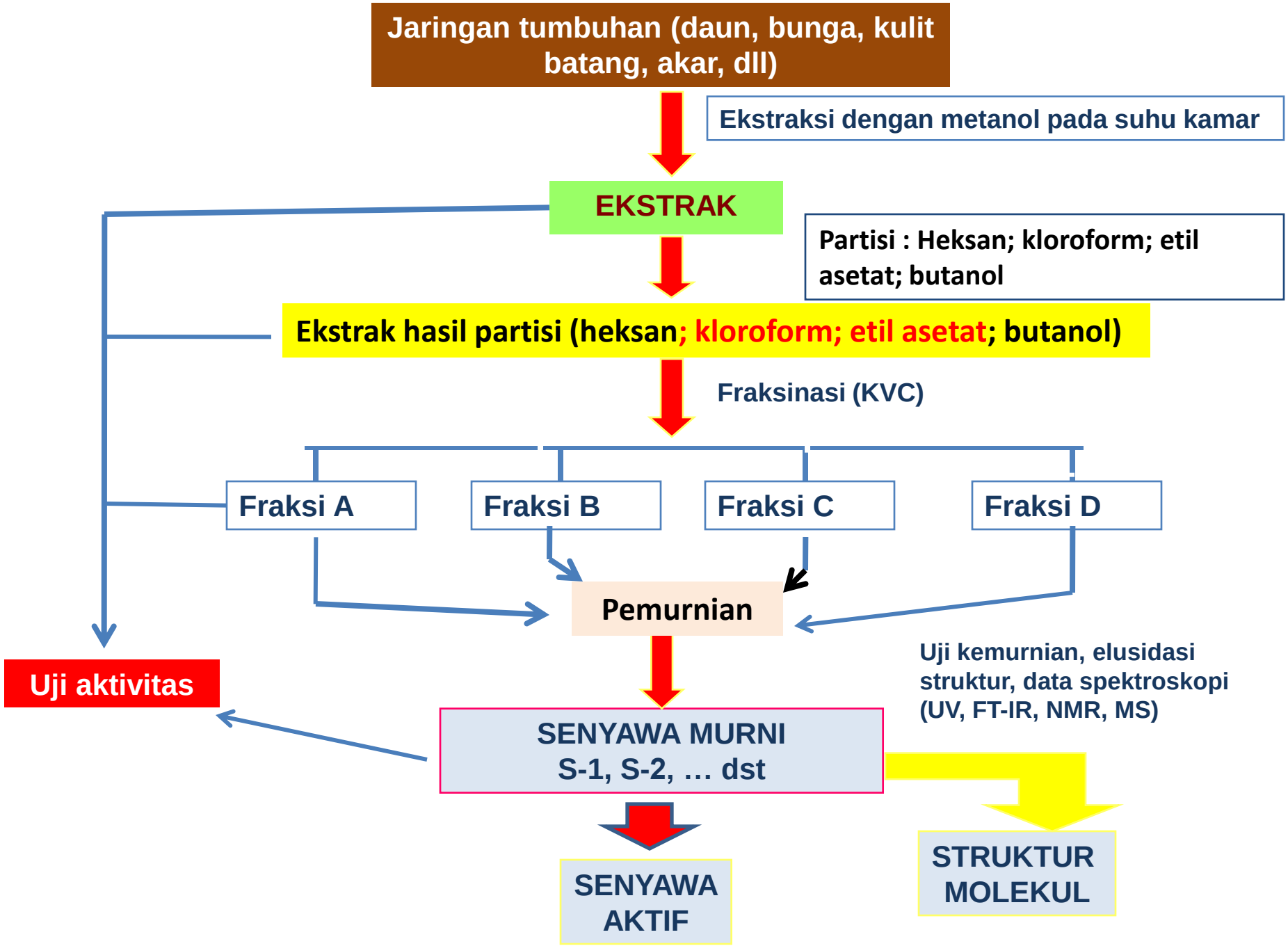
Pegagan

Meniran

Pulai

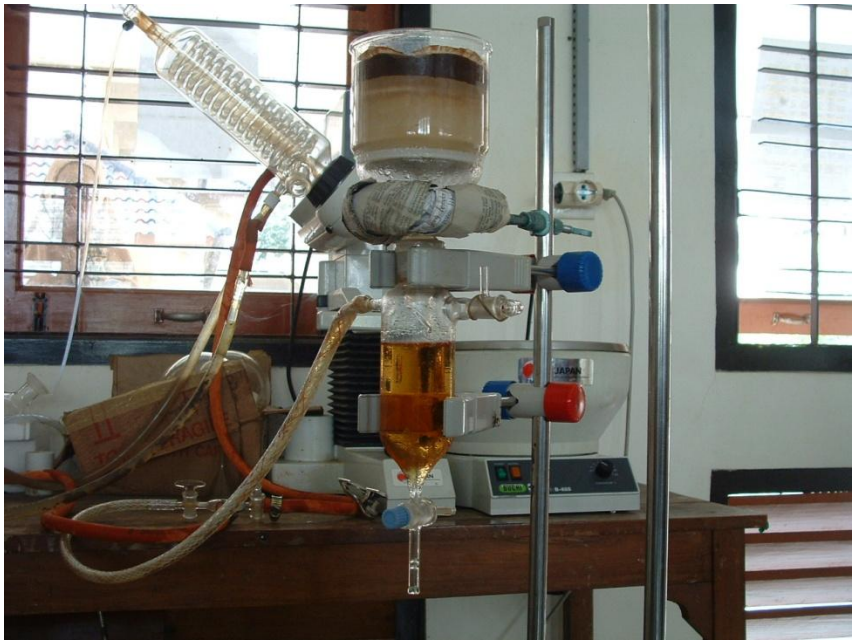
Figure 24.30
Callus cultures established from plants can be optimized to produce high concentrations of a wide variety of natural products. In some of the examples shown, metabolite pigments give the calli distinctive colors.

Metode isolasi senyawa bahan alam ?


Jaringan tumbuhan (daun, bunga, kulit batang, akar, dll)
Ekstraksi dengan metanol pada suhu kamar
EKSTRAK
Partisi : Heksan; kloroform; etil asetat; butanol
Ekstrak hasil partisi (heksan; kloroform; etil asetat; butanol)
Fraksinasi (KVC)
Fraksi A
Fraksi B
Fraksi C
Fraksi D
Pemurnian
Uji aktivitas
Uji kemurnian, elusidasi struktur, data spektroskopi (UV, FT-IR, NMR, MS)
SENYAWA MURNI S-1, S-2, … dst
SENYAWA AKTIF
STRUKTUR MOLEKUL

Ekstraksi

Partisi

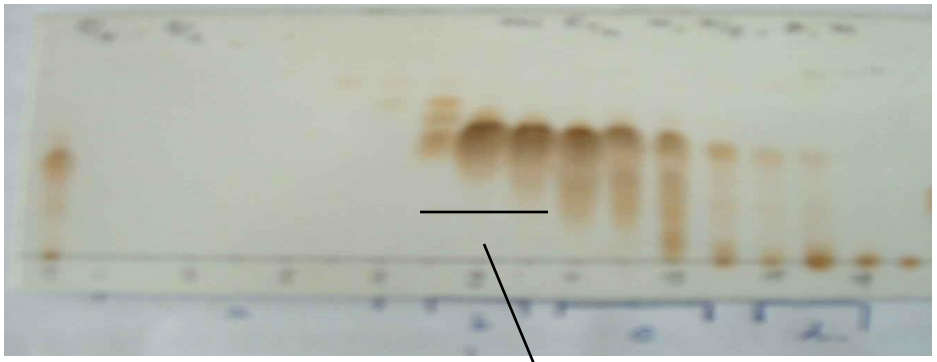


Kromatografi gravitasi

Kromatotron (*centrifugal chromatography*)

Kromatogram Hasil Pemisahan Senyawa Alam Secara Kromatografi

1



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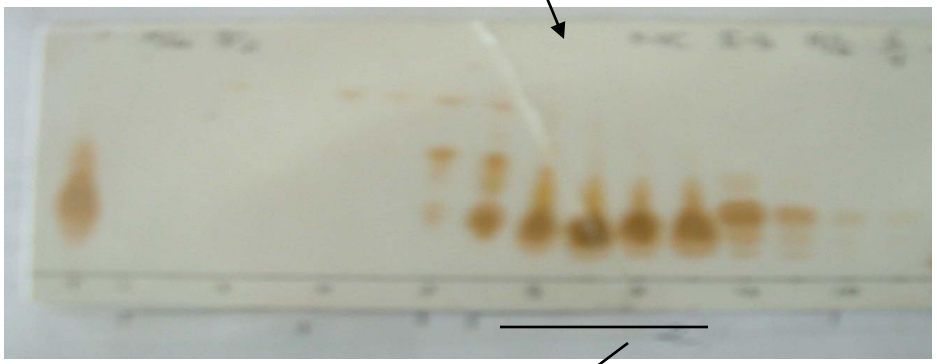

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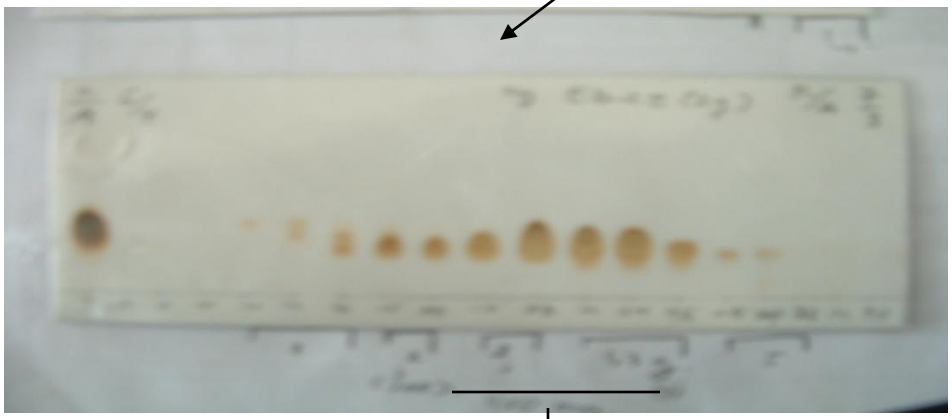

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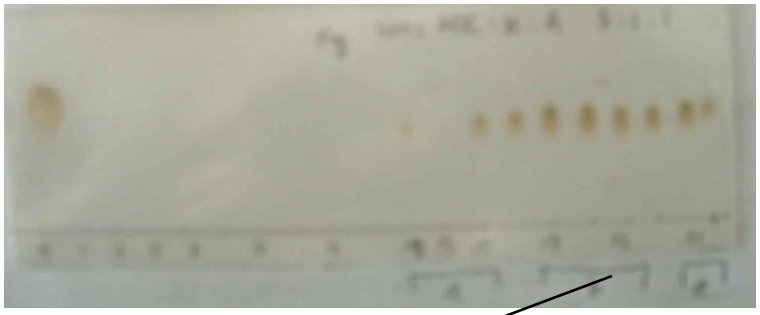

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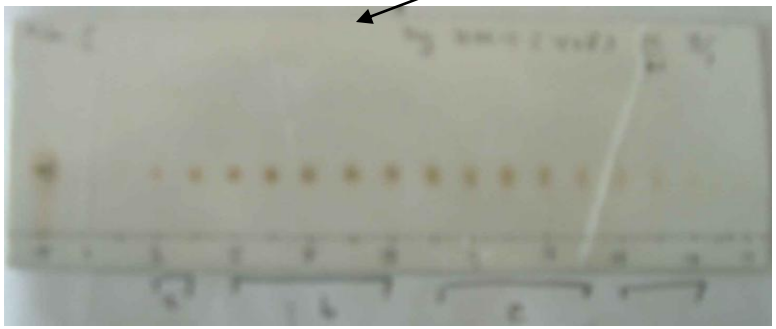
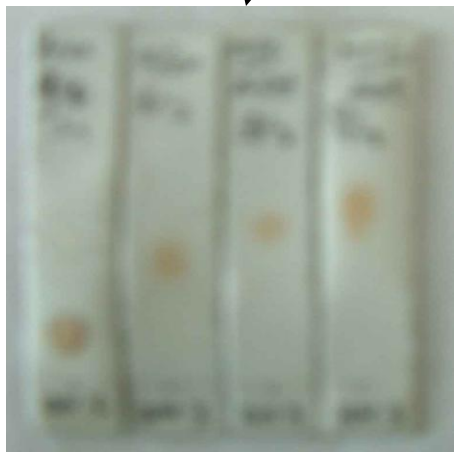
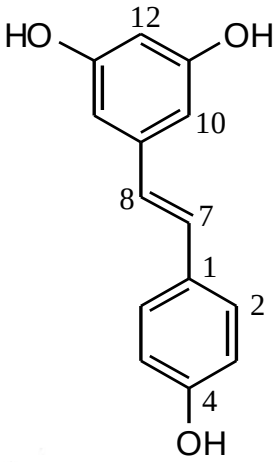


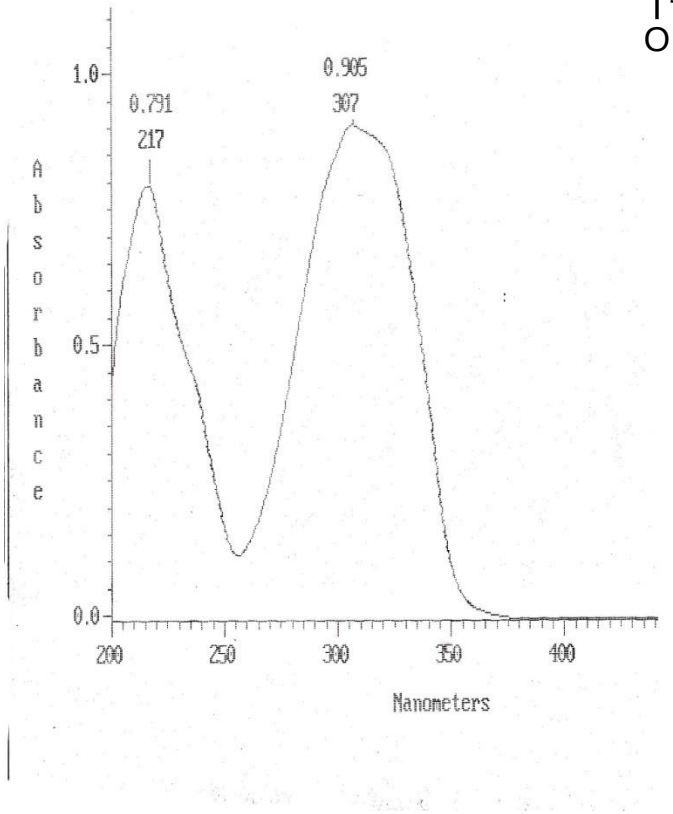


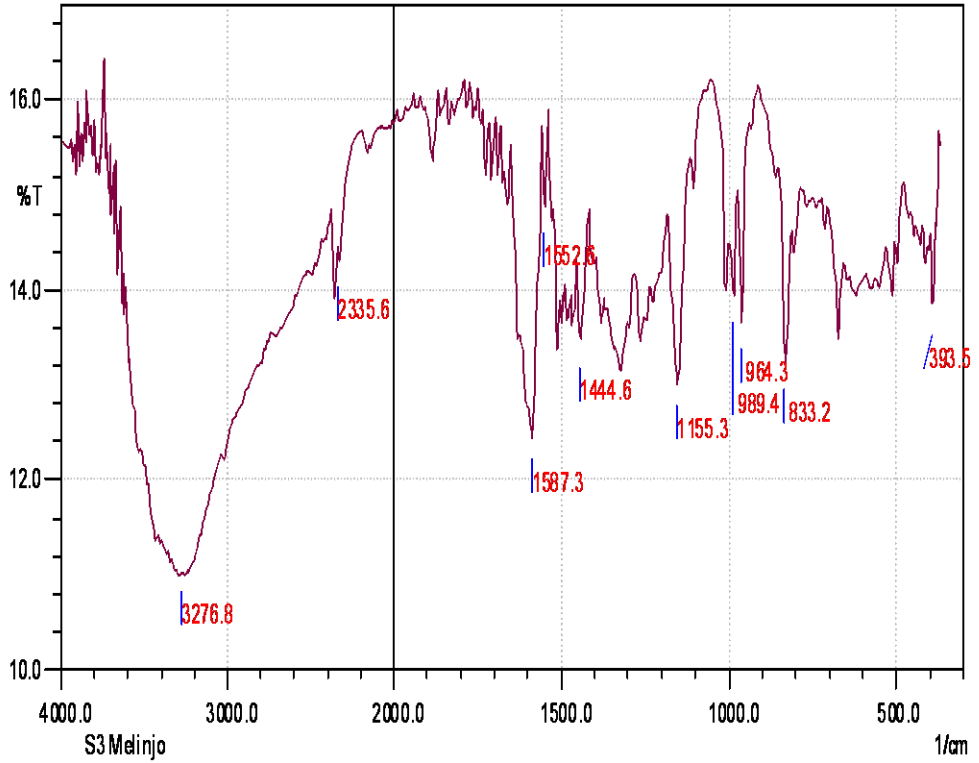
Uji kemurnian

Tahap elusidasi struktur

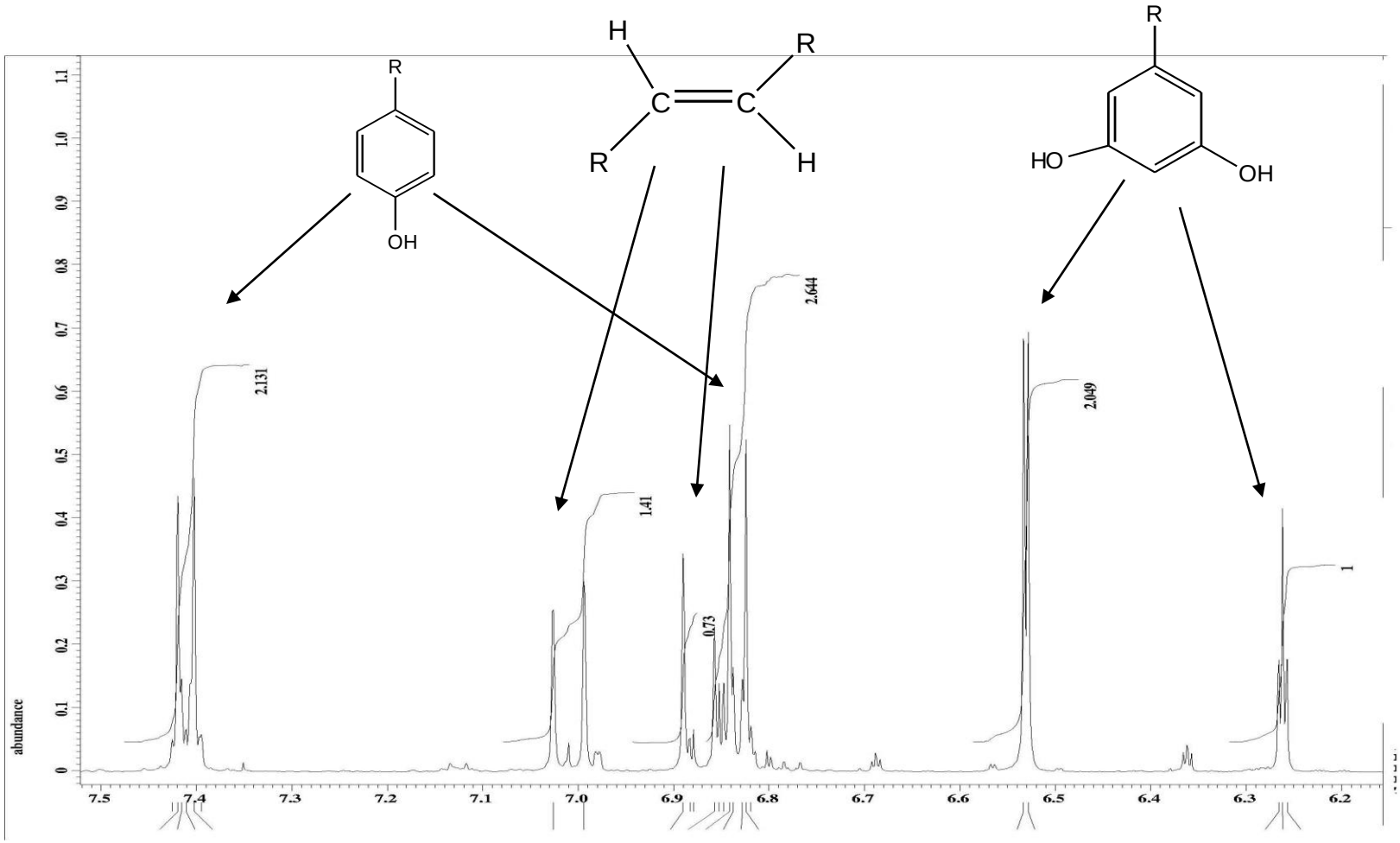
Penggunaan Metode spektroskopi dalam identifikasi struktur molekul





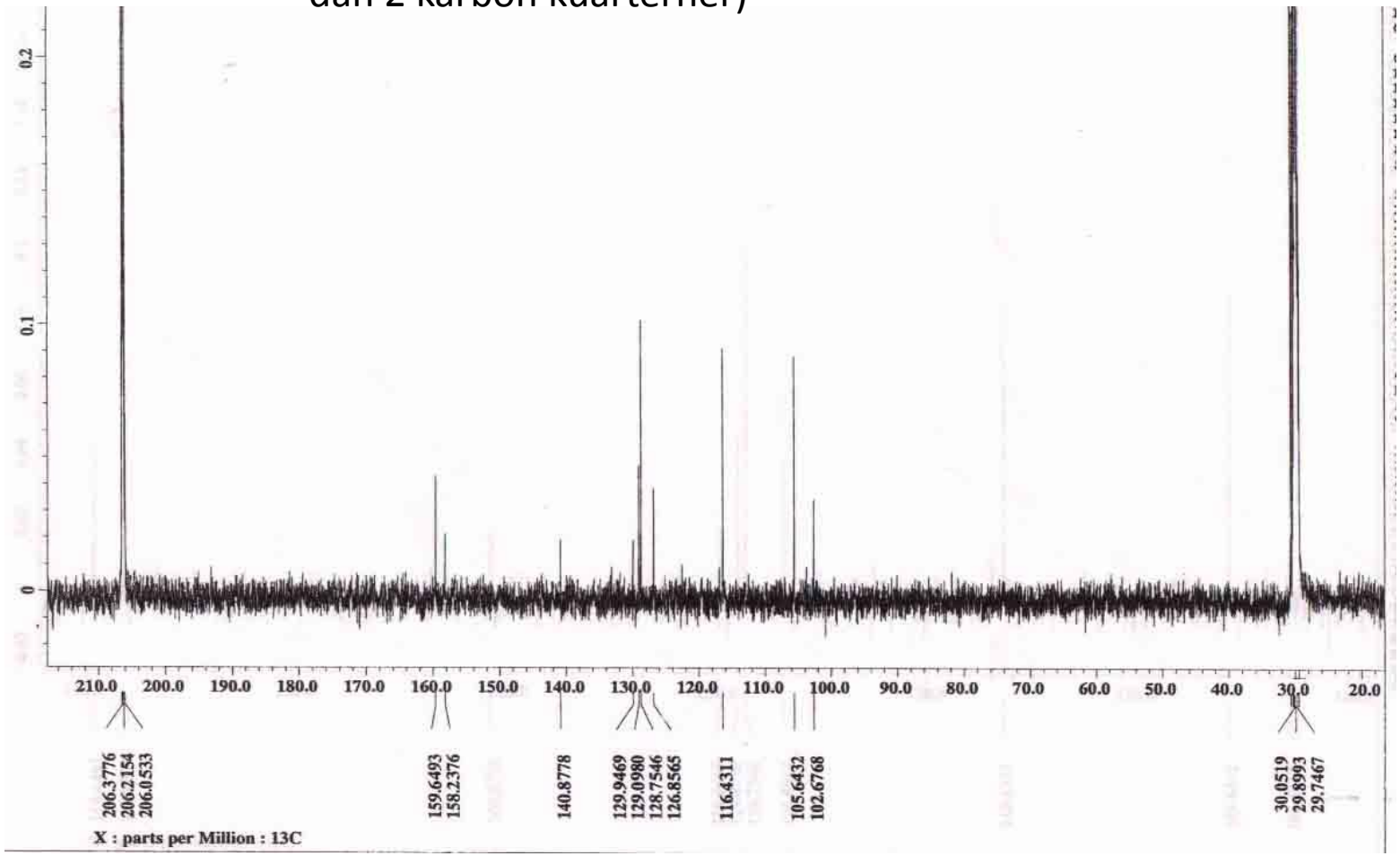


Analisis Data ^{1}H NMR satu dimensi dari Resveratrol

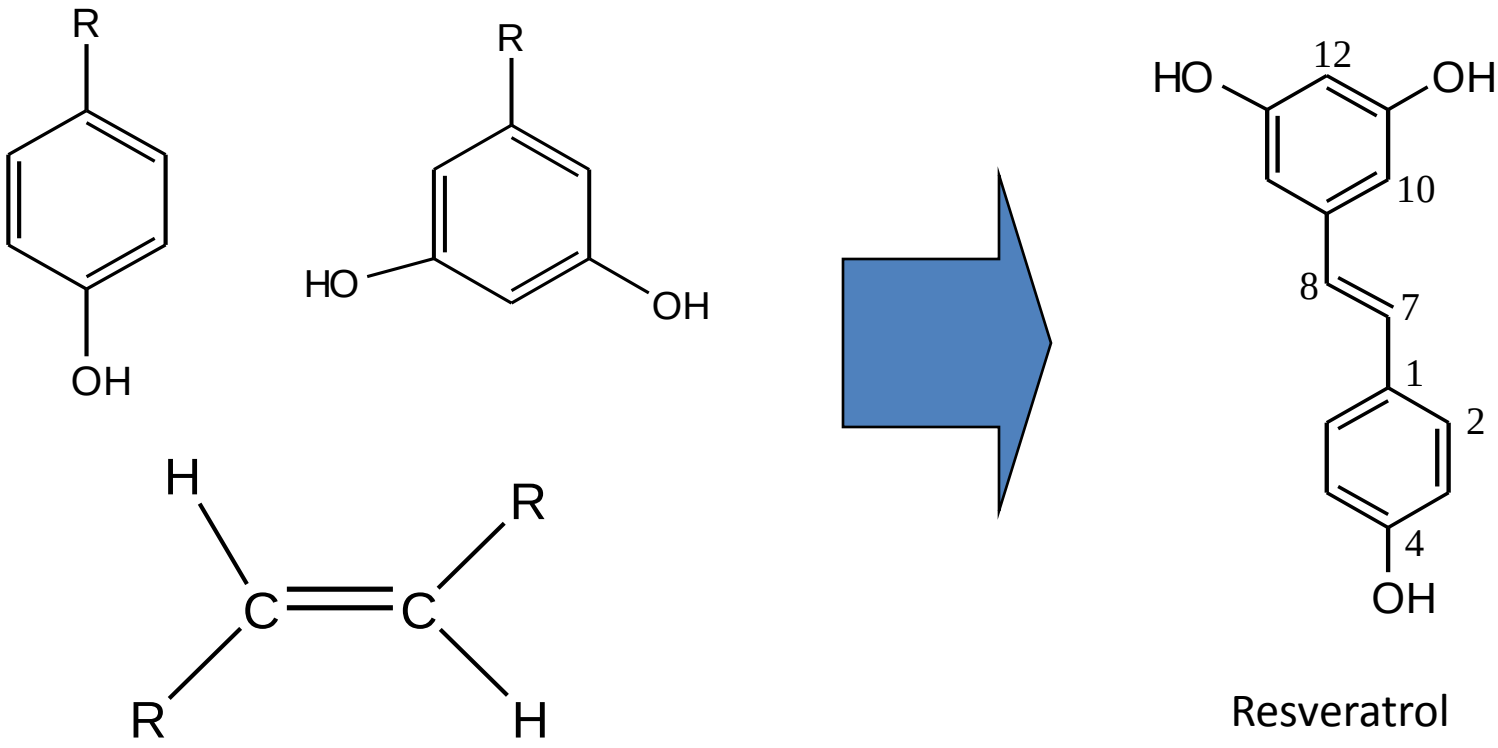


Analisis data spektrum ^{13}C NMR resveratrol

14 karbon (3 karbon oksiaril, 9 karbon metin, dan 2 karbon kuarterner)

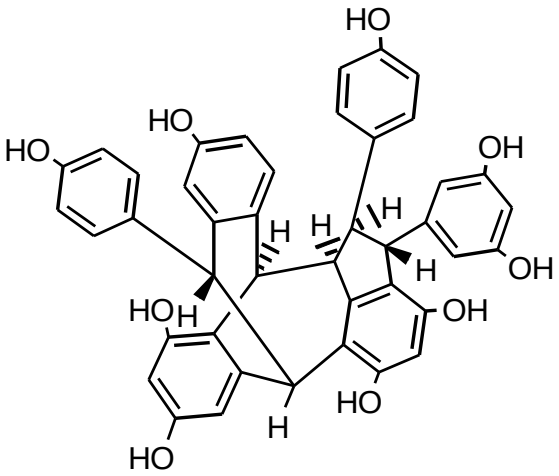


Hasil analisis data spektroskopi dari resveratrol



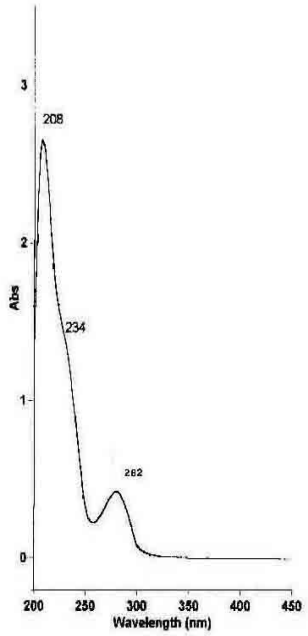
Resveratrol

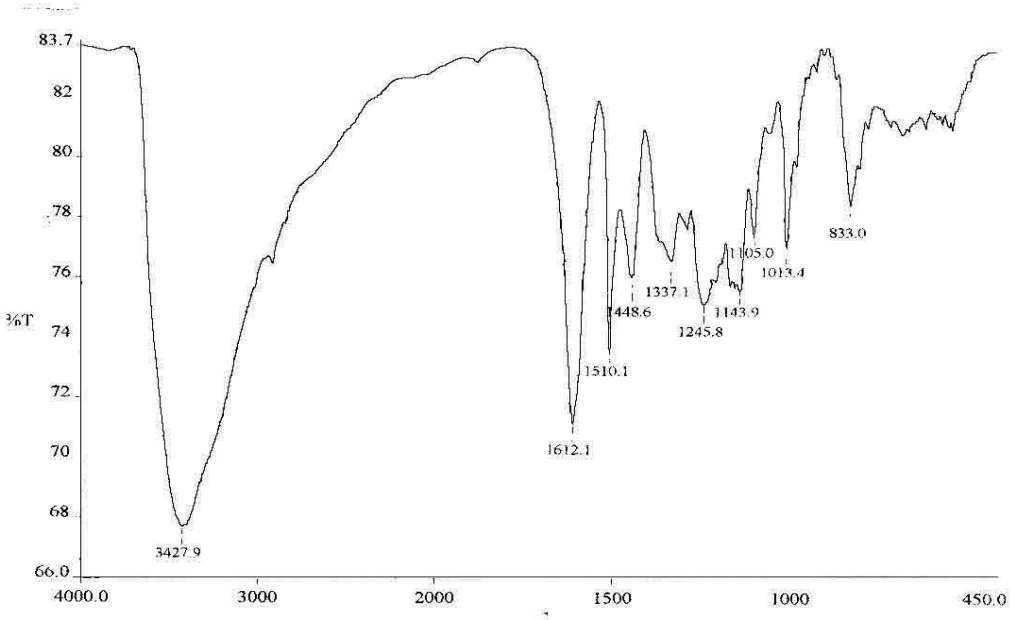
IDENTIFIKASI STRUKTUR SECARA SPEKTROSKOPI



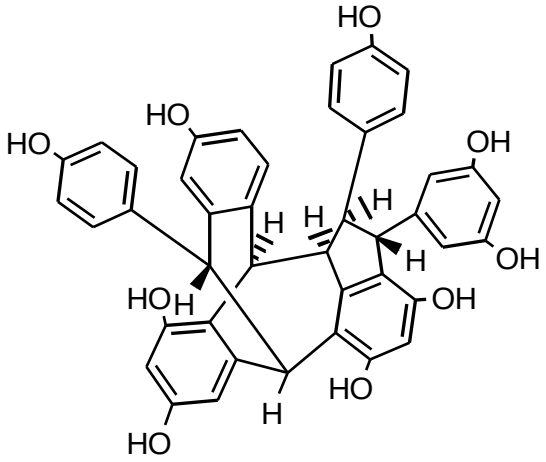
FAB-MS [M^+] 680 ($C_{42}H_{32}O_9$)

Spektrum
UV dan IR





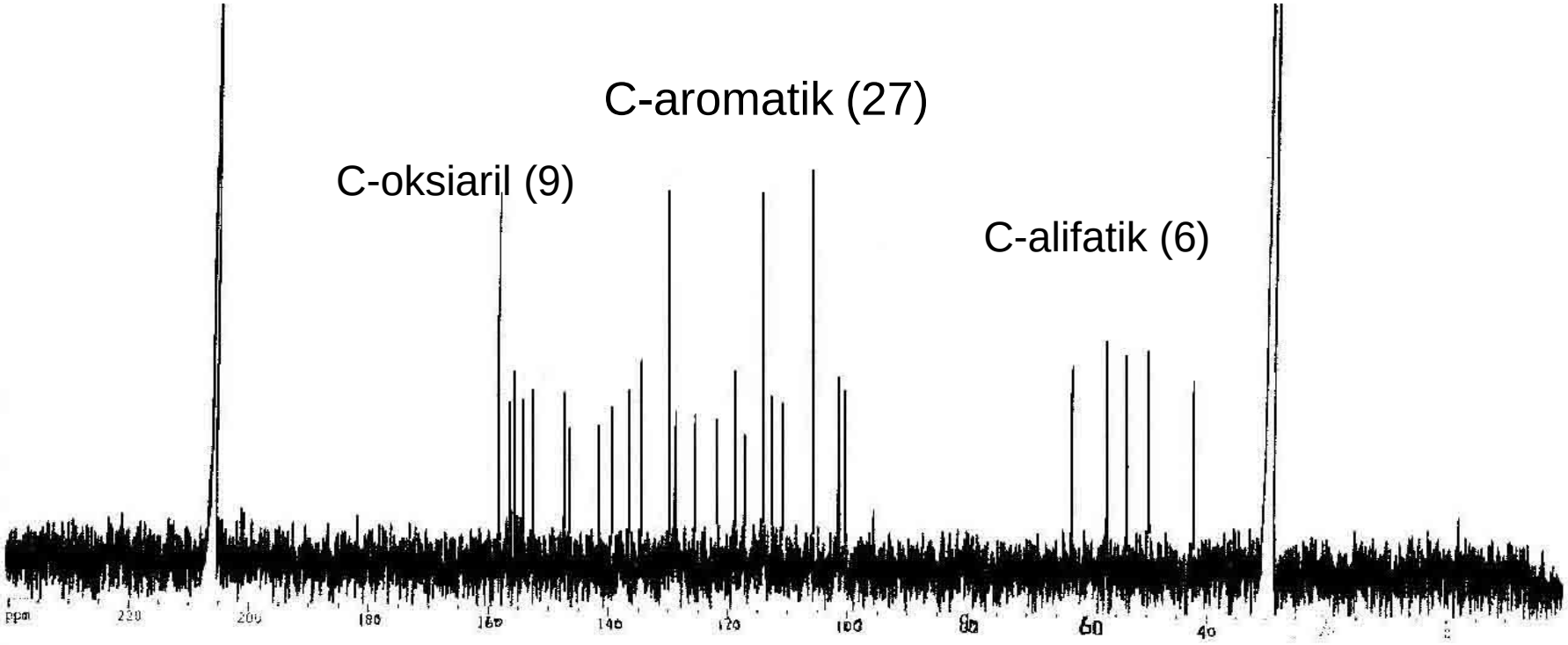
Spektrum ^{13}C



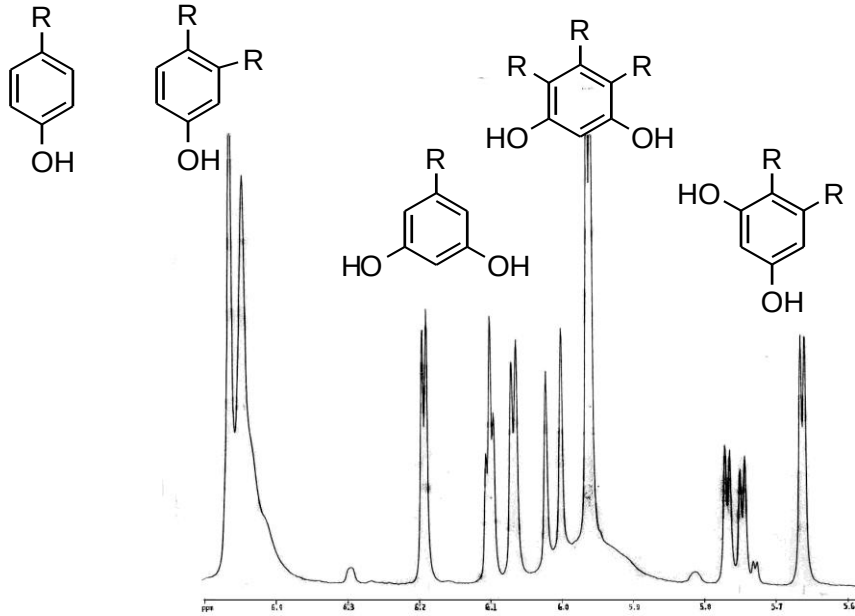
C-aromatik (27)

C-oksiaril (9)

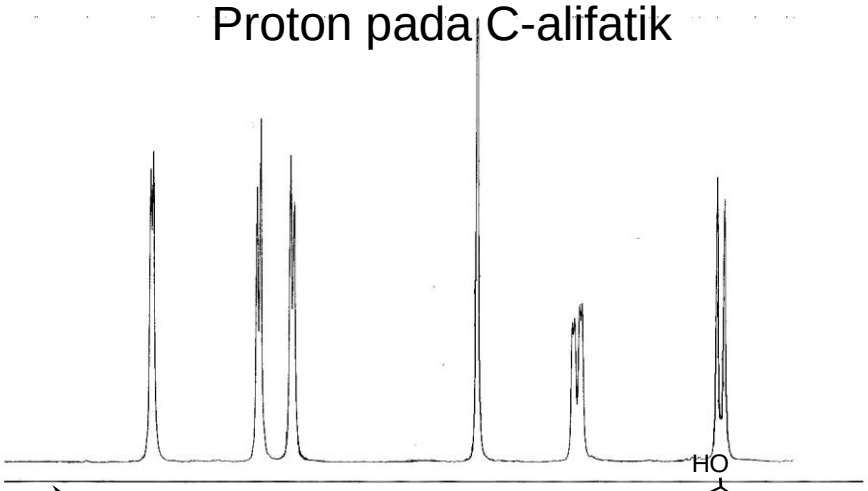
C-alifatik (6)

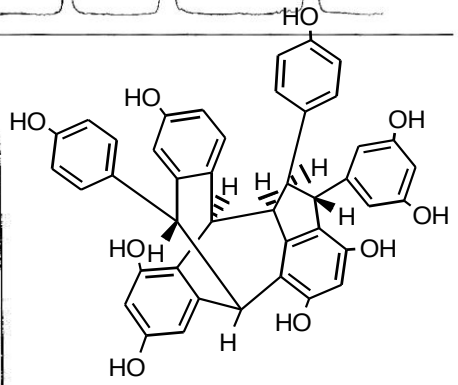


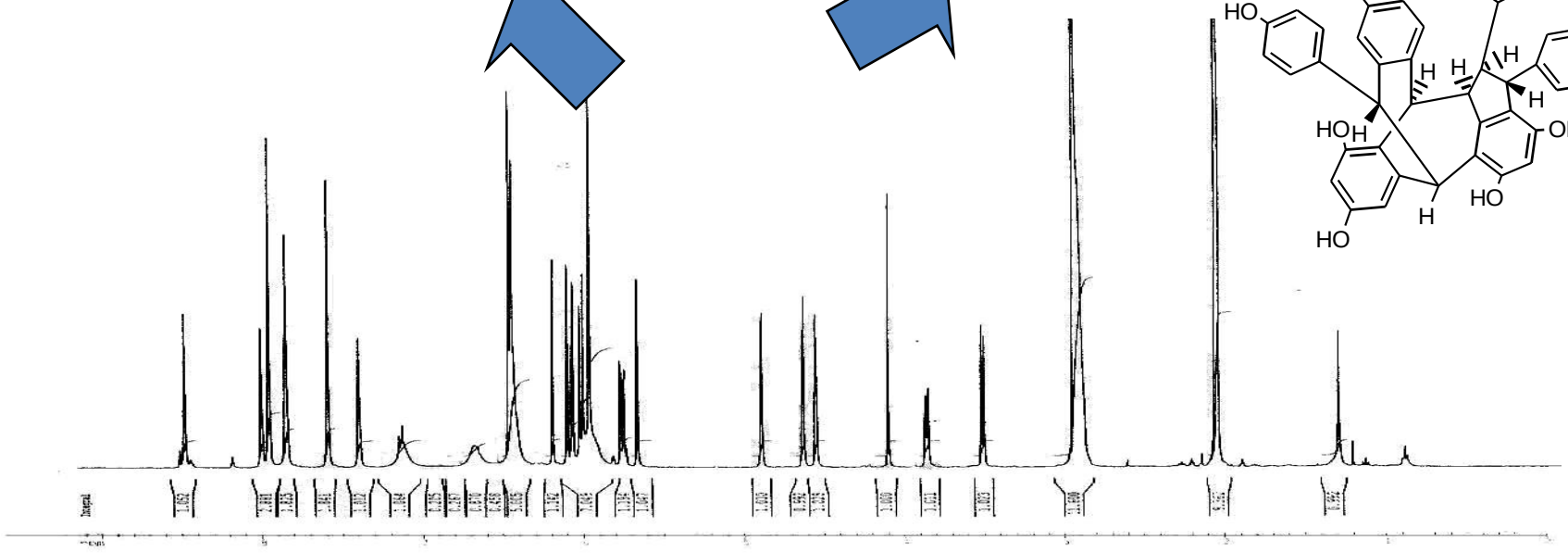
Spektrum ^{1}H NMR



Proton pada C-alifatik



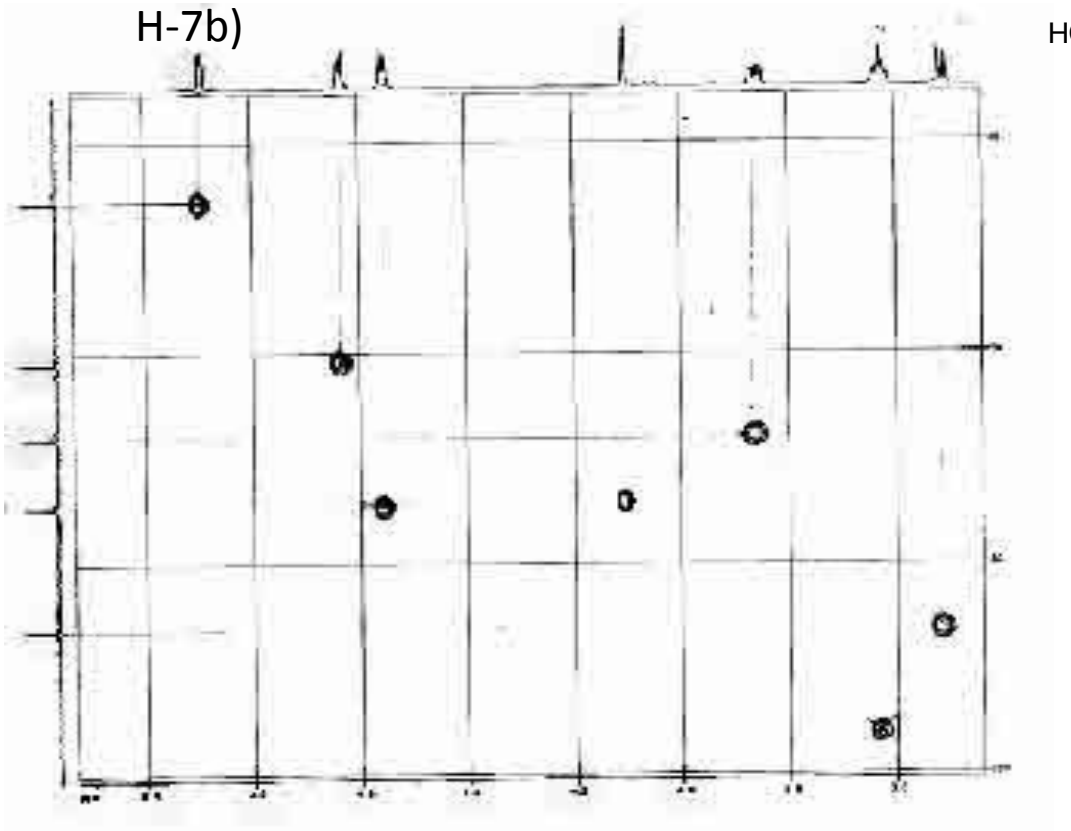


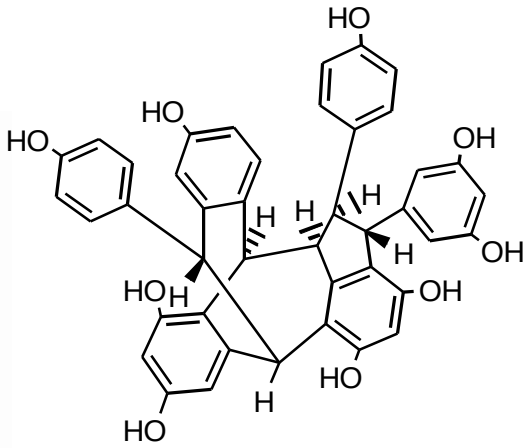


Spektrum HMQC (H→C satu ikatan)

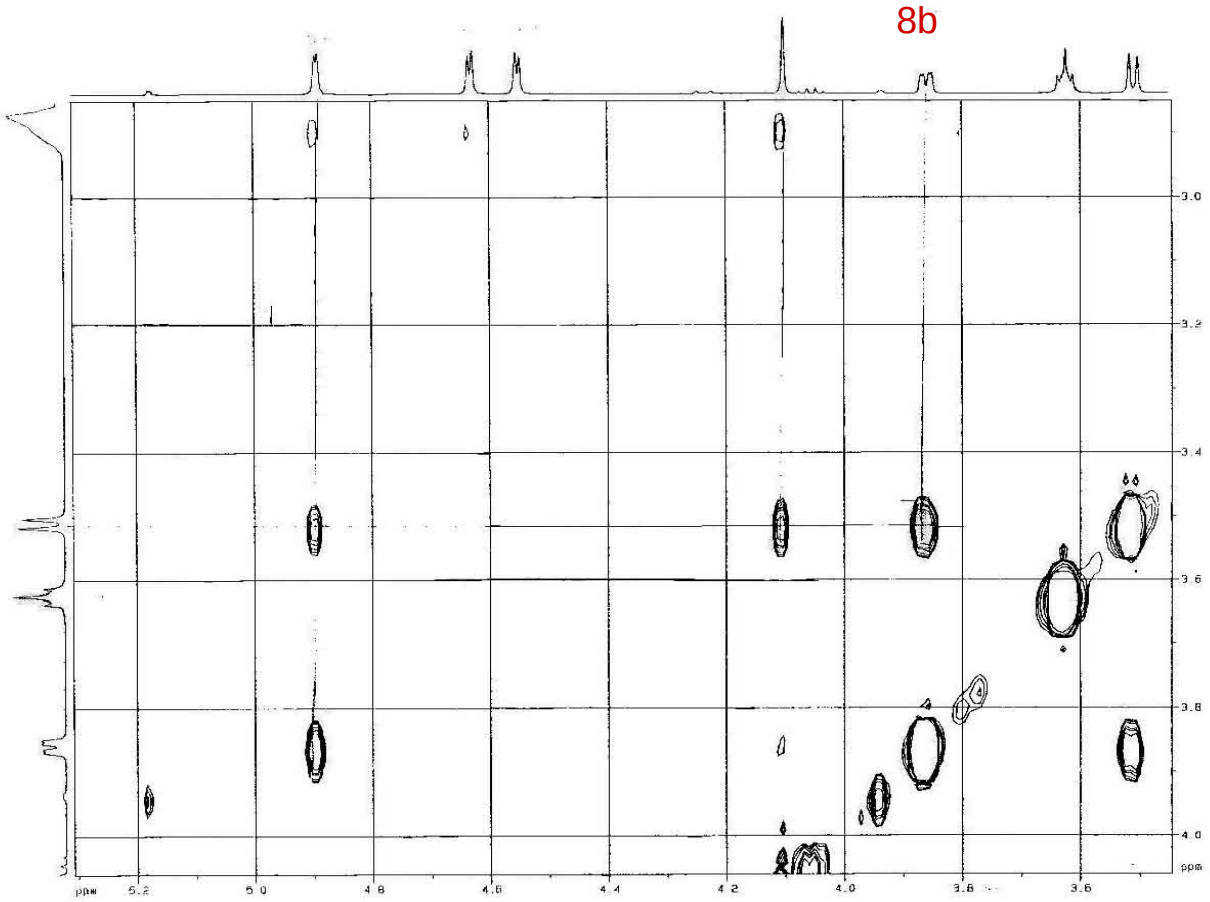
H-7b)

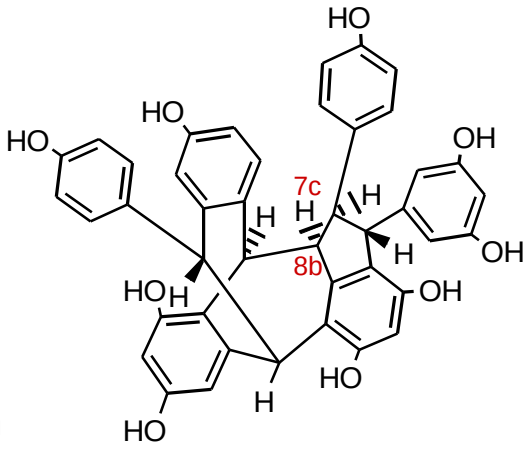
C-7b



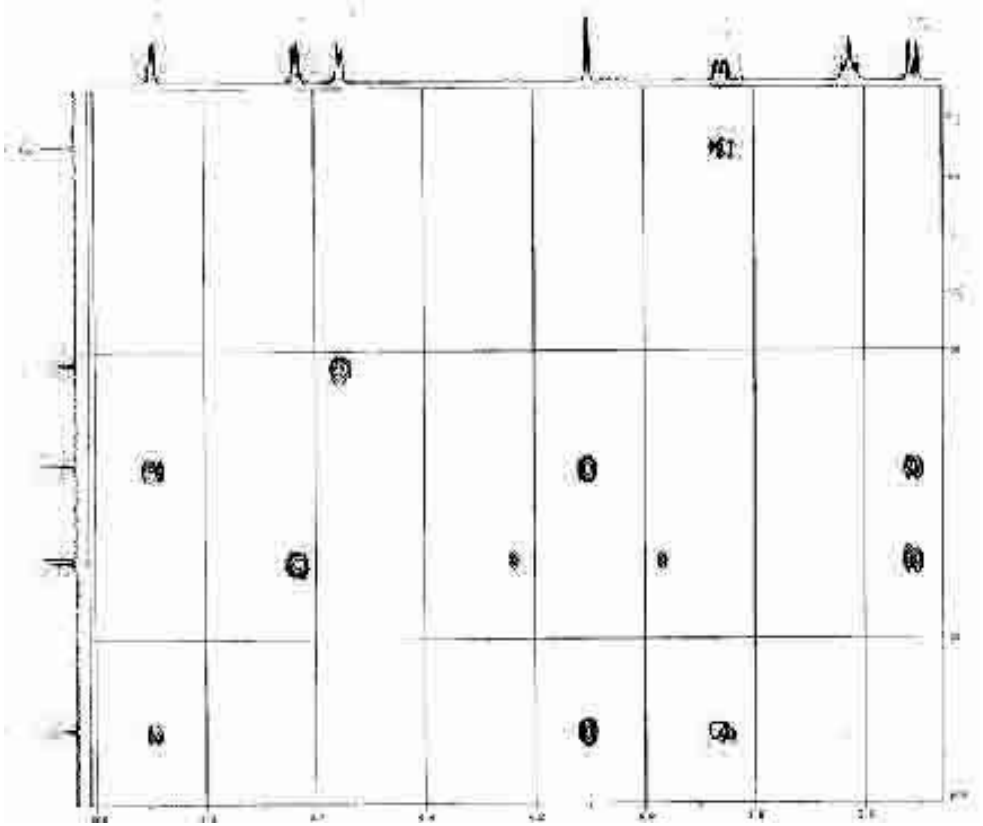


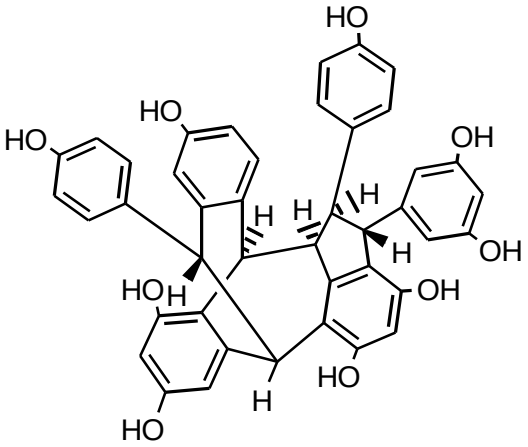
Spektrum (^{1}H-^{1}H) COSY NMR



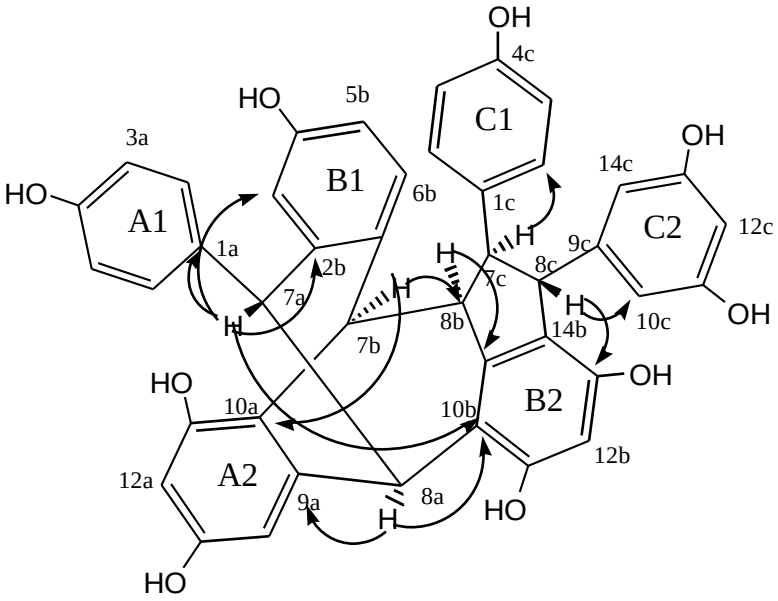


Spektrum HMBC (korelasi H→C 2/3 ikatan)

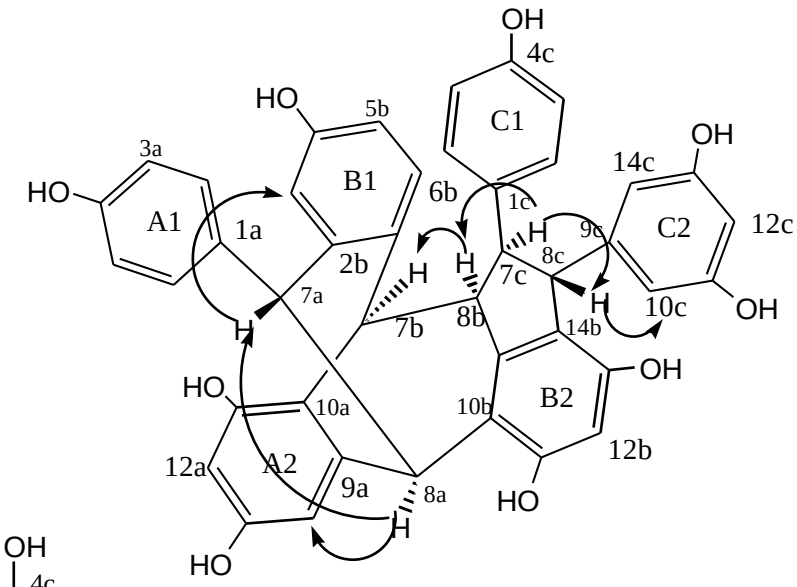




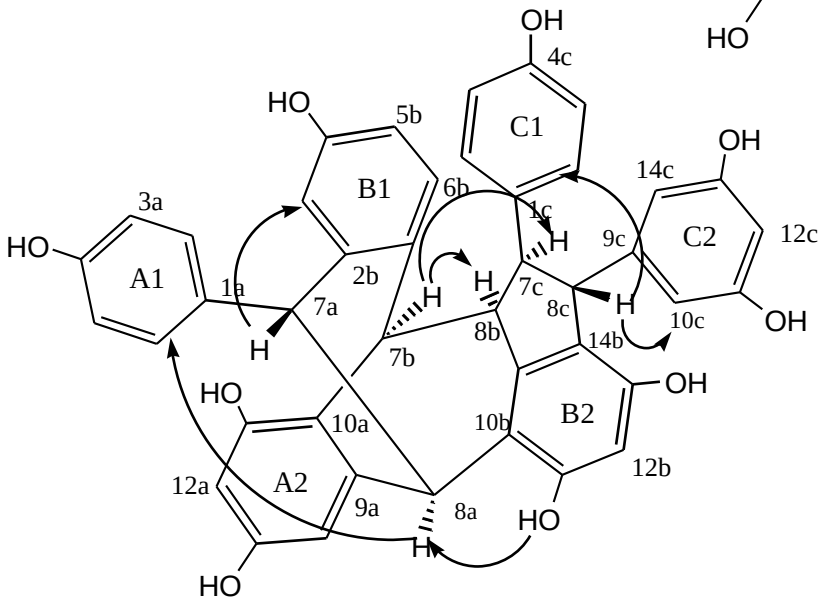
Beberapa hasil korelasi dari spektrum NMR dua dimensi



HMBC



COSY

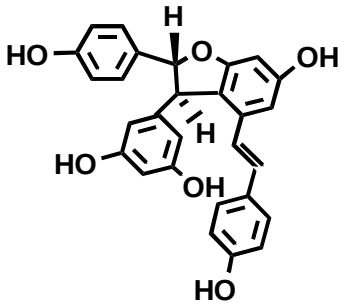


NOESY

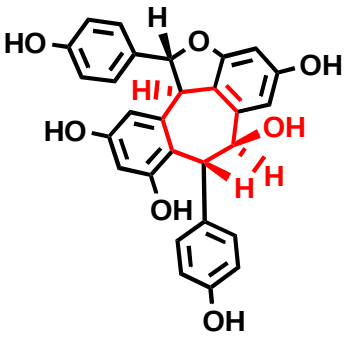
Tabel 1. Beberapa Spesies Tumbuhan Famili Dipterocarpaceae dan Kandungan Kimianya

Nama spesies	Asal tumbuhan	Peneliti	Senyawa kimia yang ditemukan
V. rassak	Bogor, Indonesia	Tanaka (2000[a])	(-)-ε-viniferin (13), vatikanol C (19); vatikanol G (20); vatikasid D (21); vatikanol A (22); vatikanol B (24); vatikanol D (31); vatikanol H (34); vatikanol I (35); vatikanol J (36)
V. oblongifolia	Kaliman-tan	Zgoda-Pols (2002)	hopeafenol A (27); isohopeafenol A (28)
V. Pauciflo ra	Bogor, Indonesia	Sri Atun (2004)	siringaresinol (12), (-)-ε-viniferin (13), (-)-ampelopsin F (14); stenofilol B (20); vatikanol G (20); vatikanol B (24); diptoindonesin C (35); diptoindonesin D (36); diptoindonesin E (37)
V. Umbona ta	Yogyakar ta, Indonesia	Sri Atun (2004)	(-)-ε-viniferin (13); (-)-ampelopsin F (14); stenofilol B (20); vatikanol G (20); vatikanol B (24); laevifonol (15); (-)-hopeafenol (25)
A. margina ta	Bogor, Indonesia	Sri Atun (2004; 2008)	bergenin (11), (-)-ε-viniferin (13), (-)-ampelopsin A (16), vatikanol B (24), (-)-hopeafenol (25), dan hopeafenol glukosida (26)
D. grandiflorius	Bogor, Indonesia	Sri Atun, (2004)	bergenin (11), (-)-ampelopsin A (16), (-)-α-viniferin (23), dan (-)-hopeafenol (25).
H. sangal	Bogor, Indonesia	Sri Atun, (2004)	(-)-ampelopsin A (16), vatikanol B (24), dan (-)-hopeafenol (25)
H. mengarawan	Banten, Indonesia	Sri Atun, (2006)	Balanokarpol (17); heimiol A (18); vatikanol G (20); dan vatikanol B (24)
H. odorata	Banten, Indonesia	Sri Atun, (2006)	Balanokarpol (17); ampelopsin H (29); hemlesyanol C (30); dan hopeafenol (25)
H. nigra	Banten, Indonesia	Sri Atun, (2005)	Vatikanol G (20)

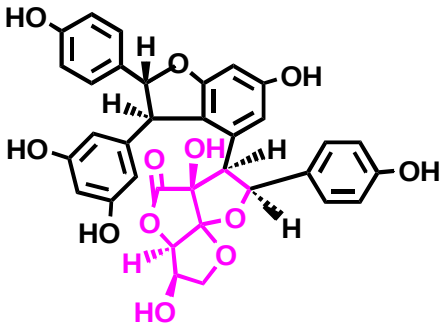
Keanekaragaman struktur molekul senyawa hasil isolasi dari beberapa spesies famili Dipterocarpaceae



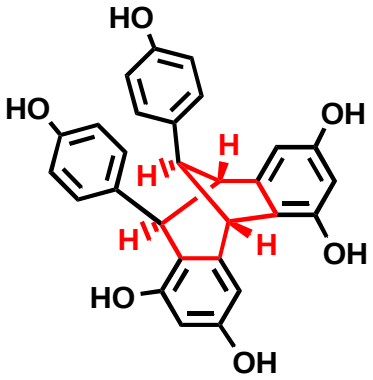
(-)-ε-Viniferin



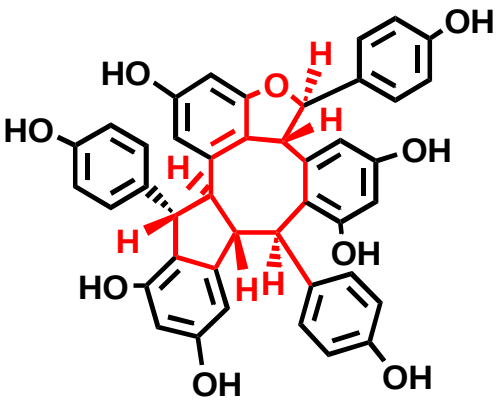
(-)-Ampelopsin A



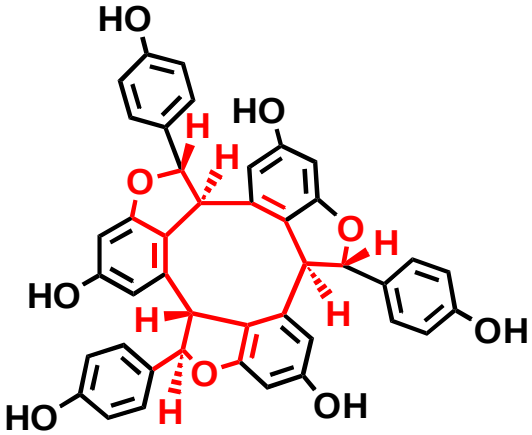
Laevifonol



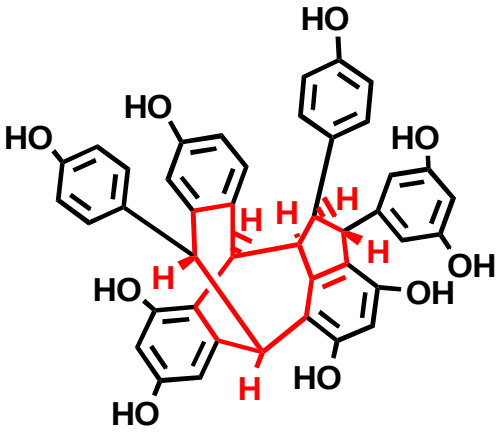
(-)-Ampelopsin F



Stenofilol B

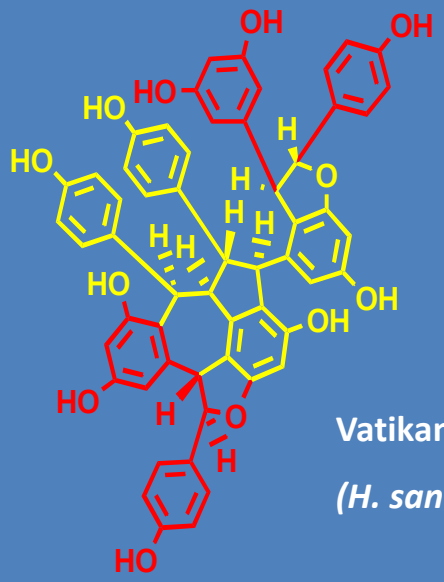


(-)-α-Viniferin



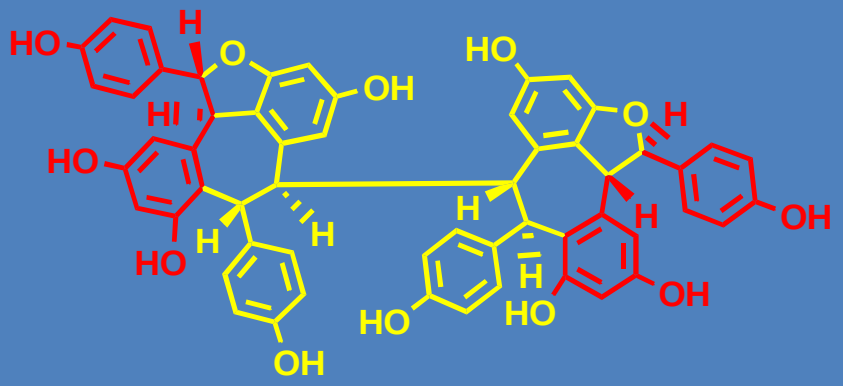
Vatikanol G

Tetramer resveratrol



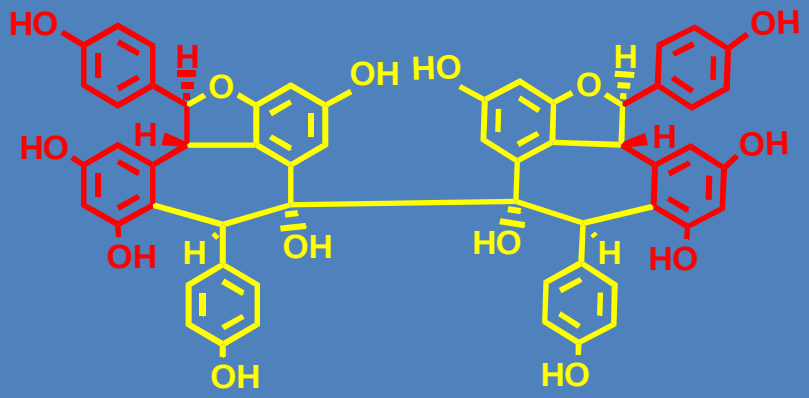
Vatikanol B

***(H. sangal, H. utilis*)**



(-)-hopeafenol

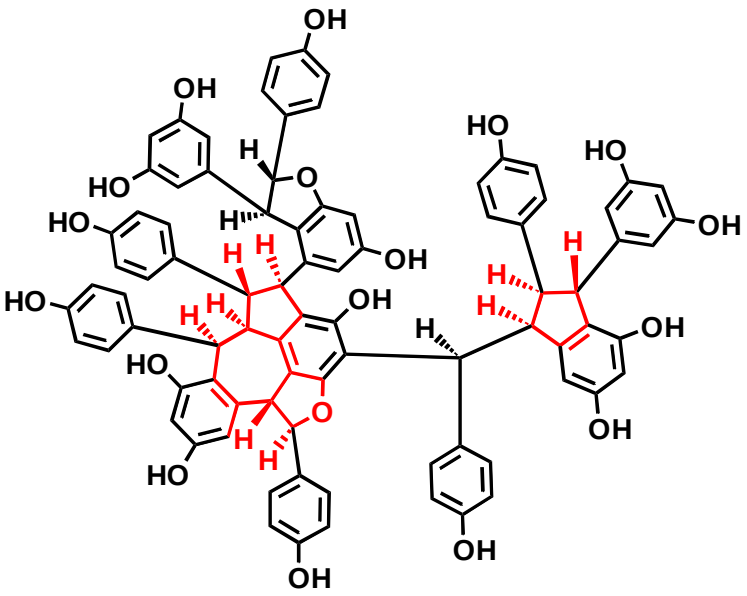
(*H. sangal, H. odorata, H. parviflora, H. utilis, H. bancana*



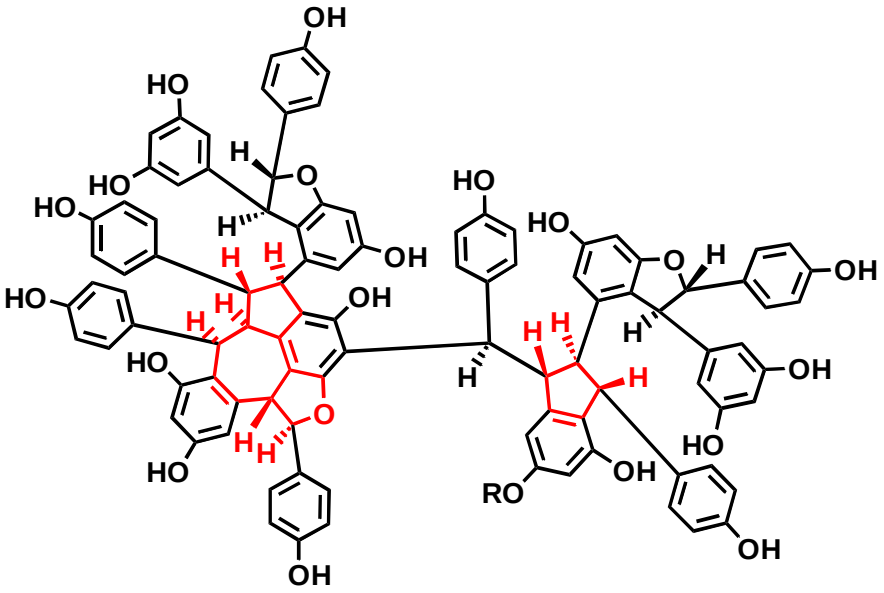
Dibalanokarpol

***(H. malibato*)**

Keanekaragaman struktur molekul senyawa hasil isolasi genus Vatica

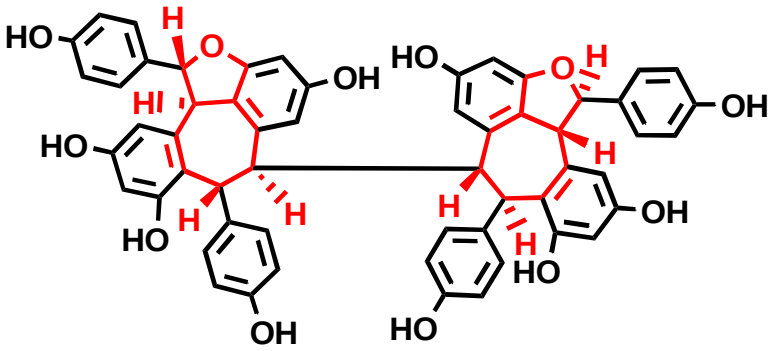


Diptoindonesin E

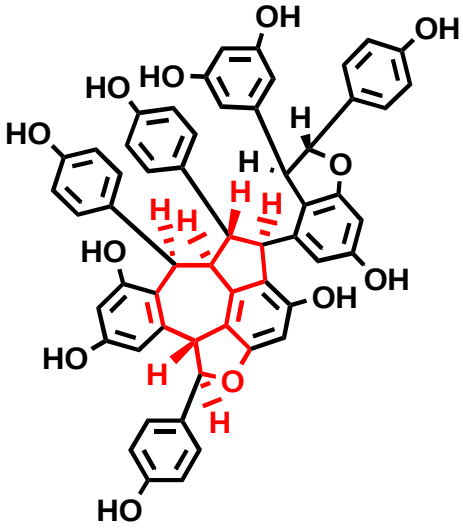


R = H, Diptoindonesin C

R = glu, Diptoindonesin D

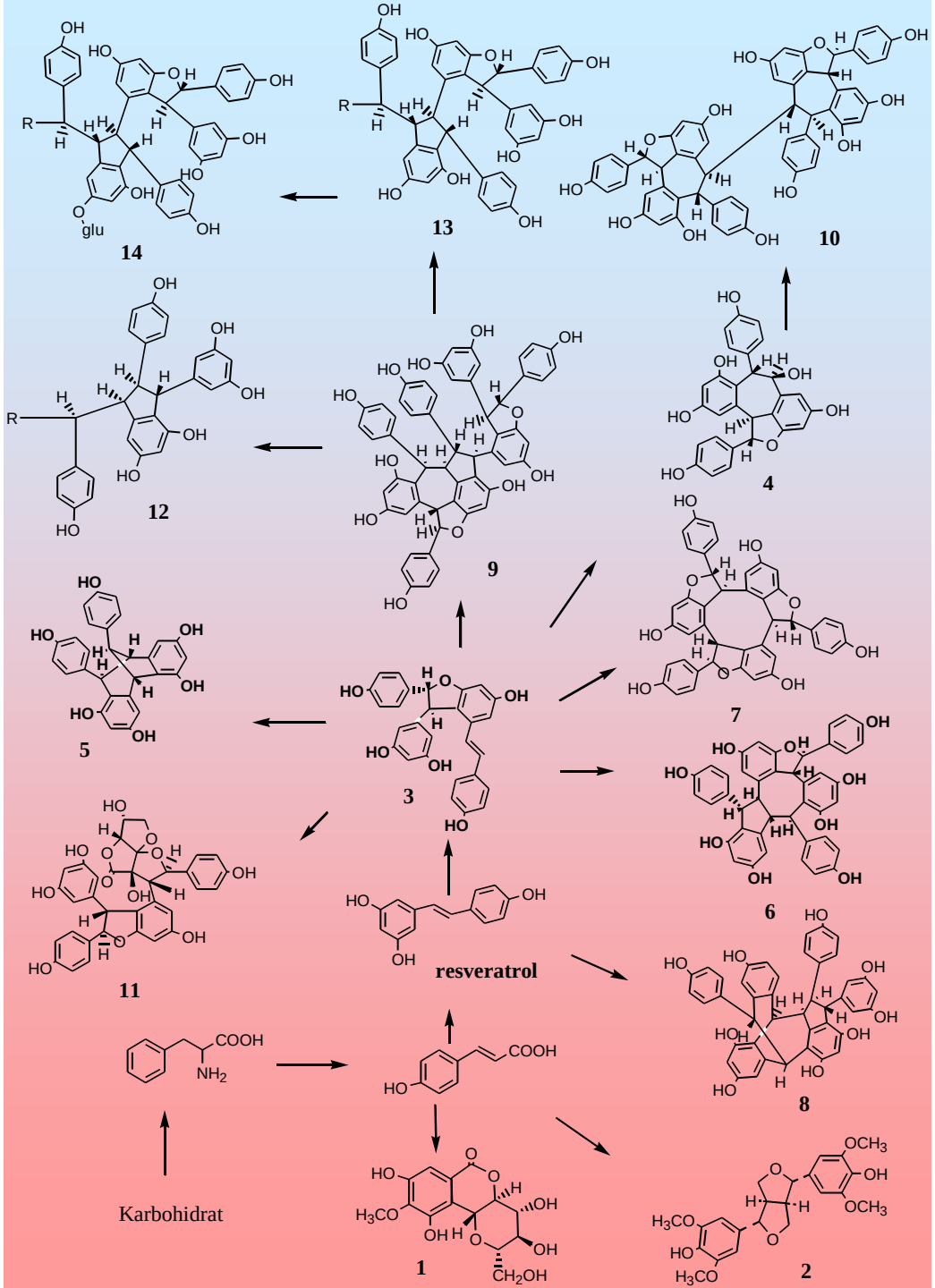


(-)-Hopeafenol

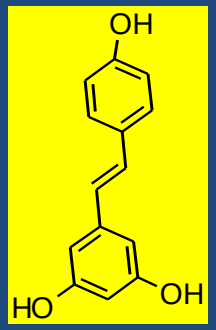


Vatikanol B

Saran Biogenesis Senyawa-senyawa Hasil isolasi

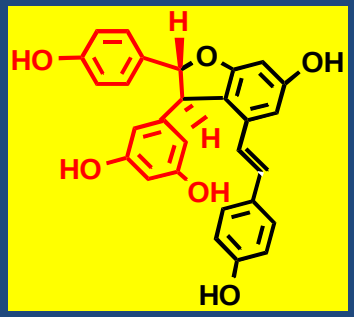


Bioaktivitas senyawa kimia pada tumbuhan Dipterocarpaceae (meranti)



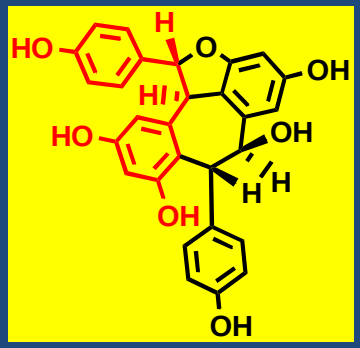
Resveratrol

antikanker



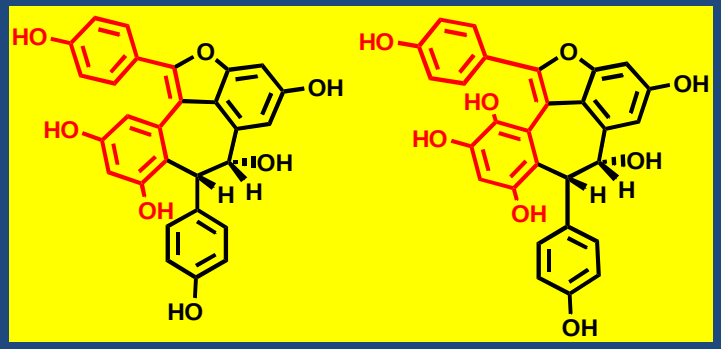
ε –viniferin

antibakteri



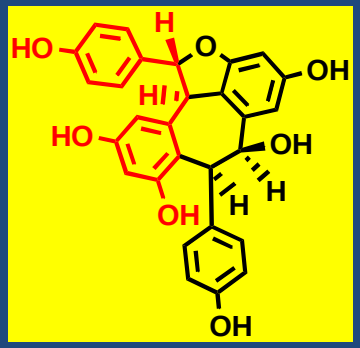
(-)-ampelopsin A

sitotoksik



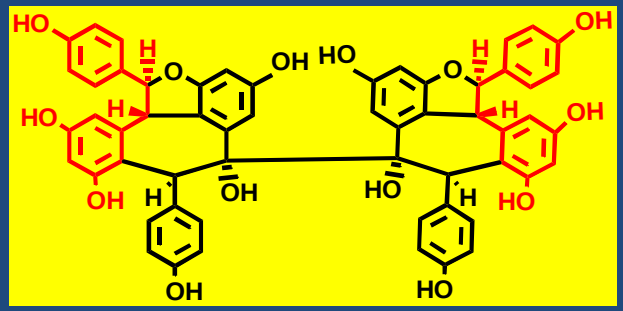
Malibatol A malibatol B

sitotoksik



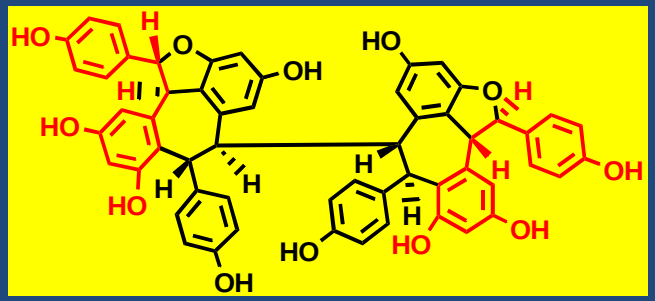
(-)-balanokarpol

Anti HIV



Dibalanokarpol

Anti-HIV

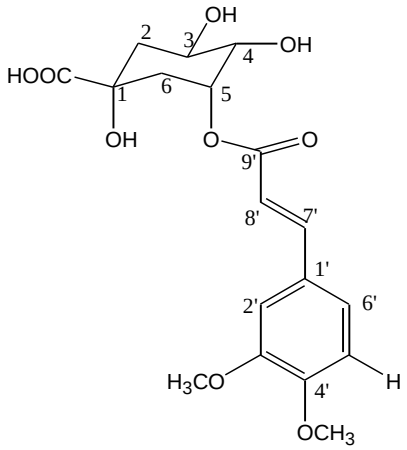


(-)-hopeafenol

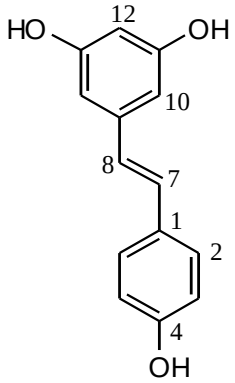
(sitotoksik)

HASIL ISOLASI SENYAWA DARI KULIT BATANG MELINJO (*Gnetum gnemon*)

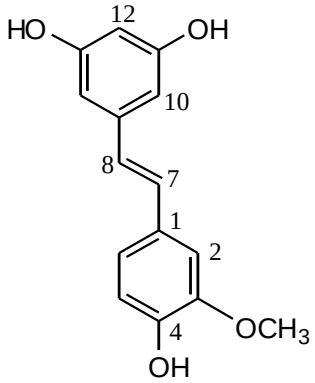
(HB-2006-2007)



3,4-dimetoksiklorogenat



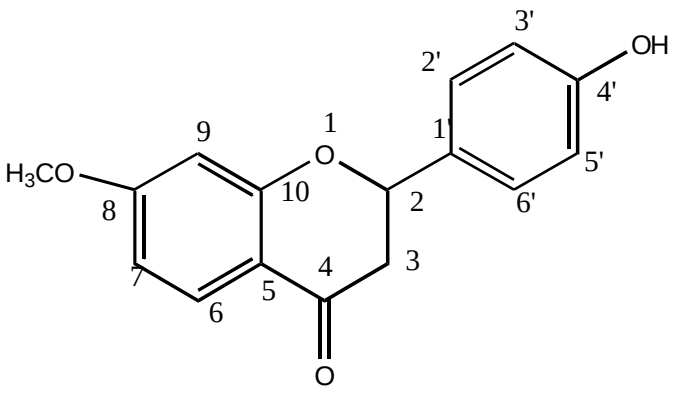
Resveratrol



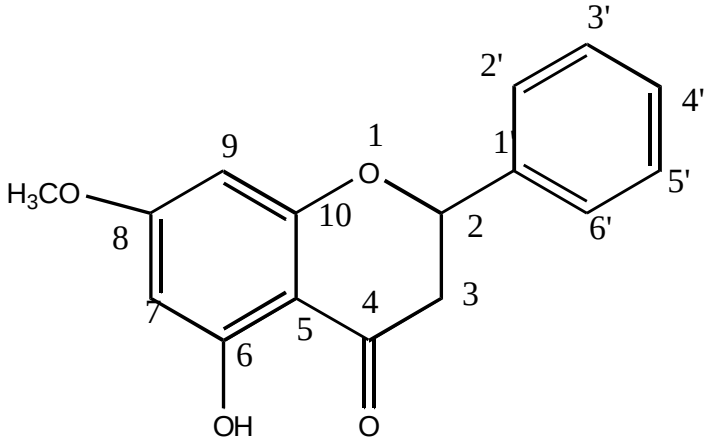
Rampotigenetin

EKSPLORASI SENYAWA ANTIVIRAL (KERJASAMA INTERNASIONAL 2010)

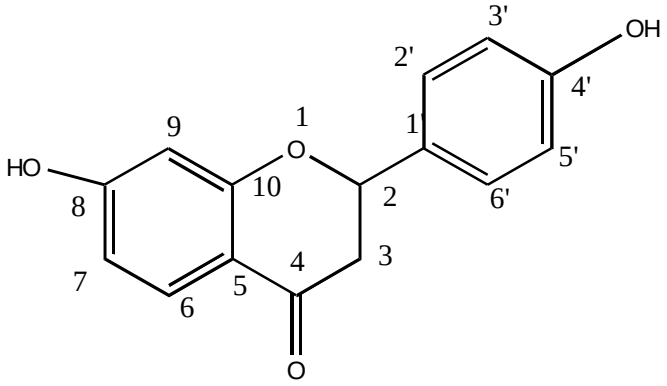
Tiga senyawa flavanon hasil isolasi dari kunci pepet (*Kaempferia rotunda*)



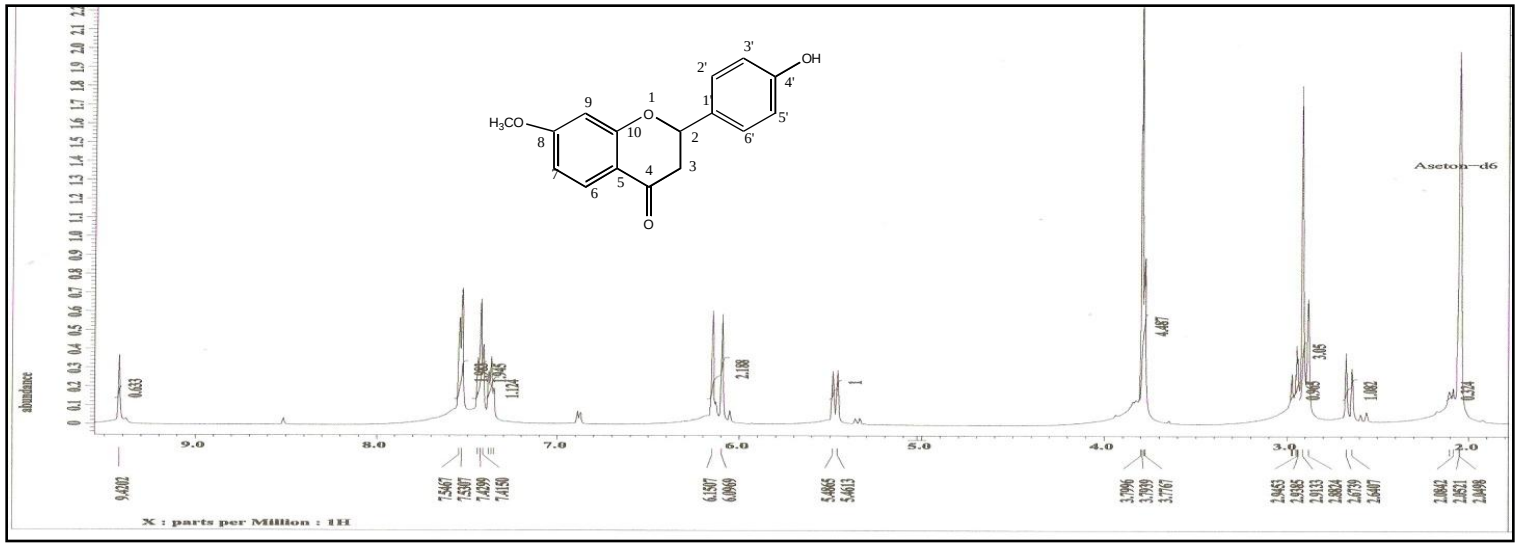
EK1 (4’-hidroksi,8-metoksi-flavanon)

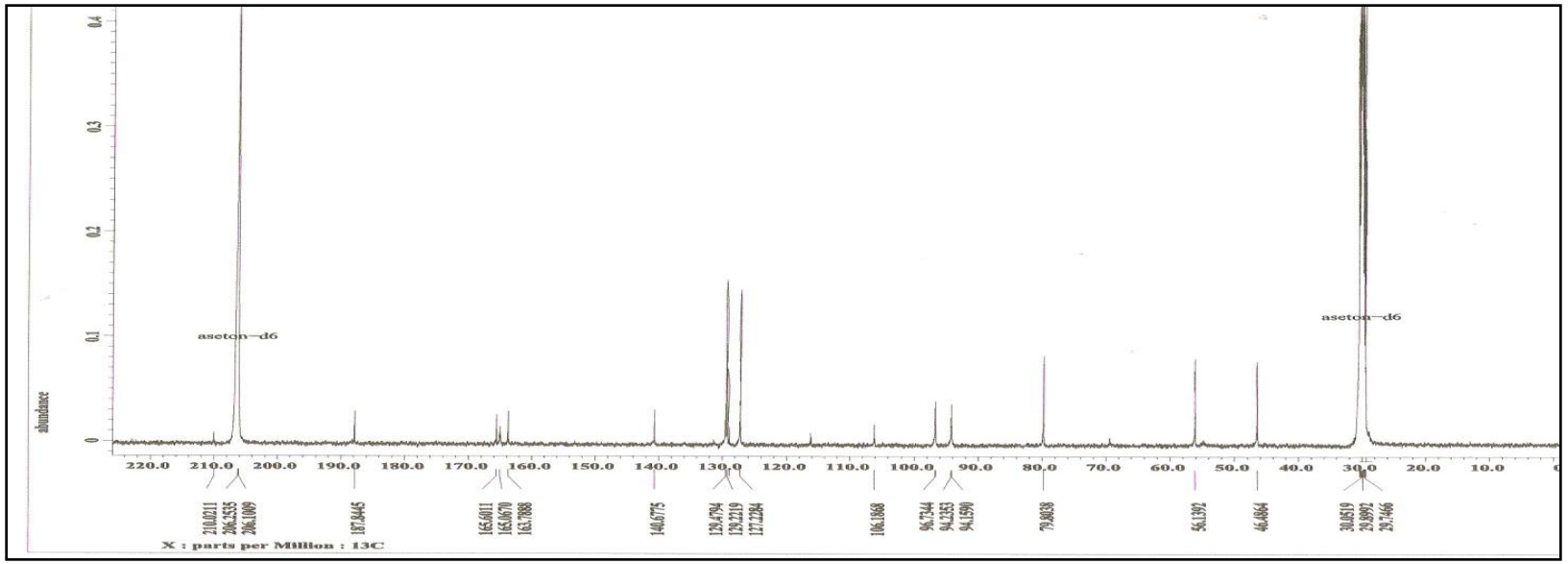


EK2 (6- hidroksi, 8-metoksi-flavanon)

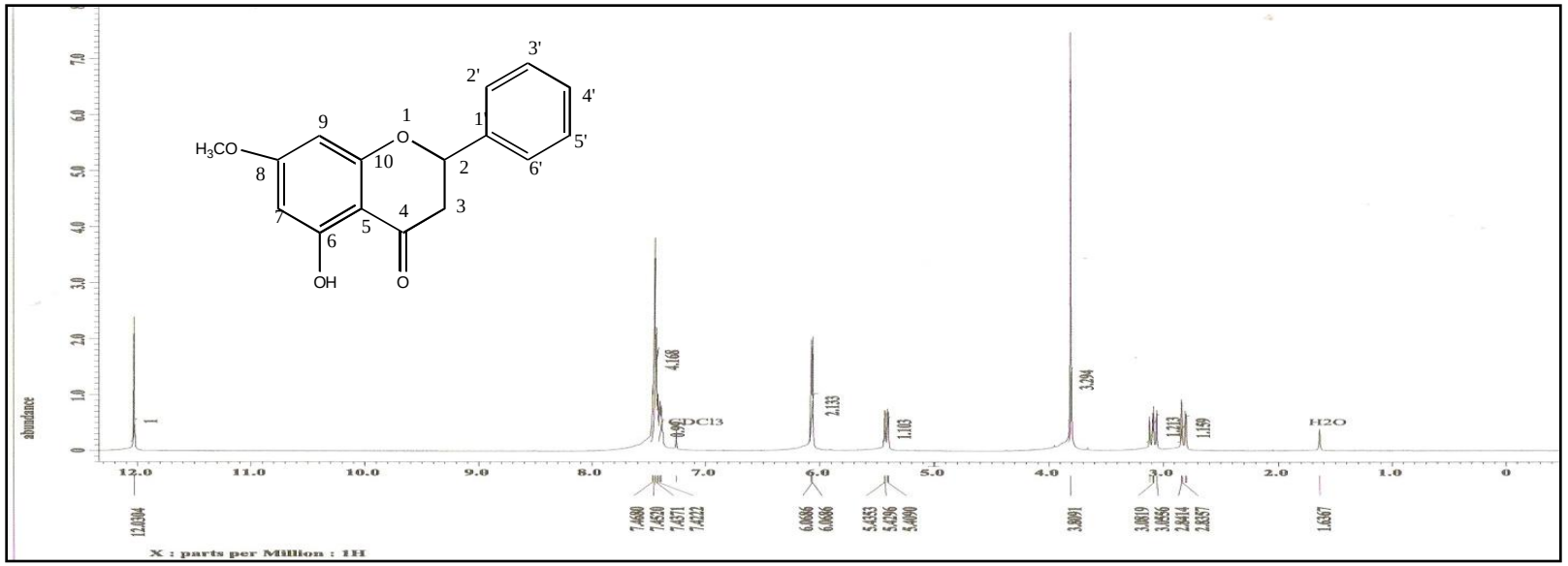


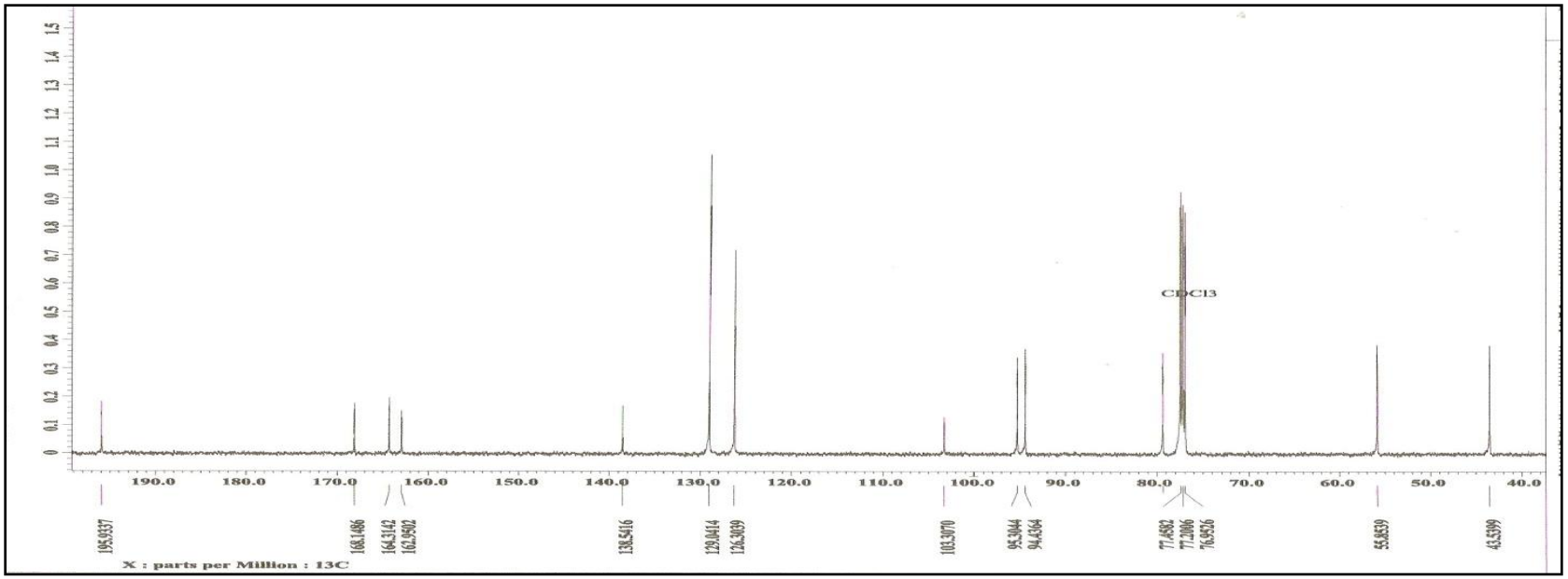
EK3 (4’, 8-dihidroksi-flavanon)



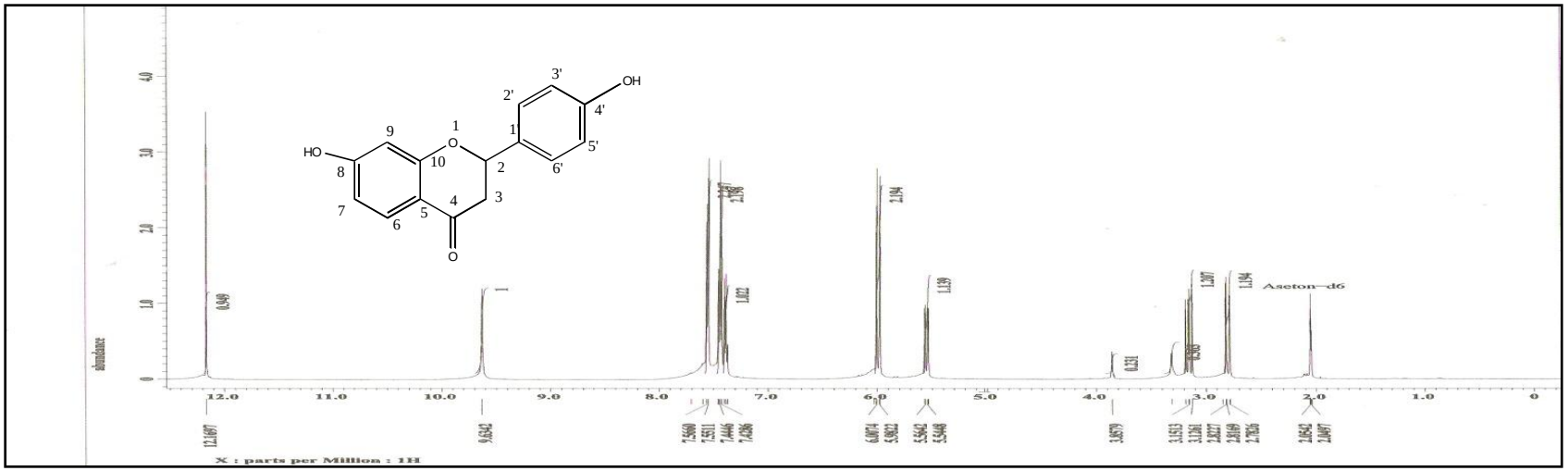


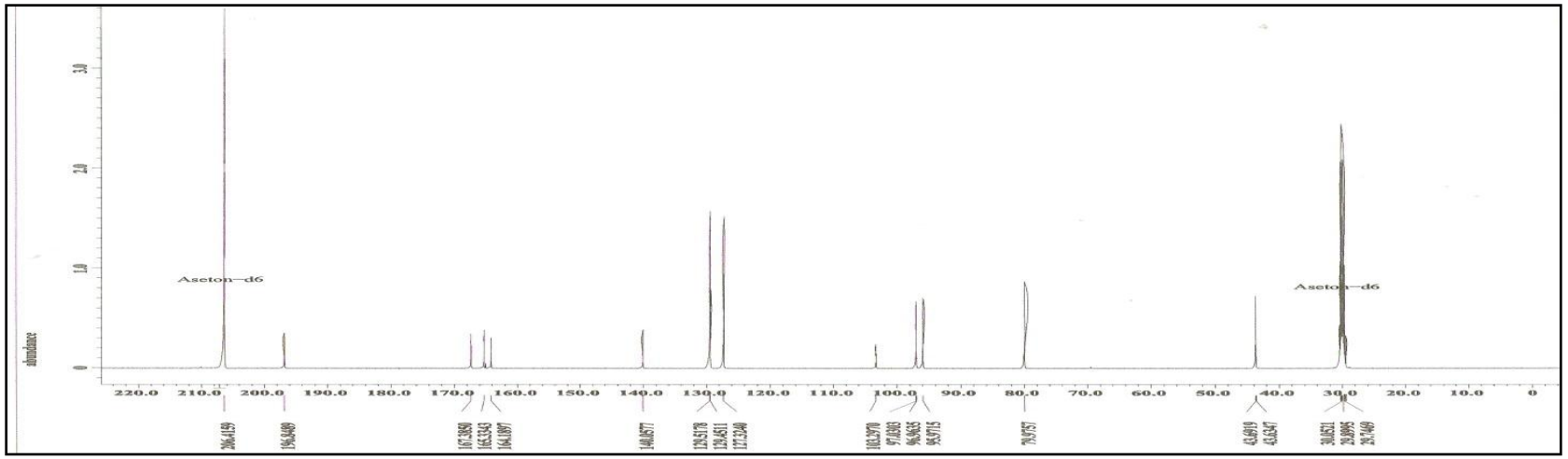
Gambar 4. Spektrum ^{1}H NMR (a) dan ^{13}C NMR (500 MHz dalam aseton-d_6) EK1





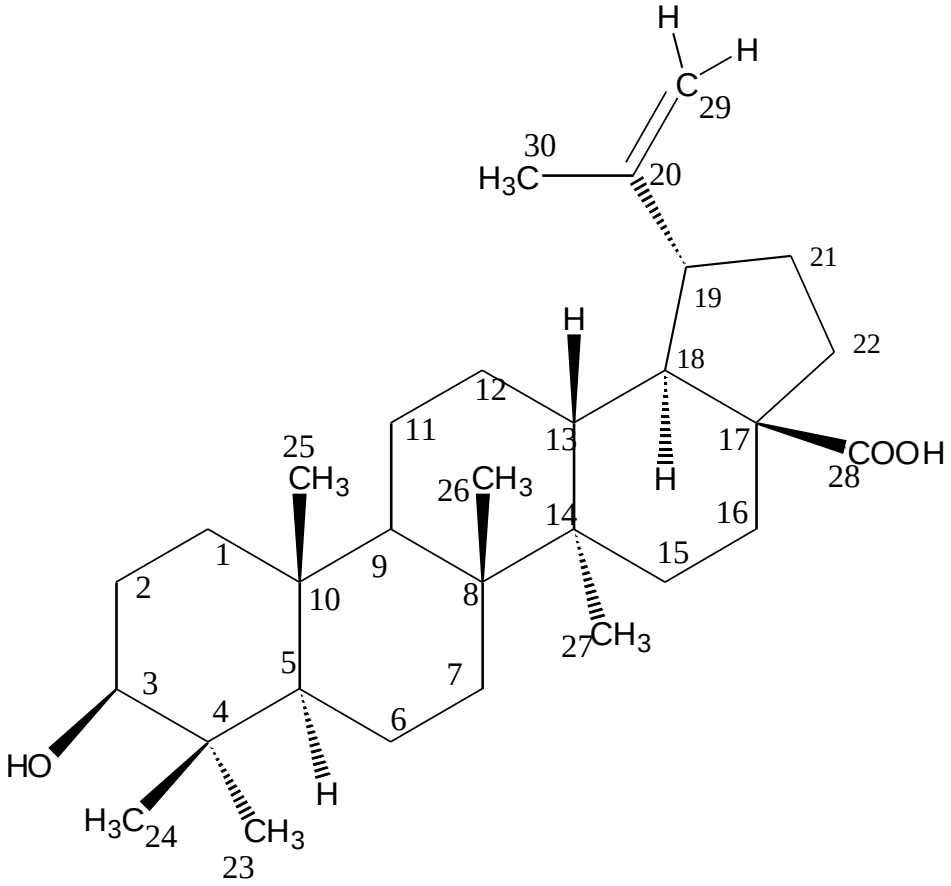
Gambar 5. Spektrum ^{1}H NMR (a) dan ^{13}C NMR (500 MHz dalam $CDCl_3$) EK2





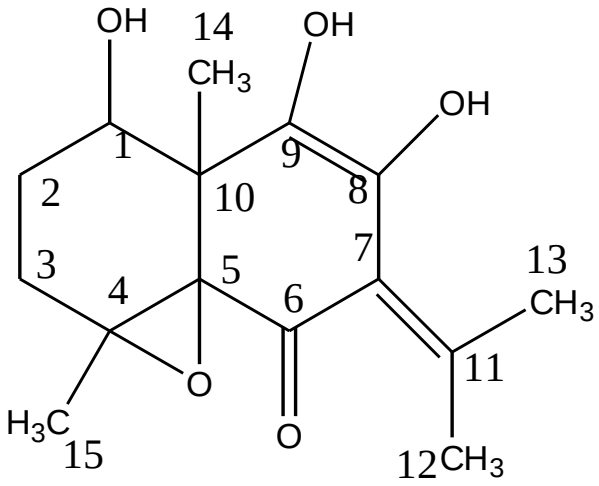
Gambar 6. Spektrum ^{1}H NMR (a) dan ^{13}C NMR (500 MHz dalam aseton-d_6) EK3

EKSPLORASI SENYAWA ANTIMALARIA DARI KULIT BATANG PULAI
(STRANAS-2010)

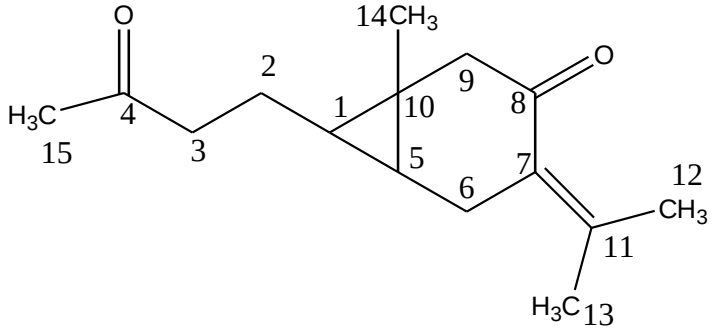


asam betulinat

EKSPLORASI SENYAWA ANTIKANKER DARI TEMU IRENG (*Curcuma aeroginosa*)
(Penelitian Kerjasama UNY-University Of Malaya – 2010)



Seskuiterpen lakton
(kemungkinan senyawa baru)



Kurkumenon

Kendala Pengembangan Potensi Senyawa Kimia dari Tumbuhan

- SARANA LABORATORIUM
- PEMBIAYAAN (DANA RESEARCH)
- SDM

KERJASAMA RESEACRH

Terimakasih