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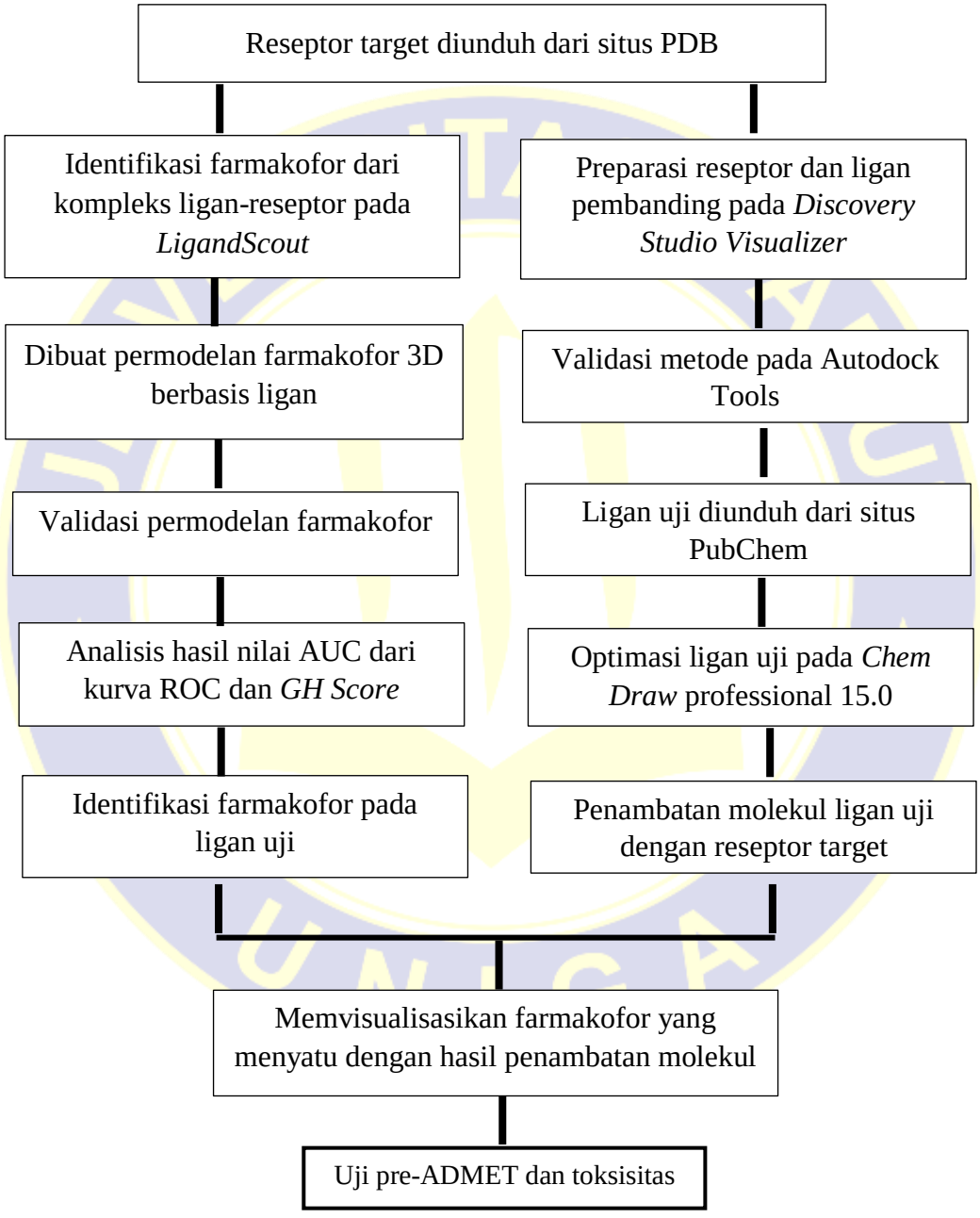
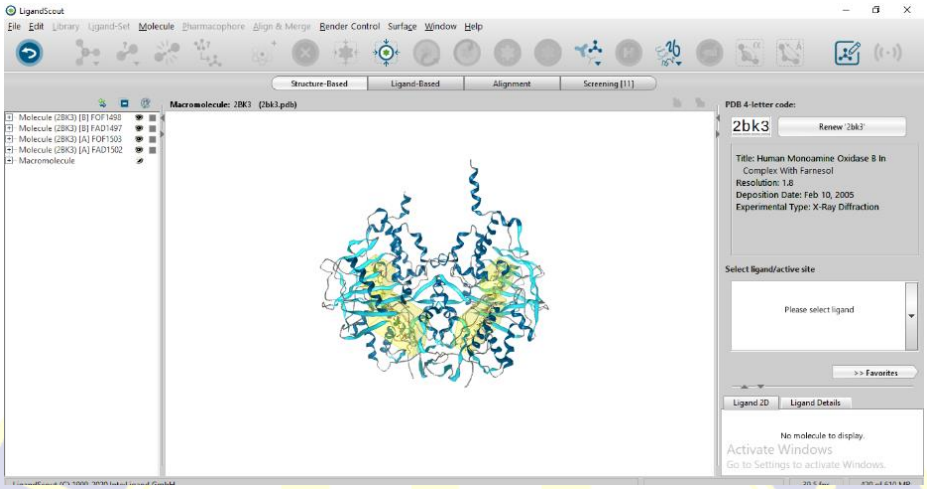
LAMPIRAN 1

ALUR PENELITIAN FARMAKOFOR MODELING DAN MOLECULAR DOCKING

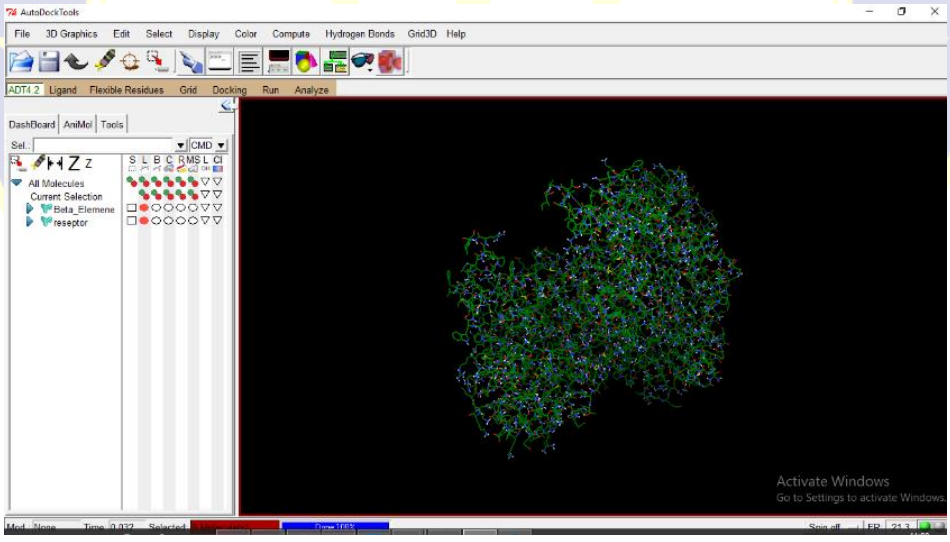


LAMPIRAN 2

APLIKASI DAN SITUS



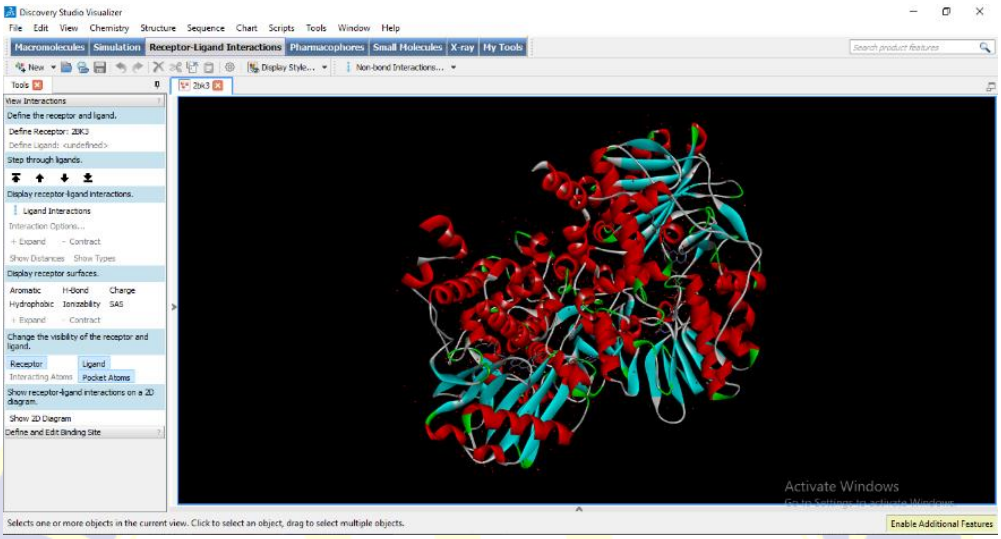
Gambar IV.1 Tampilan LigandScout



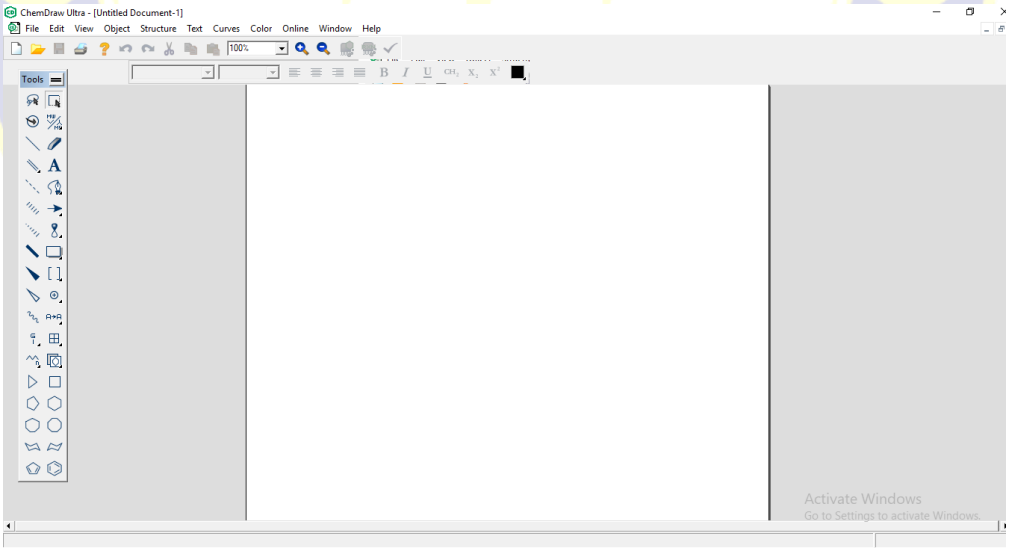
Gambar IV.2 Tampilan Autodock Tools

LAMPIRAN 2

(LANJUTAN)



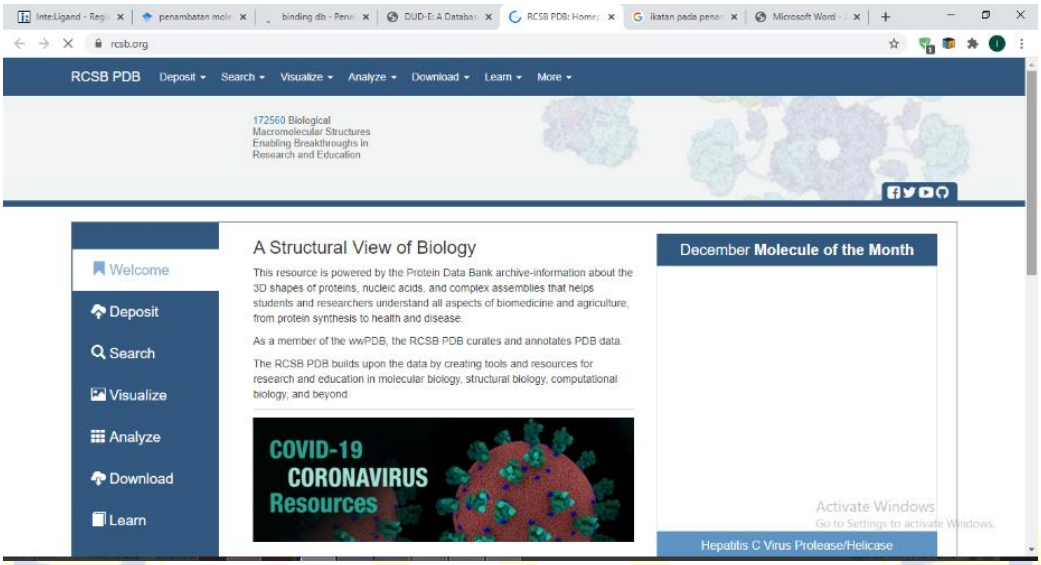
Gambar IV.3 Tampilan Discovery Studio



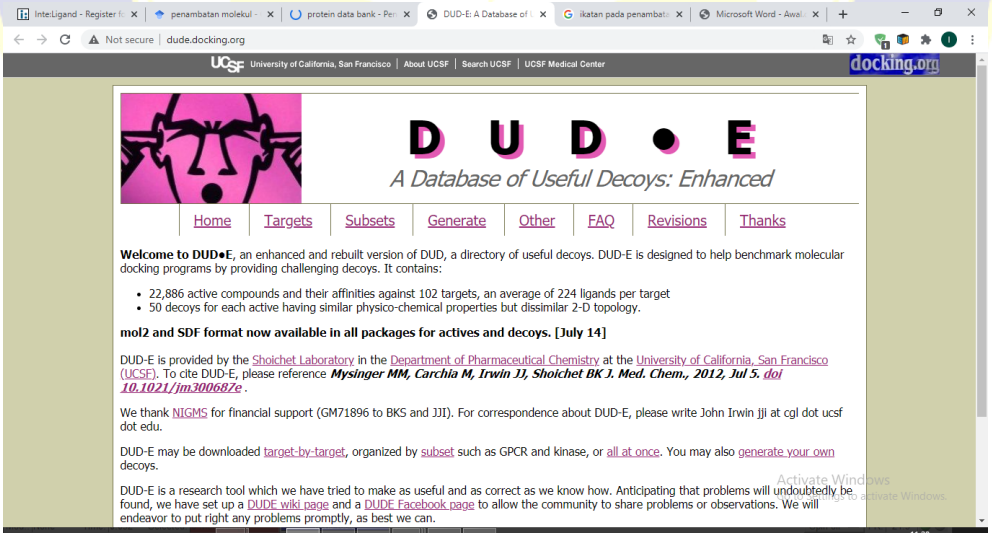
Gambar IV.4 Tampilan ChemDraw 12.0

LAMPIRAN 2

(LANJUTAN)



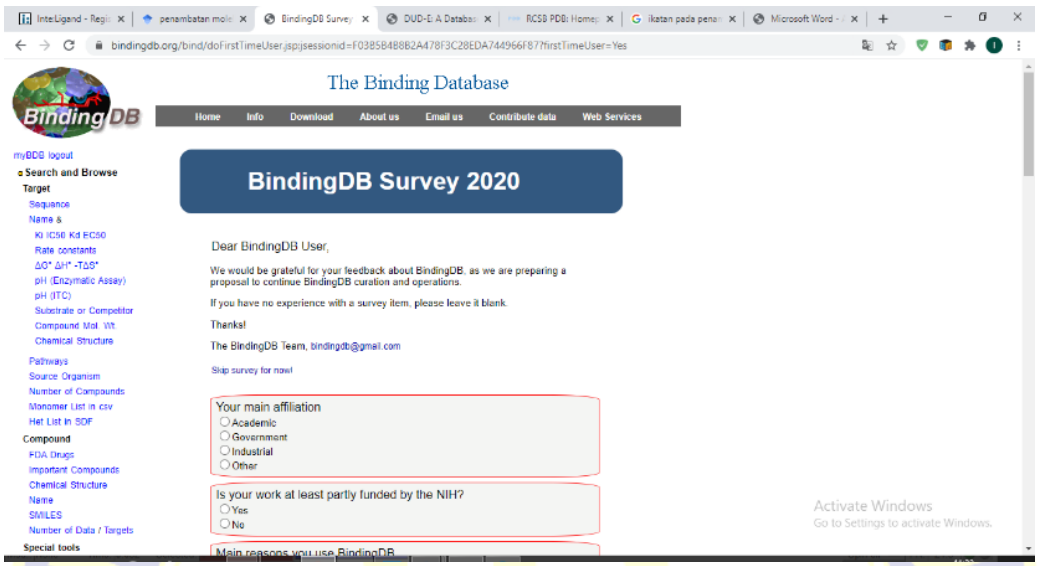
Gambar IV.5 Tampilan situs protein data bank



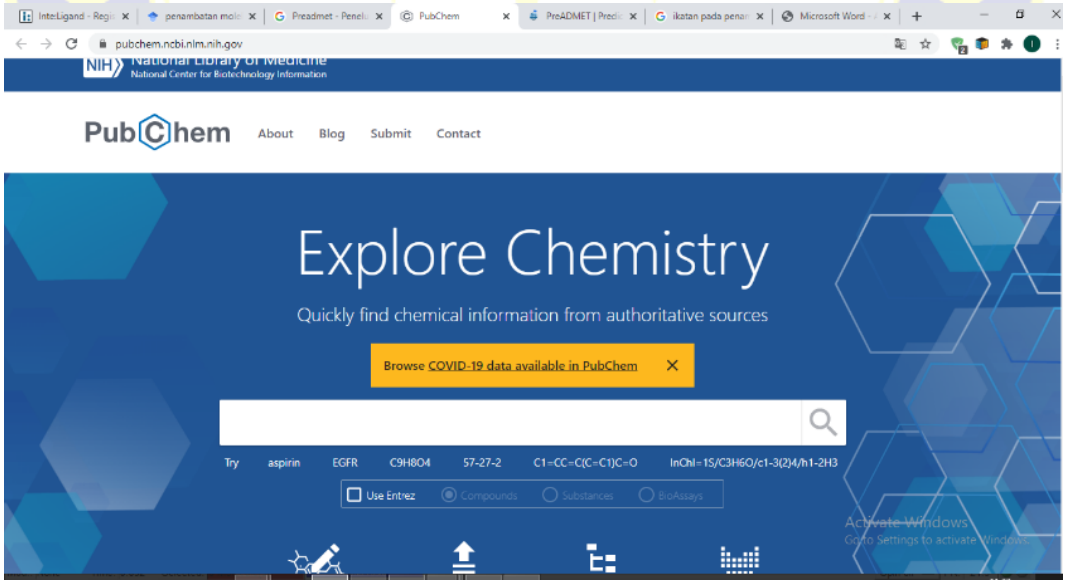
Gambar IV.6 Tampilan situs DUD-E

LAMPIRAN 2

(LANJUTAN)



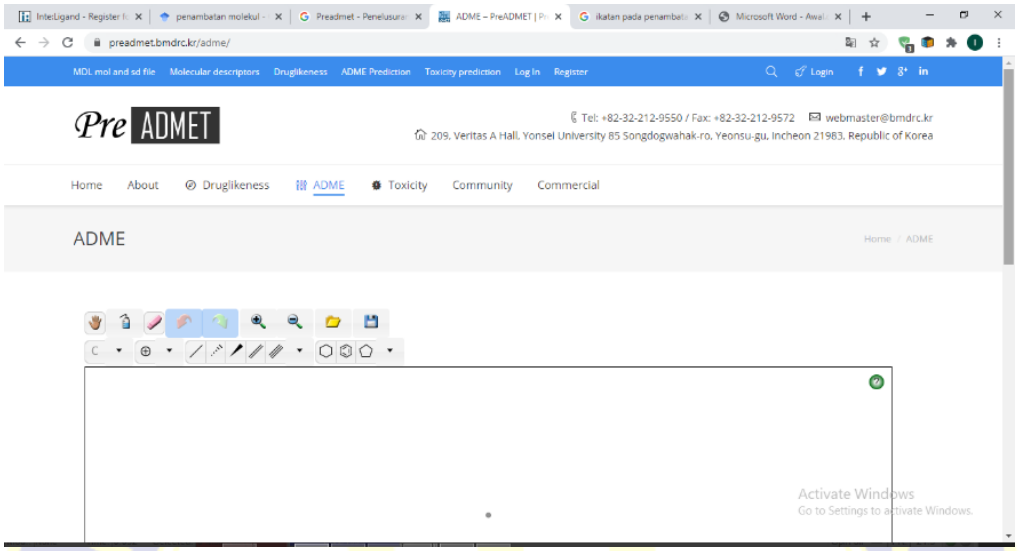
Gambar IV.7 Tampilan situs binding database



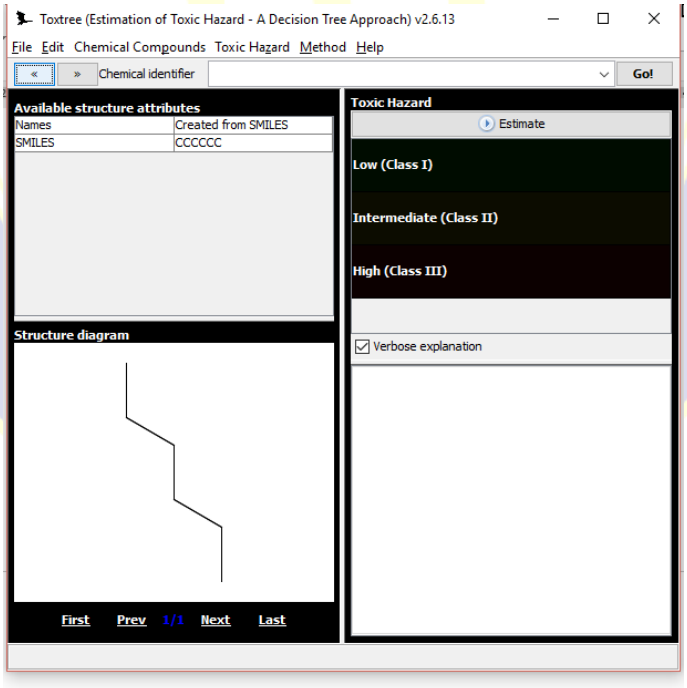
Gambar IV.8 Tampilan situs PubChem

LAMPIRAN 2

(LANJUTAN)



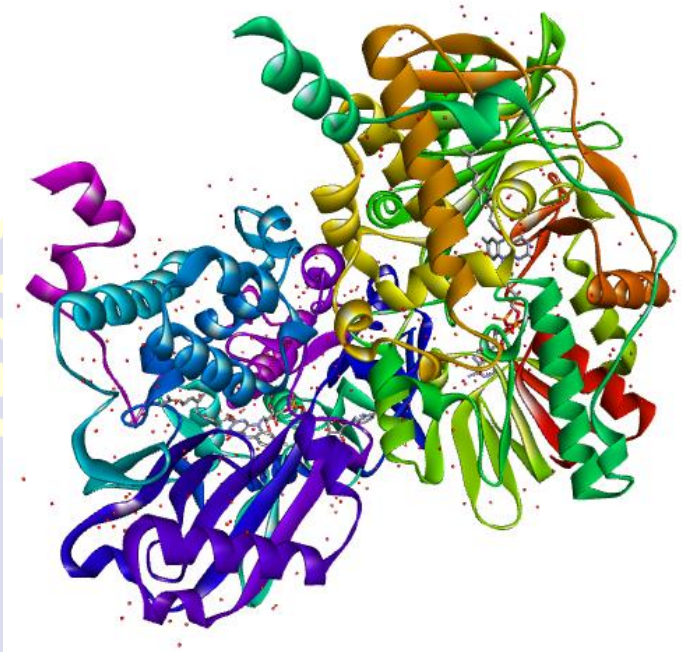
Gambar IV.9 Tampilan situs PreADMET



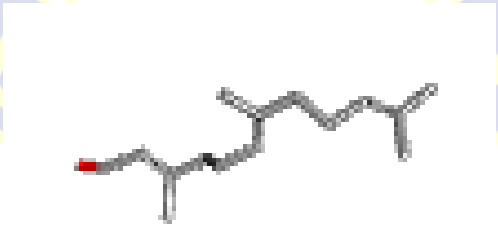
Gambar IV.10 Tampilan situs Aplikasi Toxtree

LAMPIRAN 3

STRUKTUR 3 DIMENSI RESEPTOR MONOAMINE OKSIDASE B DAN LIGAN ALAMI



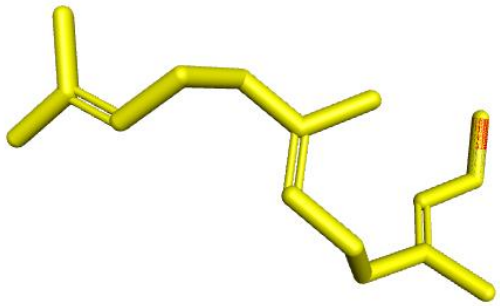
Gambar V.1 Monoamine Oksidase B ID 2BK3



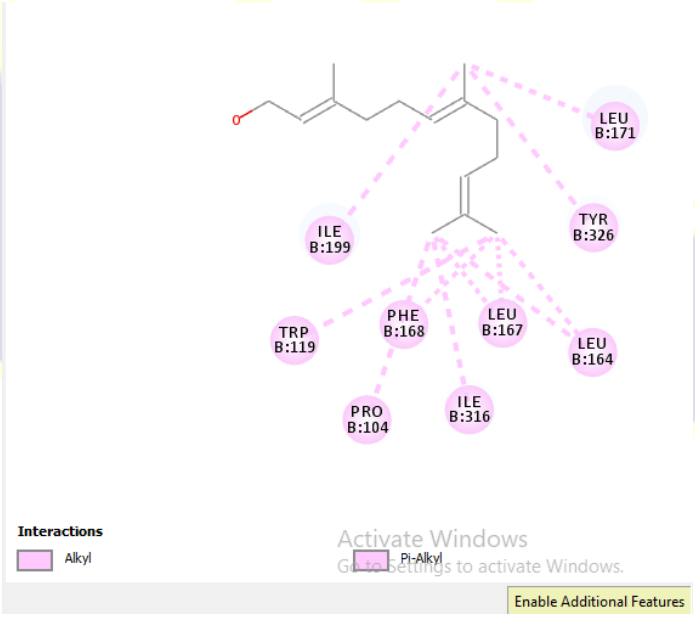
Gambar V.2 Ligan alami

LAMPIRAN 3

(LANJUTAN)



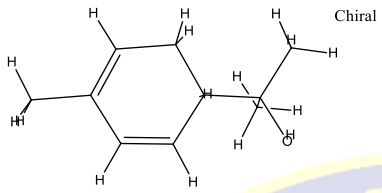
Gambar V.3 Visualisasi tumpang tindih ligan alami 2BK3 (merah-abu putih) dengan hasil *redocking* (kuning)



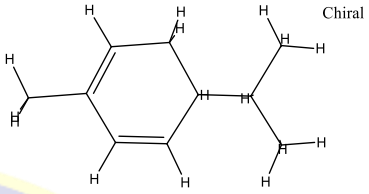
Gambar V.4 Residu Asam Amino

LAMPIRAN 4

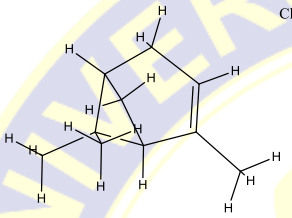
GAMBAR STRUKTUR LIGAN UJI



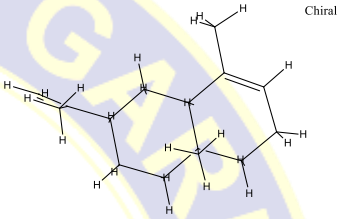
α-Phellandren-8-ol



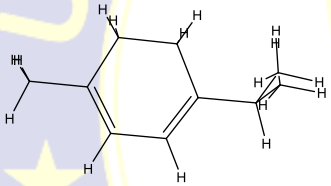
α-Phellandrene



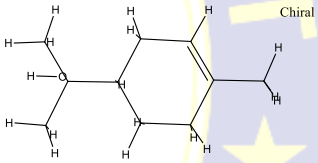
α-Pinene



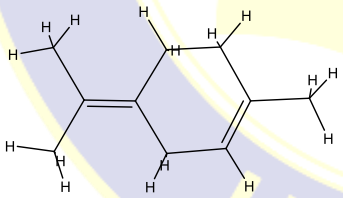
α-Selinene



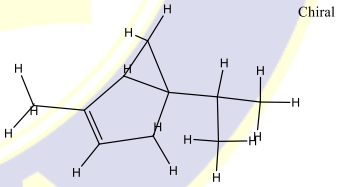
α-Terpinene



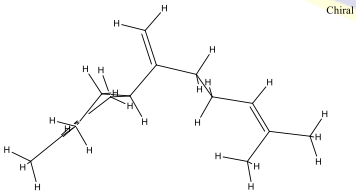
α-Terpineol



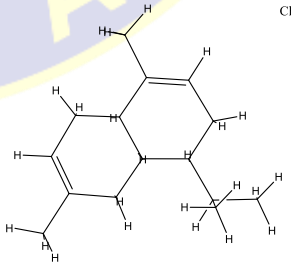
α-Terpinolene



α-Thujene



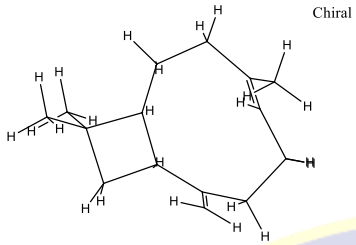
β-Bisabolene



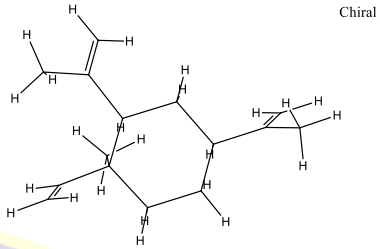
β-Cadinene

LAMPIRAN 4

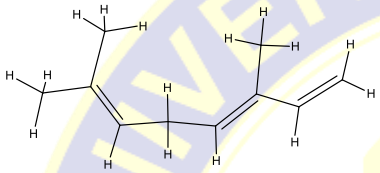
(LANJUTAN)



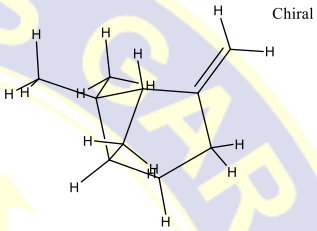
β-Caryophyllene



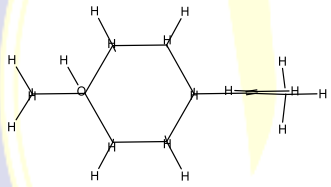
β-Elemene



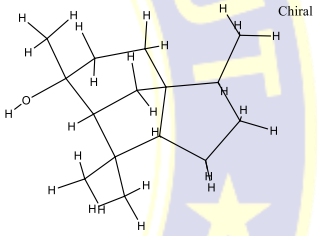
β-Ocimene



β-Pinene



β-Terpineol



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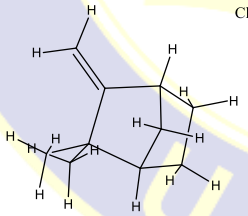
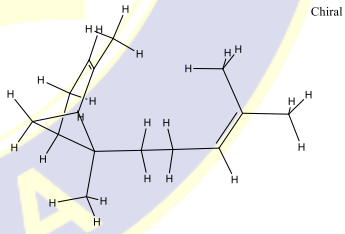
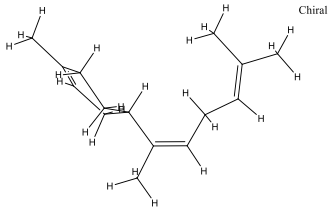


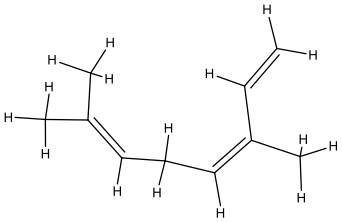
Champene



cis-α-Bergamotene



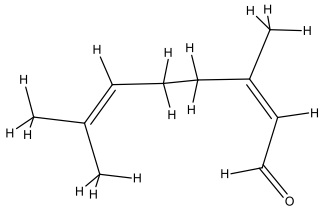
cis-α-Bisabolene



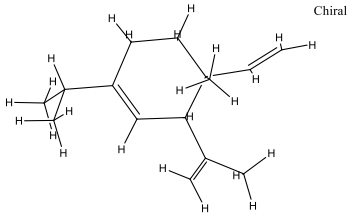
cis-β-Ocimene

LAMPIRAN 4

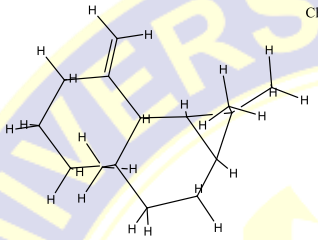
(LANJUTAN)



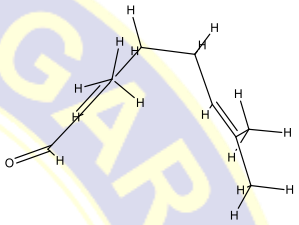
cis-Citral



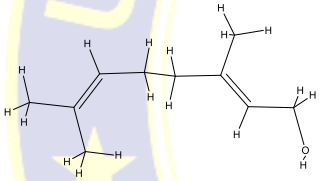
δ-Elemene



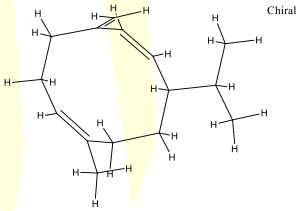
γ-Maaliene



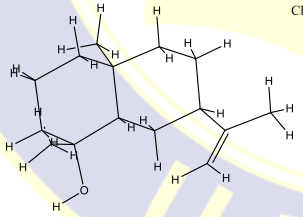
Geranial



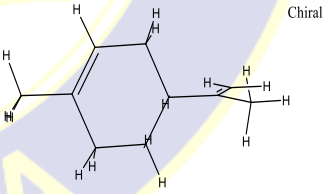
Geraniol



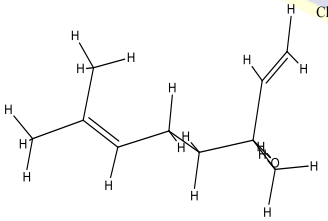
Germacrene-D



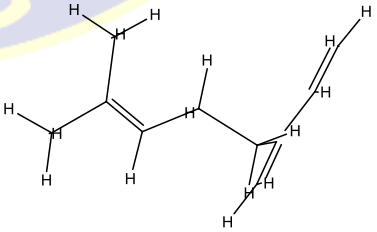
Intermedeol



Limonene



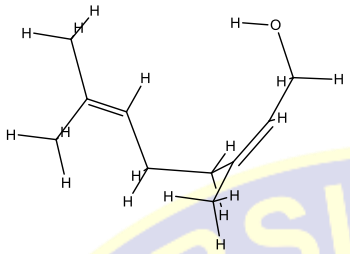
Linalool



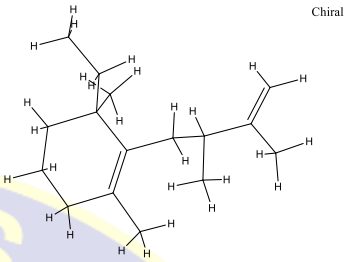
Myrcene

LAMPIRAN 4

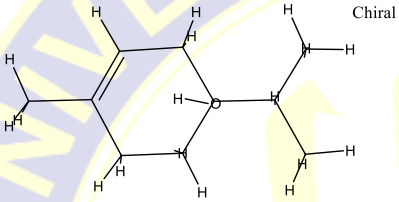
(LANJUTAN)



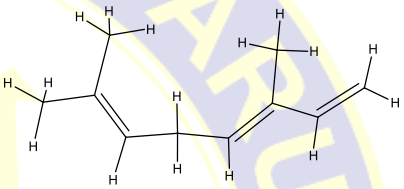
Nerol



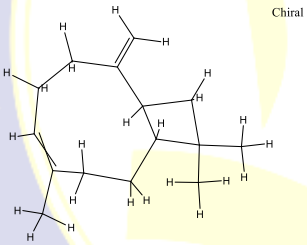
selina-4,11-diene



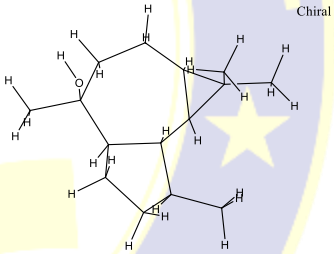
Terpinene-4-Ol



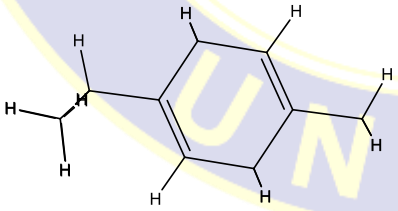
trans-β-Ocimene



trans-Caryophyllene



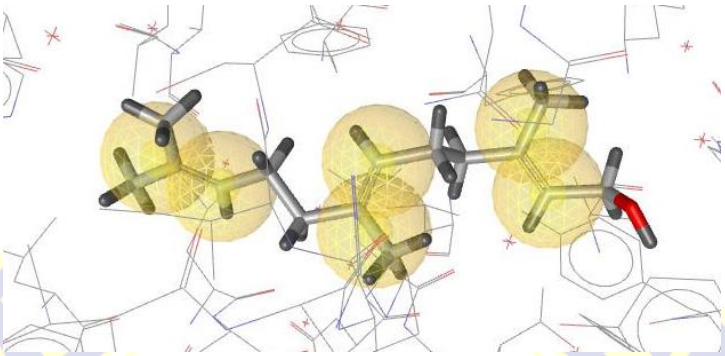
Viridiflorol



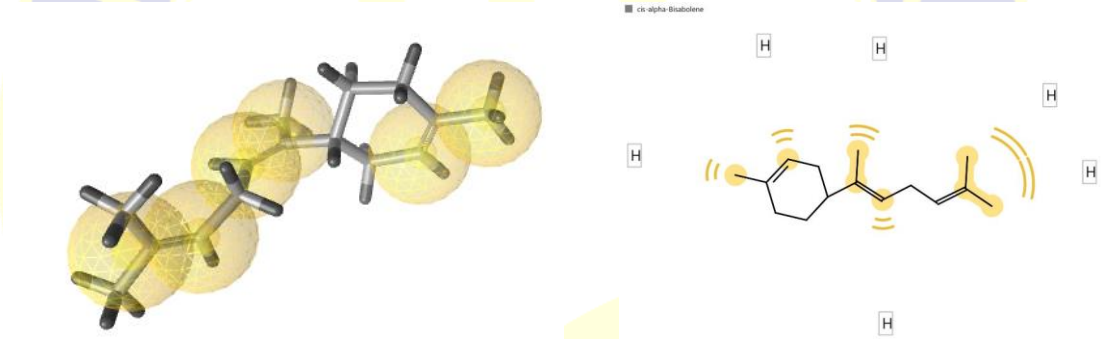
γ-Terpinene

LAMPIRAN 5

SCREENING FARMAKOFOR



Gambar V.5 Visualisasi ligan alami (Farnesol)

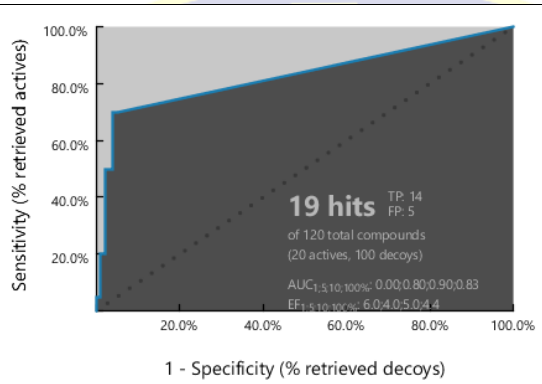


Gambar V.6 Visualisasi hasil *screening* farmakofor ligan uji (cis-α-Bisabolene)

LAMPIRAN 6

HASIL *SCREENING* FARMAKOFOR

Tabel V.1
Hasil Validasi Farmakofor

Reseptor	**ROC *Curve***	**AUC**	**GH *Score***
MAO-B		0.83	0.70

Tabel V.2
Hasil *Screening* Farmakofor

No.	**Nama Senyawa**	***Matching Features***	***Fit Score***
1.	Farnesol (Ligan Pembanding)		-
2.	*cis-α-Bisabolene*		65,91

Keterangan :

Warna biru = Cincin aromatik

Warna kuning = Ikatan hidrofobik

Warna merah = Akseptor ikatan hidrogen

Warna hijau = Donor ikatan hidrogen

LAMPIRAN 7
PREDIKSI *DRUG LIKENESS* BERDASARKAN ATURAN *LIPINSKI'S RULE OF FIVE*

Tabel V.3
Hasil Prediksi *Drug Likeness*

Senyawa	Berat Molekul (gr/mol)	Ikatan Hidrogen		Log P	Keterangan
		Donor	Akseptor		
α-Phellandren-8-ol	152.23	1	1	1.8	Memenuhi Syarat
α-Phellandrene	136.23	0	0	3.2	Memenuhi Syarat
α-Pinene	136.23	0	0	2.8	Memenuhi Syarat
α-Selinene	204.35	0	0	4.2	Memenuhi Syarat
α-Terpinene	136.23	0	0	2.8	Memenuhi Syarat
α-Terpineol	154.25	1	1	1.8	Memenuhi Syarat
α-Terpinolene	136.23	0	0	2.8	Memenuhi Syarat
α-Thujene	136.23	0	0	2.8	Memenuhi Syarat
β-Bisabolene	204.35	0	0	4.2	Memenuhi Syarat
β-Cadinene	204.35	0	0	4	Memenuhi Syarat
β-Caryophyllene	204.35	0	0	4.4	Memenuhi Syarat
β-Elemene	204.35	0	0	4.7	Memenuhi Syarat
β-Ocimene	136.23	0	0	4.3	Memenuhi Syarat
β-Pinene	136.23	0	0	3.1	Memenuhi Syarat
β-Terpineol	154.25	1	1	2.5	Memenuhi Syarat
Cedrol	222.37	1	1	3.9	Memenuhi Syarat
Champene	136.23	0	0	3.3	Memenuhi Syarat
cis-α-Bergamotene	204.35	0	0	4.8	Memenuhi Syarat
cis-α-Bisabolene	204.35	0	0	3	Memenuhi Syarat
cis-β-Ocimene	136.23	0	0	4.3	Memenuhi Syarat
cis-Citral	152.23	0	1	3	Memenuhi Syarat
δ-Elemene	204.35	0	0	4.7	Memenuhi Syarat
γ-Maaliene	204.35	0	0	4.9	Memenuhi Syarat
Geranial	152.23	0	1	3	Memenuhi Syarat
Geraniol	154.25	1	1	2.9	Memenuhi Syarat
Germacrene-D	204.35	0	0	4.7	Memenuhi Syarat
Intermedeol	222.37	1	1	4.5	Memenuhi Syarat
Limonene	136.23	0	0	3.4	Memenuhi Syarat

LAMPIRAN 7

(LANJUTAN)

Tabel V.3
Lanjutan

Senyawa	Berat Molekul (gr/mol)	Ikatan Hidrogen		Log P	Keterangan
		Donor	Akseptor		
Myrcene	136.23	0	0	4.3	Memenuhi Syarat
Linalool	154.25	1	1	2.7	Memenuhi Syarat
Nerol	154.25	1	1	2.9	Memenuhi Syarat
selina-4,11-diene	220.39	0	0	5.2	Memenuhi Syarat
Terpinen-4-OL	154.25	1	1	2.2	Memenuhi Syarat
trans-β-Ocimene	136.23	0	0	4.3	Memenuhi Syarat
trans-Caryophyllene	04.35	0	0	4.4	Memenuhi Syarat
Viridiflorol	222.37	1	1	3.7	Memenuhi Syarat
γ-Terpinene	136.23	0	0	2.8	Memenuhi Syarat

Keterangan: BM (Berat molekul) <500 Dalton, Log P <5, Donor ikatan hidrogen <5 dan Akseptor ikatan hidrogen <10.

LAMPIRAN 8
HASIL PENAMBATAN MOLEKUL LIGAN UJI PADA RESEPTOR MONOAMINE OKSIDASE B

Tabel V.4
Hasil Validasi Reseptor

Reseptor	Grid Box	RMSD	ΔG (Energi Bebas)
Monoamine oksidase-B (2bk3)	X : 15.718 Y: 127.139 Z: 23.683	1.586 Å	-7.63 kcal/mol

Tabel V.5
Hasil Penambatan Molekul Ligan Uji

No	Senyawa / Ligan	ΔG (kkal/mol)	Residu Asam Amino	KI (nM)
1	Ligan Alami/ Farnesol (2bk3)	-7.63	B:LEU199; B:TYR326; B:PHE168; B:TRP119; B:PRO104; B:ILE316; B:LEU164; B:LEU171; B:LEU167	2.57
2	α-Phellandren-8-ol	-6.18	B:ILE199; B:PHE168; B:ILE198; B:LEU171; B:LEU167; B:CYS172	29.30
3.	α-Phellandrene	-6.08	B:TRP199; B:PRO104; B:LEU164; B:LEU167; B:TYR326; B:PHE168; B:LEU171; B:ILE199	34.66

LAMPIRAN 8
(LANJUTAN)
Tabel V.5
Lanjutan

4.	α-Pinene	-6.32	B:LEU167; B:PHE168; B:TYR326; B:LEU171	
5.	α-Selinene	-8.65	B:LEU167; B:PHE168; B:LEU171; B:TRP199; B:PRO104; B:ILE316; B:TYR326; B:ILE199; B:PHE103; B:LEU164	455.11
6.	α-Terpinene	-6.06	B:LEU171; B:ILE199; B:CYS172; B:TYR326; B:PHE168; B:LEU167; B:ILE316; B:PRO104	36.22
7.	α-Terpineol	-6.10	B:CYS172; B:PHE168; B:TRP199; B:ILE316; B:LEU167; B:LEU164; B:LEU	33.50
8.	α-Terpinolene	-6.08	B:TYR326; B:HE168; B:CYS172; B:LEU171; B:ILE199; B:TRP119; B:PRO104; B:PHE103	35.10
9.	α-Thujene	-5.52	B:LEU171; B:CYS172; B:ILE199; B:PHE168; B:LEU164; B:PRO104; B:TRP119; B:ILE316	89.64
10.	β-Bisabolene	-8.13	B:TYR60; B:LEU326; B:PHE343; B:TYR435; B:TYR326; B:ILE198; B:LEU171; B:ILE199; B:CYS172	1.09
11.	β-Cadinene	-8.39	B:TYR435; B:ILE198; B:TYR398; B:TYR60; B:LEU328; B:PHE343; B:PHE168; B:TYR326;	703.14

LAMPIRAN 8
(LANJUTAN)
Tabel V.5
Lanjutan

			B:ILE199; B:LEU171; B:CYS172	
12.	β-Caryophyllene	-7.77	B:ILE198; B:CYS172; B:TYR435; B:LEU171; B:PHE343; B:TYR60; B:TYR398	2.01
13.	β-Elemene	-8.16	B:CYS172; B:PHE168; B:TRP119; B:LEU164; B:LEU167; B:ILE316; B:TYR326; B:PRO104; B:LEU171; B:ILE199	1.05
14.	β-Ocimene	-5.60	B:ILE198; B:TYR326; B:CYS172; B:LEU171; B:ILE199; B:PHE168; B:ILE316; B:PRO104; B:LEU167; B:LEU164	78.98
15.	β-Pinene	-6.45	B:PHE168; B:PHE103; B:LEU164; B:PRO104; B:LEU167; B:TRP119; B:ILE199; B:LEU171; B:ILE316	18.75
16.	β-Terpineol	-6.11	B:PRO104; B:ILE199; B:PHE168; B:TRP119; B:LEU167; B:LEU164; B:LEU171; B:ILE316; B:PRO102	33.28
17.	Cedrol	-7.89	B:PHE168; B:ILE199; B:CYS172; B:LEU171; B:ILE198; B:TYR326; B:PHE343; B:LEU328	1.65
18.	Champene	-6.34	B:ILE199; B:PRO104; B:LEU167; B:TRP119; B:TYR326; B:LEU164;	22.70

LAMPIRAN 8
(LANJUTAN)
Tabel V.5
Lanjutan

			B:PHE168; B:ILE3316; B:LEU171	
19.	cis-α-Bergamotene	-8.19	B:PHE168; B:PHE103; B:LEU167; B:PRO104; B:ILE199; B:TRP119; B:ILE316; B:LEU164; B:LEU171; B:CYS172; B:TYR316	997.85
20.	cis-α-Bisabolene	-8.22	B:LEU328; B:PHE343; B:TYR326; B:TYYR60; B:ILE199; B:LEU171; B:CYS172; B:ILE198	940.38
21.	cis-β-Ocimene	-5.56	B:PRO104; B:ILE316; B:TRP119; B:PHE168; B:ILE199; B:TYR326; B:CYS172; B:LEU171	84.31
22.	cis-Citral	-5.50	B:CYS172; B:LEU171; B:TYR326; B:ILE199; B:TRP119; B:ILE316; B:PRO104; B:LEU164; B:LEU167	92.68
23.	δ-Elemene	-8.40	B:PRO104; B:LEU167; B:ILE199; B:LEU164; B:ILE316; B:TRP119; B:LEU171; B:PHE168; B:ILE198; B:CYS172; B:TYR326	698.48
24.	γ-Maaliene	-8.16	B:ILE316; B:LEU167; B:TYR326; B:LEU171; B:ILE198; B:PHE168; B:CYS172; B:ILE199	1.05
25.	Geranial	-5.31	B:ILE199; B:TRP119; B:PRO104; B:LEU171;	129.02

LAMPIRAN 8
(LANJUTAN)
Tabel V.5
Lanjutan

			B:CYS172; B:PHE168; B:LEU164	
26.	Geraniol	-5.79	B:ILE198; B:ILE199; B:CYS172; B:LEU171;	57.10
27.	Germacrene-D	-7.98	B:LEU171; B:TYR326; B:ILE199; B:TYR435; B:ILE198; B:CYS172; B:PHE168; B:TYR398; B:PHE343	1.42
28.	Intermedeol	-7.65	B:TYR60; B:YR435; B:TYR326; B:LEU171; B:PHE343; B:TYR398	2.46
29.	Limonene	-6.00	B:LEU167; B:LEU164; B:PRO104; B:TRP119; B:ILE199; B:LEU171; B:CYS172; B:PHE168	39.76
30.	Linalool	-5.28	B:PHE168; B:ILE199; B:TYR326; B:TYR398; B:LEU171	135.73
31.	Myrcene	-5.36	B:TRP119; B:LEU164; B:LEU167; B:ILE199; B:CYS172; B:LEU171; B:ILE198	117.18
32.	Nerol	-5.57	B:ILE199; B:PHE168; B:TYR326; B:LEU171; B:TYR398; B:PHE343; B:CYS172	83.13
33.	selina-4,11-diene	-7.40	B:TYR435; B:TYR398; B:LEU328;B:PHE343; B:TYR60; B:TYR326; B:LEU171; B:ILE198	3.76
34.	Terpinen-4-OL	-6.09	B:CYS172; B:PHE168; B:LEU171; B:PHE343;	34.08

LAMPIRAN 8
(LANJUTAN)
Tabel V.5
Lanjutan

			B:TYR398; B:TYR326; B:ILE199; B:ILE198	
35.	trans-β-Ocimene	-5.59	B:TYR398; B:CYS172; B:LEU171; B:167; B:PHE168; B:ILE199	79.39
36.	trans-Caryophyllene	-8.29	B:LEU171; B:CYS172; B:PHE168; B:ILE199; B:ILE198; B:LEU328; B:TYR326; B:TYR435; B:PHE343; B:TYR398; B:TYR60	837.02
37.	viridiflorol	-7.94	B:TYR398; B:TYR435; B:ILE198; B:CYS172; B:TYR326; B:ILE199; B:PHE168; B:LEU171	1.51
38.	γ-Terpinene	-5.51	B:LEU164; B:PHE168; B:CYS172; B:ILE199; B:PRO104; B:ILE316; B:ILE316; B:LEU171; B:LEU167	90.68

LAMPIRAN 9
HASIL PREDIKSI ADME SENYAWA AKTIF BUAH LEMON (*CITRUS LIMON* L.)
Tabel V.6
Hasil Prediksi ADME

No.	Nama Senyawa	Adsorbsi		Distribusi
		CaCo2 (nm. Sec-1)	HIA (%)	PPB (%)
1.	α-Phellandren-8-ol	50.71	100	30.55
2.	α-Phellandrene	23.41	100	100
3.	α-Pinene	23.63	100	100
4.	α-Selinene	23.63	100	100
5.	α-Terpinene	23.45	100	100
6.	α-Terpineol	50.80	100	23.41
7.	α-Terpinolene	23.63	100	93.16
8.	α-Thujene	23.63	100	100
9.	β-Bisabolene	23.40	100	100
10.	β-Cadinene	23.63	100	100
11.	β-Caryophyllene	23.63	100	100
12.	β-Elemene	23.49	100	100
13.	β-Ocimene	23.63	100	100
14.	β-Pinene	23.49	100	100
15.	β-Terpineol	50.80	100	21.98
16.	Cedrol	51.23	100	82.43
17.	Champene	23.49	100	100
18.	cis-α-Bergamotene	23.40	100	100
19.	cis-α-Bisabolene	23.40	100	100
20.	cis-β-Ocimene	23.63	100	100
21	cis-Citral	13.96	100	100
22.	δ-Elemene	23.64	100	100
23.	γ-Maaliene	23.49	100	100
24.	Geranial	4.88	100	100
25.	Geraniol	8.75	100	100
26.	Germacrene-D	23.63	100	100
27.	Intermedeol	55.68	100	86.27
28.	Limonene	23.63	100	100
29.	Linalool	29.35	100	100

LAMPIRAN 9

(LANJUTAN)

Tabel V.6
Lanjutan

30.	Myrcene	23.63	100	100
31.	Nerol	8.75	100	100
32.	selina-4,11-diene	23.49	100	100
33.	Terpinen-4-OL	50.80	100	100
34.	trans-β-Ocimene	23.63	100	100
35.	trans-Caryophyllene	23.63	100	100
36.	Viridiflorol	54.57	100	100
37.	γ-Terpinene	23.6401	100	100

Keterangan :

% *Human Intestinal Absorbsi* (% HIA) = (a)70-100% *well absorbed*

(b) 20-70% *moderately absorbed*

(c) 0-20% *poorly absorbed*

In Vitro Caco-2 *cell permeability* (nm sec-1) = (a) >70 *higher permeability*

(b) 4-70 *medium permeability*

(c) <4 *low permeability*

Plasma protein binding = (a) >90 *strongly bound*

(b) < 90% *weakly bound*

LAMPIRAN 10
HASIL PREDIKSI SIFAT TOKSISITAS SENYAWA AKTIF BUAH LEMON (*CITRUS LIMON L.*)

Tabel V.7
Hasil Prediksi Sifat Toksisitas

No	Ligan	Cramer rules	Benigni/bosarulebase	Kroes TTC decission tree
1	α-Phellandren-8-ol	3	8,9	1
2	α-Phellandrene	1	8,9	1
3.	α-Pinene	1	8,9	1
4.	α-Selinene	1	8,9	1
5.	α-Terpinene	1	8,9	1
6.	α-Terpineol	3	8,9	1
7.	α-Terpinolene	1	8,9	1
8.	α-Thujene	1	8,9	1
9.	β-Bisabolene	1	8,9	1
10.	β-Cadinene	1	8,9	1
11.	β-Caryophyllene	1	8,9	1
12.	β-Elemene	1	8,9	1
13.	β-Ocimene	1	8,9	1
14.	β-Pinene	1	8,9	1
15.	β-Terpineol	3	8,9	1
16.	Cedrol	3	8,9	2
17.	Champene	1	8,9	1
18.	cis-α-Bergamotene	1	8,9	1
19.	cis-α-Bisabolene	1	8,9	1

LAMPIRAN 10

(LANJUTAN)

Tabel V.7
Lanjutan

20.	cis-β-Ocimene	1	8,9	1
21.	cis-Citral	1	4,8,9	1
22.	δ-Elemene	1	8,9	1
23.	γ-Maaliene	1	8,9	1
24.	Geranial	1	4,8,9	1
25.	Geraniol	1	8,9	1
26.	Germacrene-D	1	8,9	1
27.	Intermedeol	3	8,9	1
28.	Limonene	1	8,9	1
29.	Linalool	3	8,9	1
30.	Myrcene	1	8,9	1
31.	Nerol	1	8,9	1
32.	selina-4,11-diene	1	8,9	1
33.	Terpinen-4-OL	3	8,9	1
34.	trans-β-Ocimene	1	8,9	1
35.	trans-Caryophyllene	1	8,9	1
36.	Viridiflorol	3	8,9	1
37.	γ-Terpinene	1	8,9	1

LAMPIRAN 10

(LANJUTAN)

Keterangan :

Cramer rules = (1) *Substances with sample chemical structures and fix which efficient modes of metabolism exist, suggesting a low order of oral toxicity.*

(2) *Substances which possess structures that are less innocuous than class I substances, but do not contain structural features suggestive of toxicity like those substances in class III.*

(3) *Substances with chemical structures that permit no strong unitial presumption of safety or may even suggest significant toxicity ir have reactive functional groups.*

Benigni/Bossa rulebase = (1) *Structural Alert for genotoxic carcinogenicity.*

(2) *Structural Alert for nongenotoxic carcinogenicity.*

(4) *Unlikely to be a s. typhimurium TA100 mutagen based on qsar*

(8) *Negative for genotoxic carcinogenicity.*

(9) *Negative for nongenotoxic carcinogenicity.*

Kroes TTC = (1) *Substance would not be expected to be a safety concern.*

(2) *Negligible risk (low probability of life-time cancer risk greater than 1 in 10^6).*