

LAMPIRAN

Lampiran 1. Certificate of Analysis (CoA) Bahan Baku

Kurkumin



Certificate of Analysis

8.20354.0000 Curcumin for synthesis
Batch S8350354

Batch Values		
Assay (HPLC, area%)	77.1	% (a/a)
Bisdemethoxycurcumin (HPLC, Area%)	4.5	% (a/a)
Demethoxycurcumin (HPLC, Area%)	17.7	% (a/a)
Identity (IR)	passes test	

Date of examination (DD MM YYYY) 19 12 2022
Minimum shelf life (DD MM YYYY) 31 12 2027

Dr. Jörg Bauer
Responsible laboratory manager quality control

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Merck KGaA
Corporation with General Partners
Frankfurter Straße 250
64293 Darmstadt, Germany

The life science business of Merck KGaA, Darmstadt,
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Canada

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SALSA Version 126047359000993739// Date: 19.12.2022

Dimethyl sulfoxide



Certificate of Analysis

1.02952.1000 Dimethyl sulfoxide for analysis EMSURE® ACS
 Batch K54861652

	Spec. Values		Batch Values	
Purity (GC)	≥ 99.9	%	99.9	%
Identity (IR)	conforms		conforms	
Appearance	clear		clear	
Color	≤ 10	Hazen	< 5	Hazen
Titration acid	≤ 0.0002	meq/g	0.0001	meq/g
Density (d 20 °C/20 °C)	1.101 - 1.103		1.102	
Refractive index (n 20/D)	1.478 - 1.481		1.479	
Melting point	≥ 18.0	°C	18.2	°C
Heavy metals (as Pb)	≤ 0.0001	%	≤ 0.0001	%
Fe (Iron)	≤ 0.0001	%	≤ 0.0001	%
Related substances (GC)	conforms		conforms	
Readily carbonizable substances	conforms		conforms	
Evaporation residue	≤ 0.001	%	< 0.001	%
Water	≤ 0.1	%	< 0.1	%

Date of release (DD.MM.YYYY) 22.12.2022
 Minimum shelf life (DD.MM.YYYY) 31.12.2025

Jeannette David
 Responsible laboratory manager quality control

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SALSA Version 1261876/99000083043/ Date 22.12.2022 Page 1 of 1

Methanol PA



Certificate of Analysis

1.06009.0000 Methanol for analysis EMSURE® ACS,ISO,Reag. Ph Eur
Batch I1108609

	Spec. Values		Batch Values	
Purity (GC)	≥ 99.9	%	99.9	%
Identity (IR)	conforms		conforms	
Appearance	clear		clear	
Color	≤ 1.0	hazen	< 5	hazen
Solubility in water	conforms		conforms	
Acidity	≤ 0.0002	meq/g	0.0001	meq/g
Alkalinity	≤ 0.0002	meq/g	< 0.0002	meq/g
Density (d 20 °C/20 °C)	0.791 - 0.793		0.793	
Boiling point	64 - 65	°C	64	°C
Benzene (impurity A) (GC)	≤ 2	ppm	< 1	ppm
Ethanol (GC)	≤ 0.05	%	< 0.01	%
Acetone	≤ 0.001	%	≤ 0.001	%
Acetaldehyde	≤ 0.001	%	≤ 0.001	%
Formaldehyde	≤ 0.001	%	≤ 0.001	%
Readily carbonizable substances	conforms		conforms	
Carbonyl compounds (as C2)	< 0.001	%	< 0.001	%
Chloride (Cl)	≤ 0.5	ppm	≤ 0.5	ppm
Sulfate (SO ₄)	≤ 1	ppm	≤ 1	ppm
Substances reducing potassium permanganate (as O)	≤ 0.00025	%	≤ 0.00025	%
Ag (Silver)	≤ 0.000002	%	≤ 0.000002	%
Al (Aluminum)	≤ 0.00005	%	≤ 0.00005	%
As (Arsenic)	≤ 0.000002	%	≤ 0.000002	%
Au (Gold)	≤ 0.000002	%	≤ 0.000002	%
Ba (Barium)	≤ 0.00001	%	≤ 0.00001	%
Be (Beryllium)	≤ 0.000002	%	≤ 0.000002	%
Bi (Bismuth)	≤ 0.000002	%	≤ 0.000002	%
Ca (Calcium)	≤ 0.00005	%	≤ 0.00005	%
Cd (Cadmium)	≤ 0.000005	%	≤ 0.000005	%
Co (Cobalt)	≤ 0.000002	%	≤ 0.000002	%
Cr (Chromium)	≤ 0.000002	%	≤ 0.000002	%
Cu (Copper)	≤ 0.000002	%	≤ 0.000002	%
Fe (Iron)	≤ 0.00001	%	≤ 0.00001	%
Ga (Gallium)	≤ 0.000002	%	≤ 0.000002	%
In (Indium)	≤ 0.000002	%	≤ 0.000002	%
Li (Lithium)	≤ 0.000002	%	≤ 0.000002	%
Mg (Magnesium)	≤ 0.00001	%	≤ 0.00001	%
Mn (Manganese)	≤ 0.000002	%	≤ 0.000002	%
Mo (Molybdenum)	≤ 0.000002	%	≤ 0.000002	%
Ni (Nickel)	≤ 0.000002	%	≤ 0.000002	%
Pb (Lead)	≤ 0.00001	%	≤ 0.00001	%
Pt (Platinum)	≤ 0.000005	%	≤ 0.000005	%

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Certificate of Analysis

1.06009.0000 Methanol for analysis EMSURE® ACS,ISO,Reag. Ph Eur
Batch I1108609

Sn (Tin)	≤ 0.00001	%	≤ 0.00001	%
Ti (Titanium)	≤ 0.000002	%	≤ 0.000002	%
Tl (Thallium)	≤ 0.000002	%	≤ 0.000002	%
V (Vanadium)	≤ 0.000002	%	≤ 0.000002	%
Zn (Zinc)	≤ 0.00001	%	≤ 0.00001	%
Zr (Zirconium)	≤ 0.000002	%	≤ 0.000002	%
Evaporation residue	≤ 0.0005	%	< 0.0001	%
Water	≤ 0.05	%	0.01	%

ACS, ISO, Reag Ph Eur

Date of release (DD.MM.YYYY) 14.08.2020
Minimum shelf life (DD.MM.YYYY) 31.03.2025

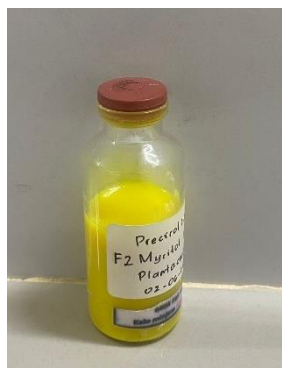
Jeanette David
Responsible laboratory manager quality control

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SALSA Version 00109 00000712119 Date 14.08.2020

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Lampiran 2. Formula NLC Kurkumin



Lampiran 3. Perhitungan Kurva Kalibrasi Kurkumin

A. Perhitungan Pembuatan Larutan Kurkumin

- Larutan Induk 100 ppm dalam 50 ml

$$100 \text{ ppm} = \frac{100 \text{ mg}}{1000 \text{ ml}}$$

$$\begin{aligned} \text{Bobot Kurkumin} &= \frac{100 \text{ mg}}{1000 \text{ ml}} \times 50 \text{ mL} \\ &= 5 \text{ mg} \end{aligned}$$

- Seri Konsentrasi Larutan Kurkumin

- Konsentrasi 5 ppm

$$V1 \times C1 = V2 \times C2$$

$$V1 \times 100 \text{ ppm} = 10 \text{ ml} \times 5 \text{ ppm}$$

$$V1 = \frac{10 \text{ mL} \times 5 \text{ ppm}}{100 \text{ ppm}}$$

$$V1 = 0,5 \text{ mL}$$

- Konsentrasi 4 ppm

$$V1 \times C1 = V2 \times C2$$

$$V1 \times 100 \text{ ppm} = 10 \text{ ml} \times 4 \text{ ppm}$$

$$V1 = \frac{10 \text{ mL} \times 4 \text{ ppm}}{100 \text{ ppm}}$$

$$V1 = 0,4 \text{ mL}$$

- Konsentrasi 3,5 ppm

$$V1 \times C1 = V2 \times C2$$

$$V1 \times 100 \text{ ppm} = 10 \text{ ml} \times 3,5 \text{ ppm}$$

$$V1 = \frac{10 \text{ mL} \times 3,5 \text{ ppm}}{100 \text{ ppm}}$$

$$V1 = 0,35 \text{ mL}$$

- Konsentrasi 3 ppm
- $V_1 \times C_1 = V_2 \times C_2$
- $V_1 \times 100 \text{ ppm} = 10 \text{ ml} \times 3 \text{ ppm}$
- $V_1 = \frac{10 \text{ mL} \times 3 \text{ ppm}}{100 \text{ ppm}}$
- $V_1 = 0,3 \text{ mL}$

- Konsentrasi 2,5 ppm
- $V_1 \times C_1 = V_2 \times C_2$
- $V_1 \times 100 \text{ ppm} = 10 \text{ ml} \times 2,5 \text{ ppm}$
- $V_1 = \frac{10 \text{ mL} \times 2,5 \text{ ppm}}{100 \text{ ppm}}$
- $V_1 = 0,25 \text{ mL}$

- Konsentrasi 2 ppm
- $V_1 \times C_1 = V_2 \times C_2$
- $V_1 \times 100 \text{ ppm} = 10 \text{ ml} \times 2 \text{ ppm}$
- $V_1 = \frac{10 \text{ mL} \times 2 \text{ ppm}}{100 \text{ ppm}}$
- $V_1 = 0,2 \text{ mL}$

Lampiran 4. Perhitungan %EE NLC Kurkumin

Diketahui : $y = 0,1389x + 0,0237$

$r = 0,998$

Volume Sampel = 0,1 mL

Volume Labu = 10 mL

Faktor Pengenceran = $\frac{\text{Volume Labu}}{\text{Volume Sampel}}$

= $\frac{10 \text{ mL}}{0,1 \text{ mL}}$

= 100

Total Zat Aktif = $\frac{\text{Volume Sampel}}{\text{Volume NLC}} \times \text{zat aktif NLC}$

= $\frac{0,1 \text{ mL}}{100 \text{ mL}} \times 15 \text{ mg}$

= 0,015 mg

Hasil perhitungan %EE hari ke-1

PENGUJIAN %EE NLC KURKUMIN H1								
Formula	Abs	C (ppm)	Fp	C' (ppm)	Vol (mL)	mcg	mg	%EE
F1	0,048	0,175	5	0,87	5	4,37365	0,004	99,97084
F2	0,048	0,175	5	0,87	5	4,37365	0,004	99,97084
F3	0,052	0,204	5	1,02	5	5,093593	0,005	99,96604
F4	0,049	0,182	5	0,91	5	4,553636	0,005	99,96964
F5	0,006	-0,127	5	-0,64	5	-3,18575	-0,003	100,0212

Hasil perhitungan %EE hari ke-30

PENGUJIAN %EE NLC KURKUMIN H30								
Formula	Abs	C (ppm)	Fp	C' (ppm)	Vol (mL)	mcg	mg	%EE
F1	0,054	0,218	5	1,09	5	5,453564	0,005	99,96364
F2	0,065	0,297	5	1,49	5	7,433405	0,007	99,95044
F3	0,064	0,290	5	1,45	5	7,25342	0,007	99,95164
F4	0,058	0,247	5	1,23	5	6,173506	0,006	99,95884
F5	0,052	0,204	5	1,02	5	5,093593	0,005	99,96604

Lampiran 5. Data Karakterisasi NLC Kurkumin

Hasil pengujian karakteristik NLC Kurkumin hari ke-1

Pengujian Karakteristik NLC hari ke-1				
Formula	Ukuran Partikel (nm)	Polidispersity Index	Zeta Potensial (mV)	Efeciency Entrapment (%)
K F1	208 ± 10.20	0.416 ± 0.05	-48.6 ± 0.86	99.97084233
K F2	196.5 ± 7.32	0.478 ± 0.04	-47.4 ± 0.17	99.97084233
K F3	185.3 ± 5.33	0.349 ± 0.03	-53.2 ± 0.15	99.96604272
K F4	200 ± 3.68	0.401 ± 0.01	-51.1 ± 1.31	99.96964243
K F5	175.7 ± 3.74	0.349 ± 0.08	-49.0 ± 1.30	100.0212383

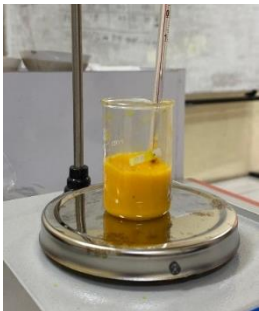
Hasil pengujian karakteristik NLC Kurkumin hari ke-30

Pengujian Karakteristik NLC hari ke-30				
Formula	Ukuran Partikel (nm)	Polidispersity Index	Zeta Potensial (mV)	Efeciency Entrapment (%)
K F1	175.5 ± 1.10	0.329 ± 0.02	-50.3 ± 1.04	99.96364291
K F2	165.3 ± 2.77	0.275 ± 0.02	-48.2 ± 0.87	99.95044396
K F3	180.4 ± 5.33	0.273 ± 0.01	-57.0 ± 1.34	99.95164387
K F4	172.8 ± 3.21	0.278 ± 0.02	-50.2 ± 0.50	99.95884329
K F5	292.2 ± 6.07	0.306 ± 0.20	-54.3 ± 0.58	99.96604272

Lampiran 6. Hasil Uji Statistik NLC Kurkumin

		Paired Samples Test							
		Paired Differences			95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	PMP_F1_PSA_H1 - PMP_F1_PSA_H30	32.43333	11.26691	6.50496	4.44477	60.42190	4.986	2	.038
Pair 2	PMP_F2_PSA_H1 - PMP_F2_PSA_H30	31.20000	4.83839	2.79344	19.18078	43.21922	11.169	2	.008
Pair 4	PMP_F4_PSA_H1 - PMP_F4_PSA_H30	27.16667	6.88501	3.97506	10.06336	44.26997	6.834	2	.021
Pair 5	PMP_F5_PSA_H1 - PMP_F5_PSA_H30	-116.53333	8.69042	5.01741	-138.12152	-94.94514	-23.226	2	.002
Pair 6	PMP_F1_PdI_H1 - PMP_F1_PdI_H30	.087333	.058535	.033795	-.058075	.232742	2.584	2	.123
Pair 7	PMP_F2_PdI_H1 - PMP_F2_PdI_H30	.203000	.071021	.041004	.026574	.379426	4.951	2	.038
Pair 8	PMP_F3_PdI_H1 - PMP_F3_PdI_H30	.076333	.045545	.026295	-.036806	.189473	2.903	2	.101
Pair 9	PMP_F4_PdI_H1 - PMP_F4_PdI_H30	.123333	.018148	.010477	.078252	.168414	11.771	2	.007
Pair 10	PMP_F5_PdI_H1 - PMP_F5_PdI_H30	.042667	.266766	.154018	-.620018	.705351	.277	2	.808
Pair 11	PMP_F1_Zeta_H1 - PMP_F1_Zeta_H30	1.73333	.35119	.20276	.86093	2.60573	8.549	2	.013
Pair 12	PMP_F2_Zeta_H1 - PMP_F2_Zeta_H30	.80000	.78102	.45092	-1.14017	2.74017	1.774	2	.218
Pair 13	PMP_F3_Zeta_H1 - PMP_F3_Zeta_H30	3.76667	1.35769	.78387	.39397	7.13937	4.805	2	.041
Pair 14	PMP_F4_Zeta_H1 - PMP_F4_Zeta_H30	-.83333	1.75024	1.01050	-5.18117	3.51450	-.825	2	.496
Pair 15	PMP_F5_Zeta_H1 - PMP_F5_Zeta_H30	5.30000	.95394	.55076	2.93028	7.66972	9.623	2	.011

Lampiran 7. Dokumentasi Penelitian

		
Pengujian Daya Jerap dan Solidifikasi Lipid Padat Precirol	Pengujian Kelarutan Kurkumin dalam Surfaktan Plantacare	Penyiapan bahan baku untuk pembuatan NLC Kurkumin
		
Pembuatan NLC Kurkumin dengan menggunakan Magnetic Stirrer	Proses Pengecilan Ukuran Partikel dengan Sonicator Probe	Pengujian Ukuran Partikel, PDI, dan Zeta dengan menggunakan PSA Zeta Sizer Nano (Malvern)
		
Proses sentrifugasi NLC Kurkumin untuk pengujian %EE	Pengukuran Absorbansi dengan Spektrofotometri UV-Vis	Pengujian morfologi dengan menggunakan alat TEM

Lampiran 8. Cek Plagiarisme

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Lampiran 9. Kartu Bimbingan

No. Dok. 02.64.00FRM-03AKD-SPMI



Fakultas Farmasi
Universitas
Bhakti Kencana



KARTU BIMBINGAN TUGAS AKHIR II

Pembimbing Utama		Dr. Apt. Gamadi Jafar, M.Si			
Nama Mahasiswa		Zahra Alfa Latifah			
NPM		201FF03153			
Bidang Ilmu		Farmasetika Teknologi Farmasi (FTF)			

No	Hari/Tanggal	Waktu	Tempat	Materi	Paraf Dosen
1	10 Februari 2024	10.00	Kampus UBR	Optimasi formula NLC	
2	21 Februari 2024	10.00	Kampus UBR	Laporan pembuatan NLC blanko	
3	28 Februari 2024	09.30	Kampus UBR	Laporan pembuatan kemasan NLC blanko	
4	9 Maret 2024	09.00	Kampus UBR	Laporan pemotakan alat viskositas untuk XET	
5	16 Maret 2024	09.00	Kampus UBR	Laporan hasil pengujian PCA	
6	6 April 2024	10.00	Kampus UBR	Laporan hasil pengujian PSA dan Zeta	
7	30 April 2024	10.00	Kampus UBR	Bahas hasil pengujian	
8	20 April 2024	10.00	Kampus UBR	Laporan pengujian XET	
9	10 Juni 2024	10.00	Kampus UBR	Review mengenai NLC	
10	05 Juli 2024	10.00	Kampus UBR	Review pembahasan	
11	10 Juli 2024	10.00	Kampus UBR	Review pembahasan	
12	11 Juli 2024	10.00	Kampus UBR	Review pembahasan	

Catatan: Kartu ini harus diisi setiap kali melakukan bimbingan dan harus ditanda-tangani oleh dosen pembimbing.

No. Dok. 02.64.00FRM-03AKD-SPMI



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KARTU BIMBINGAN TUGAS AKHIR I/TUGAS AKHIR II

Pembimbing Serta		Soni Muhsinin, M.Si			
Nama Mahasiswa		Zahra Alfa Latifah			
NPM		201FF03153			
Bidang Ilmu		Farmasetika Teknologi Farmasi (FTF)			

No	Hari/Tanggal	Waktu	Tempat	Materi	Paraf Dosen
1	Rabu, 14 April 2024	11.00	Kampus UBR	Laporan kemasan I	
2	Jumat, 17 Mei 2024	10.00	Kampus UBR	Laporan kemasan II	
3	Senin, 3 Juni 2024	10.00	Kampus UBR	Laporan hasil pengujian PSA dan Zeta	
4	Rabu, 20 Juni 2024	15.00	Kampus UBR	Laporan hasil pembahasan	
5	Kamis, 4 Juli 2024	10.00	Kampus UBR	Review dan pengumpulan SP3	
6	Rabu, 19 Juli 2024	10.00	Kampus UBR	Review pembahasan	
7	Rabu, 10 Juli 2024	15.00	Kampus UBR	Review pembahasan	
8	Kamis, 11 Juli 2024	10.00	Kampus UBR	Review pembahasan	

Catatan: Kartu ini harus diisi setiap kali melakukan bimbingan dan harus ditanda-tangani oleh dosen pembimbing.

Lampiran 10. Daftar Riwayat Hidup**DAFTAR RIWAYAT HIDUP**

Nama : Zahra Alfa Latifah
 Tempat, Tanggal Lahir : Majalengka, 12 Februari 2002
 Alamat : RT.006 RW.002, Blok Ahad, Desa Bongas Wetan
 Kecamatan Sumberjaya, Kabupaten Majalengka,
 Jawa Barat, 45455
 No. Handphone : 089643505190
 Email : zarahalfa12@gmail.com
 Riwayat Pendidikan :

1. SDN Bongas Wetan V	2008-2014
2. Pesantren Persatuan Islam 99 Rancabango	2014-2017
3. SMK Bhakti Kencana Jatiwangi	2017-2020
4. Universitas Bhakti Kencana	2020-2024