BAB V
KESIMPULAN DAN SARAN

A. Kesimpulan

Pertama, dengan metode *hydrophobic ion pairing* protein lendir bekicot (*Achatina fulica*) dapat dibuat formula SNEDDS dengan komponen Capryol® 90, Kolliphor® EL, dan PEG 400.

Kedua, proporsi formula optimum Capryol® 90, Kolliphor® EL, dan PEG 400 dengan menggunakan *D-Optimal Design* yaitu 1:5:4 dengan karakterisasi waktu emulsifikasi 25,53 detik, persen transmitan sebesar 84,19 %, dan prediksi *drug loading* lebih dari 10 %.

B. Saran

Pertama, perlu dilakukan penelitian lebih lanjut dalam pembuatan SNEDDS lendir bekicot dengan perbandingan bahan dan karakterisasi serta uji fisik.

Kedua, perlu dilakukan penelitian lebih lanjut mengenai optimasi SNEDDS lender bekicot dalam pembuatan ke dalam bentuk sediaan obat lain.

DAFTAR PUSTAKA

AboulFotouh Khaled , Allam Ayat A, El-Badry Mahmoud, El-Sayed Ahmed M. 2018 Role of self-emulsifying drug delivery systems in optimizing the oral delivery of hydrophilic macromolecules and reducing interindividual variability, Colloids and Surfaces B: Biointerfaceshttps://doi.org/10.1016/j.colsurfb.2018.03.034

Anggraeni D, Darmawati S, Maharani E T W. 2018. Profil Protein dan Daya Anti Mikroba Lendir Bekicot *(Achatina fulica)* Terhadap *Methicillin Resistant Staphylococcus aureus* (MRSA). Prosiding Seminar Nasional Mahasiswa Unimus Vol. 1

Anggraeni, D. 2017. Daya Antimikroba Lendir Bekicot (*Achatina fulica*) terhadap *Staphylococcus aureus*.

Anton, N. and T. F. Vandamme. 2009. The universality of low-energy nano-emulsification. *International Journal of Pharmaceutics,* 377(1-2); 142–147

Azeem, A., Rizwan, M., Ahmad, F.J., Iqbal, Z., Khar, R.K., Aqil, M., et al., 2009, Nanoemulsion Components Screening and Selection: a Technical Note. *AAPS PharmSciTech*, 10: 69–76.

Amrutkar, C., Salunkhe, K., Chaudhari, S., 2014, Study on Self Nano Emulsifying Drug Delivery System of Poorly Water Soluble Drug Rosuvastatin Calcium, *World Journal of Pharmaceutical Research,* 3 (4): 2137-2151

Bhattacharya, S., Mishra S., Prajapati B.G. 2018. Design and Deveplopment of Docetaxel Solid Self-Microemulsifying Drug Delivery System Using Principal Component Analysis and D-Optimal Design. *Asian Journal of Pharmaceutics*, 122-123

Berniyanti, T.Suwarno. (2007). Karakteristik Protein Lendir Bekicot (Achasin) Isolat Lokal sebagai Faktor Antibakteri. Media Kedokteran Hewan, 139-144

Bolton, S and Bon, C . 2004. Pharmaceutical Statistics :Practical and Clinical Applications Fourth Edition, Revised and Expanded. Marceld Ekker, inc.

Campbell, N.A., Jane B.R., dan Lawerance G.R., 2000. *Biologi*. Erlangga. Jakarta. Hal. 224-225.

Chan CC, Herman L, Lee YC, Zhang XM. 2004. Analitical Method Validation and Instrument Performance Verification. New Jersey : Inc Publication

Chen, YS., Chiu, YH., Li, YS. 2019. Integration of PEG 400 into a self-nanoemulsifying drug delivery system improves drug loading capacity and

nasal mucosa permeability and prolongs the survival of rats with malignant brain tumors. *International Journal of Nanomedicine*.

Choudhury, H., Gorain B., Pandey M., Chatterjee, L.A., Sengupta,P., Das, A., Molugulu, N., Kesharwani P. 2017. Recent update on nanoemulgel as topical drug delivery system.

Collucci M, Maione F, Boino MC, Piscopo A, Giannuario AD, Pieretti S. 2008. New of Dimethyl Sulphoxide Effects (DMSO) on experimental in vivomodels of nociception and inflammation. *Pharmacologial Research*.57: 419-425.

Date, A. A., Desai, N., Dixit, R., dan Nagarsenker, M., 2010. Self-Nanoemulsifying Drug Delivery Systems: Formulation insights, applications and advances. *Nanomed.*, 5 (10), 1595–1616.

Debnath, S., Satayanarayana, dan Kumar, G. V., 2011, Nanoemulsion-A Method to Improve The Solubility of Lipophilic Drugs, *Pharmanest.*, **2** (2-3), 72-76

Deller MC, Kong L, and Rupp B. 2016. Protein stability: A Crystallographer's Perspective. *IYCr crystallization series*.72-95

Dewi, Nia Yuliani. 2013. Penetapan Kadar dan Analisis Profil Protein dan Asam Amino Ekstrak Apas Biji Jinten Hitam (*Nigella sativa* Linn.) dengan metode SDS-PAGE dan KCKT. Skripsi: UIN Syarif Hidayatullah Jakarta.

Douromis, D., and Fahr, A., 2013, Drug delivery strategies for poorly watersoluble drugs, John Wiley & Sons, Chiceste

Elgart, A., Cherniakov, I., Aldouby, Y., Domb, A. J., and Hoff man, A. (2013). Improved oral bioavailability of BCS class 2 compounds by self nanoemulsifyingdrugdeliverysystems.(SNEDDS):theunderlyingmechanis msfor amiodarone and talinolol. *Pharm*. Res. 30, 3029–3044. doi: 10.1007/s11095013-1063-y

Fudholi, A., 2013, *Disolusi dan Pelepasan Obat In-vitro*, Pustaka Pelajar, Yogyakarta.

Griesser Janine , Het´enyi Gergely, Moser Michael, Demarne Fr´ed´eric, Jannin Vincent, Schn¨ urch Andreas Bernkop. 2017. Hydrophobic ion pairing: Key to highly payloaded self-emulsifying peptide drug delivery systems. *International Journal of Pharmaceutics*

Gursoy RN, Benita S, 2004. Self-Emulsifying Drug Delivery Systems (SEDDS) for Improved Oral Delivery of Lipophilic Drugs. *Biomed Pharmacother* (3):173-82.

Jaiswal, M., R. Dudhe, and P.K Sharma. 2014. Nanoemulsion: An Advanced mode of Drug Delivery System. *3 Biotech*, 5 (2); 123-127

Handayani FS, Nugroho BH, Munawiroh SZ. 2019. Optimization of Low Energy Nanoemulsion of Grape Seed Oil Formulation using D-Optimal Mixture Design. *Jurnal Ilmiah Farmasi* 14(1): 17-34

Harmita, 2004. Petunjuk pelaksanaan validasi metode dan cara perhitungannya. *Majalah Ilmu Kefarmasian* 1(3) : 117-135.

Haupstetin, S., Prufert, F., Schurch, AB. 2015. Self-nanomulsifying drug delivery systems as novel approach for pDNA drug delivery. *J Sciencedirect*

Karamanidou, T., Karidi, K., Bourganis, V., Kontonikola, K., Kammona, O., Kiparissides. 2015. Effective Incorporation of Insulin in Mucus Permeating Self-emulsifying Drug Delivery System. *J Sciencedirect*

Kim HJ, Yoon KA, Hahn M, Park ES, Chi SC 2000. Peparation and vitro evaluation of Self-Microemulsifying drug delivery system (SNEDDS) containing idebenone. *Drug Dev and In Pharm* 26 (5): 523- 529.

Kronman MP, Zhou C, Mangione-Smith R. 2014. Bacterial Prevalence and antimicrobial Prescribing Trends For Acute Respiratory Track Infections. *American Academy of Pediatrics*. 134(4):956-65.

Kuncahyo, I.,Choiri, S., Fudholi, A., Martien, R., Rohman, A. 2019. Assesment of Fractional Factorial Design for the Selection and Screening of Appropriate Components of a Self-nanoemulsifying Drug Delivery System Formulation. *Advanced Pharmaceutical Bulletin* 9(4), 609-618.

Kurt D, Ristroph. Robert K, Prud'homme. 2019. Hydrohobic Ion Pairing: Encapsulating Small Molecules, Peptides, and Protein into Nanocarrier. *Nanoscale Adv*., 2019,1, 4207 –4237

Lupo, N., Tkadleckova, VN., Jelkmann, M., Laffleur, F., Hetenyi, G., Kubova, K., Schnurch, AB. 2019. Self-nanoemulsifying Drug Delivery Systems: In Vivo Evaluation of their Potential for Oral Vaccination. *J Sciencedirect*

Mafranenda HDN, Kriswandini IL and Ester AR. 2014. Antimicrobial Proteins of Snail mucus (*Achatina fulica*) against Streptococcus mutans and Aggregatibacter Actinomycetemcomitans.

Mardiana, Z. H. 2015. Formulasi Gel yang Mengandung Lendir Bekicot (Achatina fulica) serta Uji Aktivitas Antibakteri trhadap Propionibacterium acnes. Prosiding Penelitian SPeSIA Unisba 2015 , 223-230.

Makadia H. 2013. Self-Nanoemulsifying Drug Delivery System (SNEDDS): Future Aspects. *Asian J. Pharm. Res.*3(1):21-27.

Mardiyanto, Fithri Na and Tandri M. 2018. Characterization and Optimization of Capryol- 90, Polysorbate-80, and Peg-400 Proportion in Mefenamic Acid Self Nanoemulsifying Drug Delivery System (SNEDDS) With Simplex-Lattice-Design. *Science and Technology Indonesia*, 3: 164-172

Nichole, KK., Allen, MW. 2009. Th Biuret for the Determination of Total Protein Using an Evolution Array 8-Position Cell Changer. Thermo Fisher Scientific, USA.

Odaibo, Alexandr B., Olayinka, Suraj O. 2019. Shell Morphology, Radula and Genital Structures of New Invasive Giant Africans Land. University Ibadan, Nigeria.

Patel, M. J., Patel, N. M., Patel, R. B., dan Patel, R. P., 2011, Formulation and Evaluation of Self-Microemulsifying Drug Delivery System of Lovastatin, *Asian. J. Pharm. Sci.*,**5**(6), 266-267.

Pelczar, Michael J dan Chan, E. C. S. 2008. Dasar-Dasar Mikrobiologi Jilid I. Jakarta: UI Press

Pinto Reis, C., Neufeld, R.J., Ribeiro, A.N.J., dan Veiga, F., 2006, Nanoencapsulation I, Methods for Preparation of Drug-Loaded Polymeric Nanoparticles, Nanomedicine: *Nanotechnology, Biology and Medicine*, 2: 8-21

Powers, ME., Matsuura, J., Brasell, J., Manning, MC., and Shefter, E. 1993. Enhanced Solubility of Proteins and Peptides in Nonpolar Solvents through Hydrophobic Ion Pairing. *Biopolymers* 33: 927-932

Rakhmaningtyas, A.W. 2012. Preparasi dan Karakterisasi Nanopartikel Sambung Silang Kitosan-Natrium Tripolifosfat dalam Sediaan Film Bukal Verapamil Hidroklorida, Skripsi,S.Farm., Ekstensi Farmasi, Fakultas Matematika dan Ilmu Pengetahuan Alam, Universitas Indonesia, Depok, Indonesia

Rao, Sripriya VR., Shao, Kavya Y. 2008. Self-nanoemulsifying Drug Delivery System (SNEDDS) for Oral Delivery of Protein Drugs III. In Vivo Oral Absorption Study. ScienceDirect

Rashid R,Kim DW, Din FU, et al. 2015. Effect of Hydroxypropylcellulose and Tween 80 on Physicochemical Properties and Bioavaibility of Ezetimibe Loaded Solid Dispersion. *Carbohydr Polym*:130; 26-31

Rowe, R.C., Sheskey, P.J., dan Quinn, M.E., 2009, *Handbook of Pharmaceutical Excipients*, 6th Edition, sixth. Ed, Pharmaceutical Press, London.

Sadurni N., Solans, C., Azemar, N. dan García-Celma, M.J., 2005, Studies on The Formation of O/W Nano-Emulsions, by Low-Energy Emulsification Methods, Suitable for Pharmaceutical Applications, Eur. *J. Pharm. Sci*., 26(5):438–445.

Salim, N., Basri, M., Rahman, MBa., D.K., Basri, H., and Salleh, A.B., 2011, Phase Behavior, Formation and Characterization of Palm Basd Esters Nanoemulsion Formulation Containing Ibuprofen, *J Nanomedicine Nanotechnology*, 2(4): 113-117.

Sang Yoo, Park T.Gwan. 2004. Biodegradable nanoparticles containing protein fatty acid complexes for oral delivery of salmon calcitonin. *J. Pharm.Sci*. 93: 488-495

Santoso, H. B. (2003). Budidaya Bekicot. Yogyakarta: Kanisius.

Sapra, K., Sapra, A., Singh, S. K., dan Kakkar, S., 2012, Self-Emulsifying Drug Delivery System: A Tool in Solubility Enhancement of Poorly Soluble Drugs, *Int. J. Pharm. Sci.*, **2** (3), 314, 317-318, 320.

Shakeel F., Baboota S., Ahuja A., Ali J., Faisal M.S., dan Shafiq S., 2008, Stability Evaluation of Celecoxib Nanoemulsion Containing Tween 80, *Thai Journal Pharm Sci*, 32: 4-9.

Shakeel, F., Haq, N., Alanazi, F. K., and Alsarra, I. A. (2016). Surface-adsorbed reverse micelle-loaded solid self-nanoemulsifying drug delivery system of talinolol. *Pharm. Dev. Technol*. 21, 131–139. doi: 10.3109/10837450.2014. 971379

Sinko PJ. 2006. *Martin Farmasi Fisik dan Ilmu Farmasetika Edisi 5*. Jakarta: Buku Kedokteran EGC.

Solans, C., Izquierdo, P., Nolla J,, Azemar, N., Garcia-Celma Mj. Nano-emulsions, Curr. Opin. Colloid Interface Sci. 10 (2005) 102–110. doi:10.1016/j.cocis.2005.06.004.

Son HY, Chae BR, Choi JY, Shin DJ, Goo YT, Lee ES, et al. 2018. Optimization of self-microemulsifying drug delivery system for phospholipid complex of telmisartan using D-optimal mixture design.*PLoS ONE* 13(12).

Soni MGC, Prajapati SK, Chaudhri N. 2014. Self Nanoemulsion: Advance Form Of Drug Delivery System. *World Journal Of Pharmacy And Pharmaceutical Sciences*.

Srivastava, M., Kohli, K., and Ali, M. 2014. Formulation development of novel in situ nanoemulgel (NEG) of ketoprofen for the treatment of periodontitis. *Drug deliver*: 1-13.

StatEase. 2019, *Section 12 – statistical details: analysis, East Hennepin Ave*, Minneapolis, USA.

Suliatin T. 2017. Optimasi Formula Self Nano-Emulsifying Drug Delivery Sistem (SNEDDS) Tetrahidrokurkurmin Menggunakan D-Optimal Design. Skripsi : Purwokerto.

Sumardjo D. 2009. Pengantar Kimia:Buku Panduan Kuliah Mahasiswa Kedokteran Program Strata I Fakultas Bioeksata. Buku Kedokteran EGC.

Teerasak, E., Thongararm, P., Roytrakul, S., Meesuk, L., Chumnanpuen, P., 2016, Prediciton of anticancer peptides against MCF-7 breast cancer cells from the peptidomes of *Achatina fulica* mucus fraction : *Computational and Structural Biotechnology Journal, 14, 52-53.*

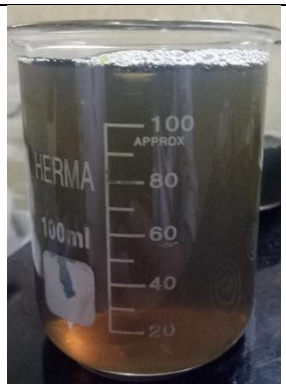
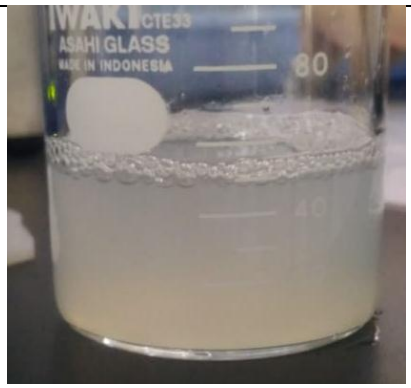
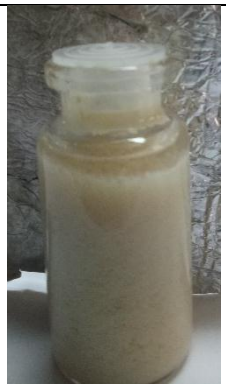
Volker, A. 2009. *Dynamic Light Scattering: Measuring the Particle Size Distribution.* http://www.1sinstruments.ch/technology/dynamiclightscatterings/, diakses tanggal 10 September 2019.

Yuliani HS, Hartini M, Stephanie, Pudyastuti B, Istyastono EP. 2016. Comparison of physical stability properties of *Pomegranate* seed oil nanoemulsion dosage forms with long-chain triglyceride and medium-chain triglyceride as the oil phase. *Traditional Medicine Journal* 21(2) : 93-98.

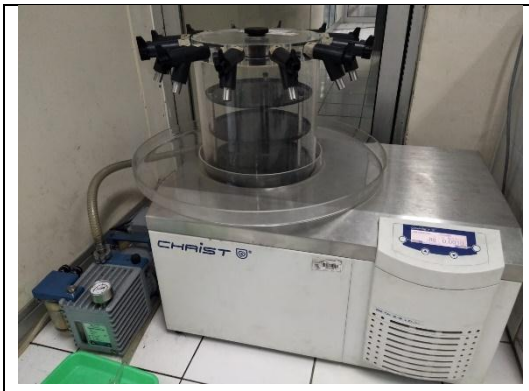
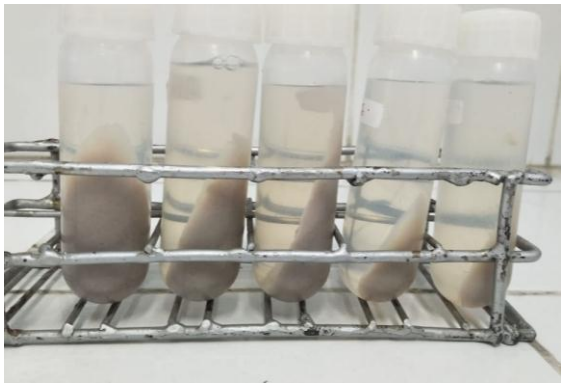
Zhang L., Song L., Zhang P., Liu T., Zhou L., Yang G., Lin R., and Zhang J., 2015. Solubilities of Naringenin in Different Solvents and Dissociation Constants of Naringenin. *J. Chem. Eng.* 60, 932-940.

L
A
M
P
I
R
A
N

Lampiran 1. Komponen Penyusun SNEDDS lendir bekicot

	LENDIR BEKICOT
	LENDIR BEKICOT + HCl + SLS
	ENDAPAN SETELAH DI SENTRIFUGASI
	ZAT AKTIF PROTEIN LENDIR BEKICOT

Lampiran 2. ***Freeze Drying***

	
Alat Freeze Drying	Freeze Drying
	
Hasil Sentrifugasi	Hasil Freeze Drying

Lampiran 3. Perhitungan persentase efisiensi pengendapan

$$\text{Precipitation efficiency [\%]} = 100 - \left(\frac{Peptide\ concentration\ after\ HIP}{Peptide\ concentration\ before\ HIP} \times 100 \right)$$

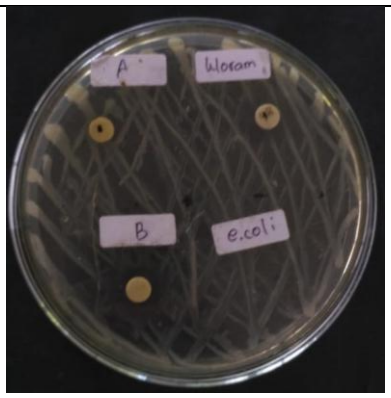
$$= \frac{8{,}8\ g}{472{,}096} x100$$

$$= 98{,}14\%$$

Lampiran 4. Hasil Uji Kualitatif Protein Lendir Bekicot

	Terdapat warna biru keunguan. Positif protein.

Lampiran 5. Uji Bakteri

	
Bakteri *Staphylococcus aureus*	Bakteri *Escherichia coli*

Lampiran 6. Tabel Kurva Baku Protein Lendir Bekicot

Konsentrasi (ppm)	Absorbansi
100	0,301
200	0,333
300	0,367
400	0,417
500	0,46
600	0,501
700	0,545
800	0,583
900	0,619
1000	0,655
a	0,255
b	0,000406
R	0,999166

Lampiran 7. Validasi Metode Analisis

- **Akurasi**

Konsentrasi	Replikasi	Absorbansi	Konsentrasi	Kons. sebenarnya	% Recovery	Rata-Rata
80%	1	0,492	584,26	600	97,37%	98,19%
	2	0,489	576,87	600	96,14%	
	3	0,501	606,45	600	101,07%	
100%	1	0,54	702,59	700	100,37%	102,13%
	2	0,549	724,78	700	103,54%	
	3	0,546	717,39	700	102,48%	
120%	1	0,574	786,41	800	98,30%	100,97%
	2	0,593	833,25	800	104,15%	
	3	0,581	803,67	800	100,45%	
					% Recovery	**100,43%**

- **Presisi**

Replikasi	Absorbansi	Konsentrasi
1	0,38	308,15
2	0,369	281,03
3	0,383	315,55
4	0,36	258,85
5	0,384	318,01
6	0,389	330,34
7	0,378	303,22
8	0,393	340,20
9	0,388	327,87
SD	25,59	
Rata-rata	309,25	
CV	0,08	

- **LOD dan LOQ**

Konsentrasi	Absorbansi (y)	y'	y-y'	$(y-y')^2$
100	0,301	0,2955	0,0054	2,9554
200	0,333	0,3361	-0,0031	9,7798
300	0,367	0,3766	-0,0096	9,3913
400	0,417	0,4172	-0,0002	6,4793
500	0,46	0,4578	0,0021	4,7603
600	0,501	0,4983	0,0026	6,8548
700	0,545	0,5389	0,0060	3,6657
800	0,583	0,5795	0,0034	1,2186
900	0,619	0,6200	-0,0010	1,1507
			Total	0,0002
			Sy/x	0,0075
			LOD	61,24

LOQ	185,58
Vx/0	0,033

Lampiran 8. Alogaritma

- **Sumber data sekunder formula**

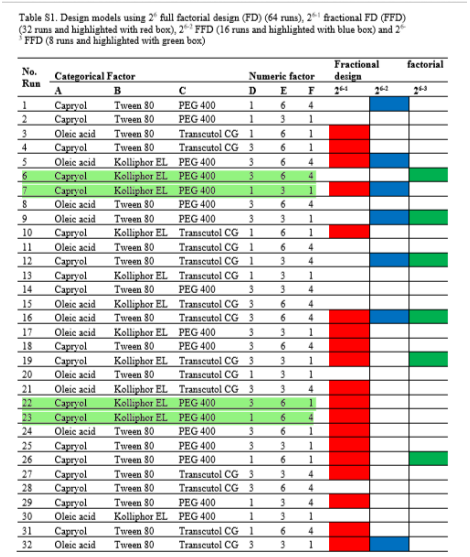
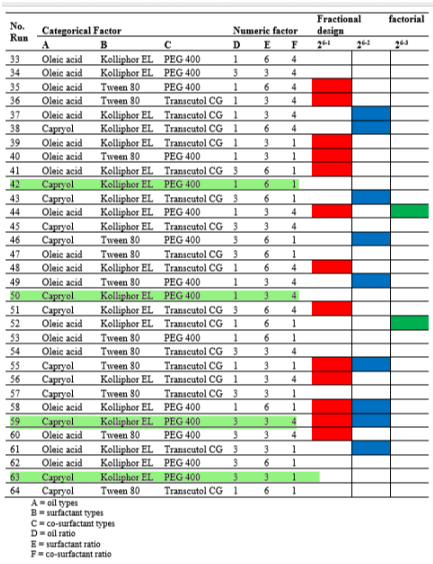


Table S1. Design models using 2^6 full factorial design (FD) (64 runs), 2^{6-1} fractional FD (FFD) (32 runs and highlighted with red box), 2^{6-2} FFD (16 runs and highlighted with blue box) and 2^{6-3} FFD (8 runs and highlighted with green box)

No. Run	Categorical Factor			Numeric factor			Fractional design		factorial
	A	B	C	D	E	F	2^{6-1}	2^{6-2}	2^{6-3}
1	Capryol	Tween 80	PEG 400	1	6	4			
2	Capryol	Tween 80	PEG 400	1	3	1			
3	Oleic acid	Tween 80	Transcutol CG	1	6	1			
4	Capryol	Tween 80	Transcutol CG	3	6	1			
5	Oleic acid	Kolliphor EL	PEG 400	3	6	4			
6	Capryol	Kolliphor EL	PEG 400	3	6	4			
7	Capryol	Kolliphor EL	PEG 400	1	3	1			
8	Oleic acid	Tween 80	PEG 400	3	6	4			
9	Oleic acid	Tween 80	PEG 400	3	3	1			
10	Capryol	Kolliphor EL	Transcutol CG	1	6	1			
11	Oleic acid	Tween 80	Transcutol CG	1	6	4			
12	Capryol	Tween 80	Transcutol CG	1	3	4			
13	Capryol	Kolliphor EL	Transcutol CG	1	3	1			
14	Capryol	Tween 80	PEG 400	3	3	4			
15	Oleic acid	Kolliphor EL	Transcutol CG	3	6	4			
16	Oleic acid	Tween 80	Transcutol CG	3	6	4			
17	Oleic acid	Kolliphor EL	PEG 400	3	3	1			
18	Capryol	Tween 80	PEG 400	3	6	4			
19	Capryol	Kolliphor EL	Transcutol CG	3	3	1			
20	Oleic acid	Tween 80	Transcutol CG	1	3	1			
21	Oleic acid	Kolliphor EL	Transcutol CG	3	3	4			
22	Capryol	Kolliphor EL	PEG 400	3	6	1			
23	Capryol	Kolliphor EL	PEG 400	1	6	4			
24	Oleic acid	Tween 80	PEG 400	3	6	1			
25	Capryol	Tween 80	PEG 400	3	3	1			
26	Capryol	Tween 80	PEG 400	1	6	1			
27	Capryol	Tween 80	Transcutol CG	3	3	4			
28	Capryol	Tween 80	Transcutol CG	3	6	4			
29	Capryol	Tween 80	PEG 400	1	3	4			
30	Oleic acid	Kolliphor EL	PEG 400	1	3	1			
31	Capryol	Tween 80	Transcutol CG	1	6	4			
32	Oleic acid	Tween 80	Transcutol CG	3	3	1			



No. Run	Categorical Factor			Numeric factor			Fractional design		factorial
	A	B	C	D	E	F	2^{6-1}	2^{6-2}	2^{6-3}
33	Oleic acid	Kolliphor EL	PEG 400	1	6	4			
34	Oleic acid	Kolliphor EL	PEG 400	3	3	4			
35	Oleic acid	Tween 80	PEG 400	1	6	4			
36	Oleic acid	Tween 80	Transcutol CG	1	3	4			
37	Oleic acid	Kolliphor EL	Transcutol CG	1	3	4			
38	Capryol	Kolliphor EL	Transcutol CG	1	6	4			
39	Oleic acid	Kolliphor EL	Transcutol CG	1	3	1			
40	Oleic acid	Tween 80	PEG 400	1	3	1			
41	Oleic acid	Kolliphor EL	Transcutol CG	3	6	1			
42	Capryol	Kolliphor EL	PEG 400	1	6	1			
43	Capryol	Kolliphor EL	Transcutol CG	3	6	1			
44	Oleic acid	Kolliphor EL	PEG 400	1	3	4			
45	Capryol	Kolliphor EL	Transcutol CG	3	3	4			
46	Capryol	Tween 80	PEG 400	3	6	1			
47	Oleic acid	Tween 80	Transcutol CG	3	6	1			
48	Oleic acid	Kolliphor EL	Transcutol CG	1	6	4			
49	Oleic acid	Tween 80	PEG 400	1	3	4			
50	Capryol	Kolliphor EL	PEG 400	1	3	4			
51	Capryol	Kolliphor EL	Transcutol CG	3	6	4			
52	Oleic acid	Kolliphor EL	Transcutol CG	1	6	1			
53	Oleic acid	Tween 80	PEG 400	1	6	1			
54	Oleic acid	Tween 80	Transcutol CG	3	3	4			
55	Capryol	Tween 80	Transcutol CG	1	3	1			
56	Capryol	Kolliphor EL	Transcutol CG	1	3	4			
57	Capryol	Tween 80	Transcutol CG	3	3	1			
58	Oleic acid	Kolliphor EL	PEG 400	1	6	1			
59	Capryol	Kolliphor EL	PEG 400	3	3	4			
60	Oleic acid	Tween 80	PEG 400	3	3	4			
61	Oleic acid	Kolliphor EL	Transcutol CG	3	3	1			
62	Oleic acid	Kolliphor EL	PEG 400	3	6	1			
63	Capryol	Kolliphor EL	PEG 400	3	3	1			
64	Capryol	Tween 80	Transcutol CG	1	6	1			

A = oil types
B = surfactant types
C = co-surfactant types
D = oil ratio
E = surfactant ratio
F = co-surfactant ratio

- **Formula dari D-Optimal**

Capryol 90	Kolliphor EL	PEG 400
2	4,5	3,5
1	5,5	3,5
1	5	4
3	3	4
3	4	3
3	3	4
2,5	4	3,5
1	5	4
2	4	4
2	4	4
3	3,5	3,5
3	4	3
1,5	5	3,5
1	6	3
2	5	3
2	4,5	3,5
1	6	3

- **Perhitungan merubah ke dalam alogaritma**

$$\frac{X - \text{the average of the two levels}}{\text{one-half the difference of the levels}}$$

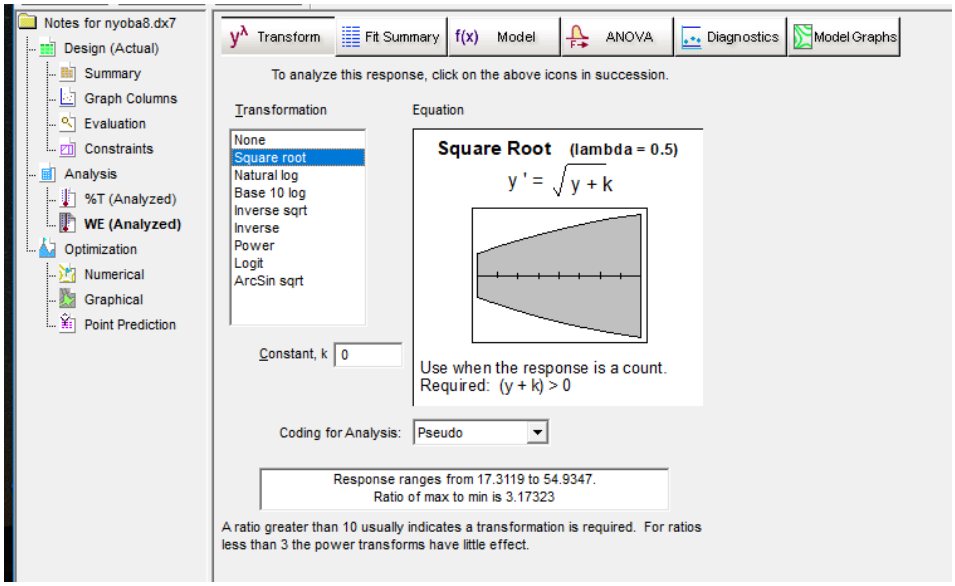
Faktorial Pak Ilham			
	capryol	kolliphor	peg 400
batas bawah	1	3	1
batas atas	3	6	4
rata-rata	2	4,5	2,5
1/2 beda	1	1,5	1,5

Lampiran 9. D-Optimal

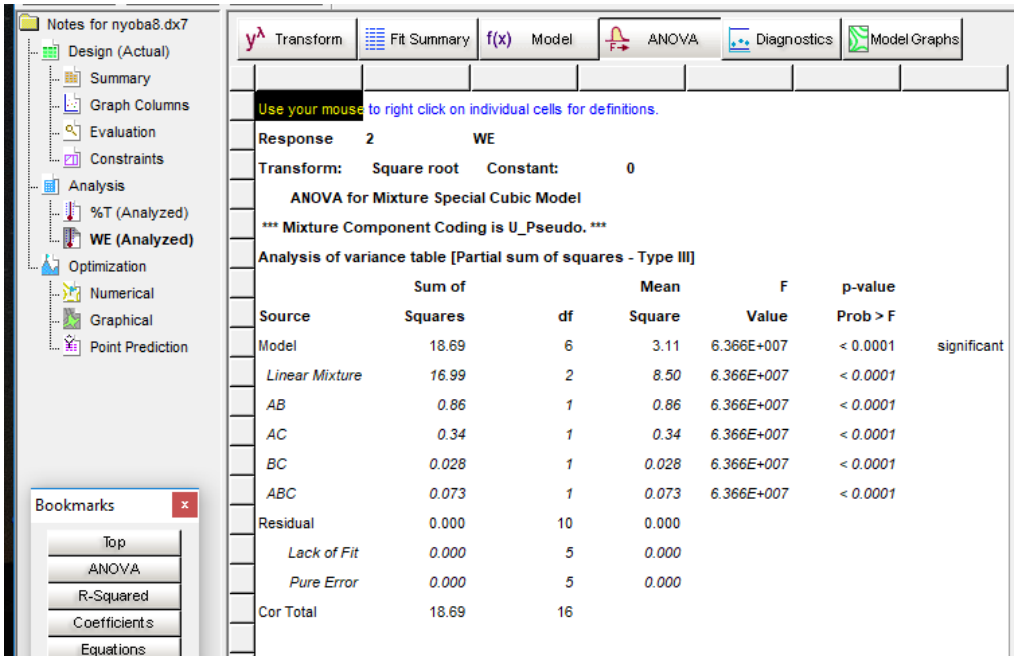
- 17 formula dan karakterisasi

Select	Std	Run	Component 1 A:capryol	Component 2 B:kolliphor	Component 3 C:peg 400	Response 1 %T	Response 2 WE
	8	1	1.250	5.375	3.375	64.7803	28.7569
	14	2	2.000	6.000	2.000	36.4502	54.9347
	5	3	2.000	6.000	2.000	36.4502	54.9347
	10	4	1.500	6.000	2.500	38.8553	38.7164
	16	5	1.000	5.000	4.000	84.1967	25.53
	2	6	1.500	4.500	4.000	69.512	45.9879
	4	7	2.000	4.000	4.000	60.6819	50.6804
	17	8	2.000	5.000	3.000	54.9375	50.7185
	9	9	1.500	4.875	3.625	66.3823	40.724
	1	10	1.000	5.000	4.000	84.1967	25.53
	6	11	1.000	6.000	3.000	52.516	17.3119
	12	12	1.500	5.250	3.250	59.8083	37.8845
	7	13	1.750	5.625	2.625	46.1641	45.8663
	11	14	1.500	5.625	2.875	50.3467	37.2337
	15	15	1.000	6.000	3.000	52.516	17.3119
	13	16	2.000	4.000	4.000	60.6819	50.6804
	3	17	2.000	5.000	3.000	54.9375	50.7185

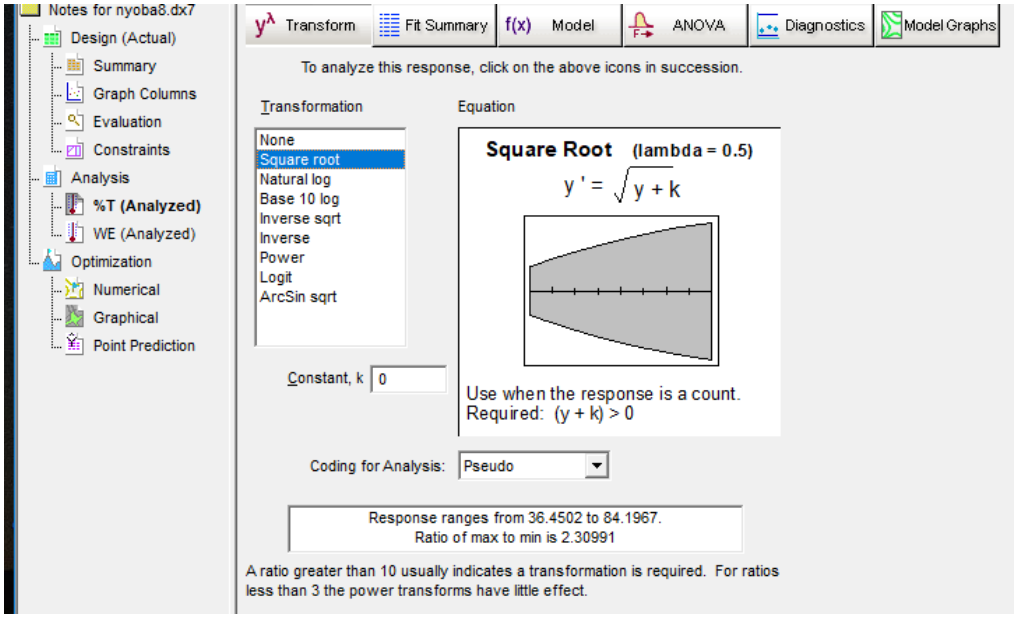
- Transformasi Waktu Emulsifikasi



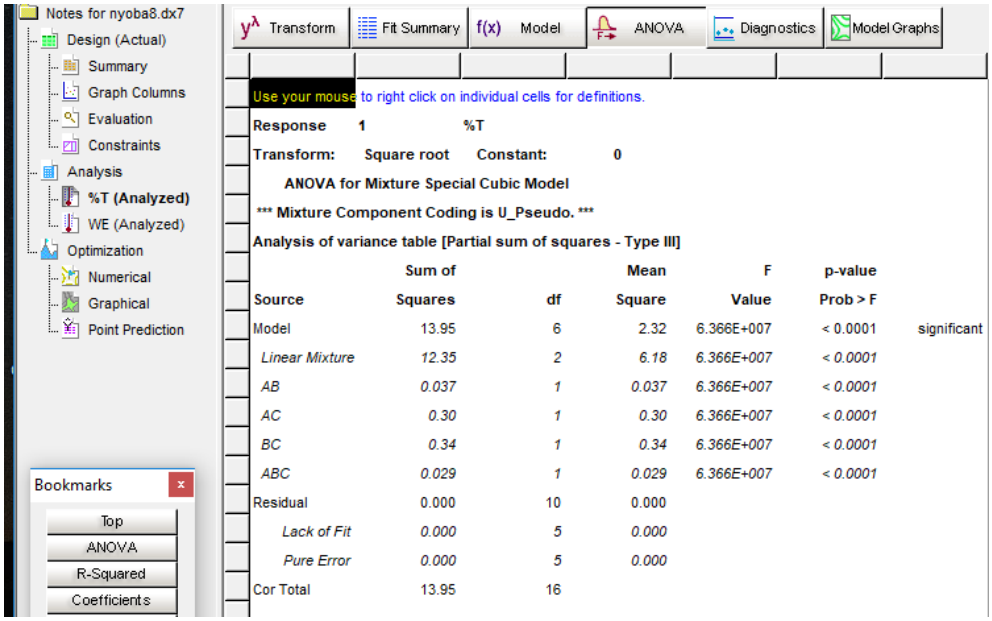
- ANOVA Waktu Emulsifikasi



- Transformasi Persen Transmitan



- ANOVA Persen Transmitan



Lampiran 10. Formula Optimum