

## **BAB V**

### **PENUTUP**

#### **5.1 Kesimpulan**

1. Berdasarkan hasil penelitian formulasi drops liquid SNEDDS astaxanthin menghasilkan formula yang jernih dengan menggunakan asam oleat sebagai fase minyak, tween 20 sebagai surfaktan dan propilen glikol sebagai ko-surfaktan.
2. Hasil Karakterisasi dan Evaluasi Drops *Liquid* SNEDDS Astaxanthin memenuhi persyaratan SNEDDS baik dari segi pengukuran persen transmitan, ukuran partikel, pengukuran efisiensi penjerapan, organoleptik, viskositas, serta waktu emulsifikasi.

#### **5.2 Saran**

Adapun saran yang dapat diberikan adalah :

1. Sebaiknya untuk peneliti selanjutnya memformulasikan bentuk sediaan lain seperti dalam bentuk solid untuk mengetahui apakah SNEDDS astaxanthin memiliki karakteristik dan stabilitas yang baik dibandingkan sediaan liquid
2. Perlu dilakukan penelitian selanjutnya mengenai uji antioksidan terhadap sediaan drops *liquid* SNEDDS astaxanthin.

## DAFTAR PUSTAKA

- Abdassah, M. (2017). Nanopartikel Dengan Gelasi Ionik. *Farmaka Volume 15 Nomor 1*, 45-52.
- Abdullah , Dorothy, E. R., & Uripto. (2010). Penentuan Waktu Reaksi Dan Jumlah Katalis Optimum Pada Pembuatan Biodisel Dari Minyak Goreng Bekas. *Info Teknik Volume 11 No 1*, 24-36.
- Aisoi, L. (2016). Karakteristik Astaxanthin Sebagai Antioksidan. *Novaes Guinea Jurnal Biologi* , 43-51.
- Ambati, R. R., Phang, S. M., Ravi, S., & Aswathanarayana, R. G. (2014). Astaxanthin: Sources, Extraction, Stability, Biological Activities And Its Commercial Applications—A Review. *Mar. Drugs* , 128-152.
- Annisa, R., Yuwono, M., & Hendradi, E. (2020). Effect Of Vegetable Oil On Self-Nanoemulsifying Drug Delivery System Of Dayak Onion [Eleutherine Palmifolia (L.) Merr.] Extract Using Hydrophilic-Lipophilic Balance Approach: Formulation, Characterization. *Research Article*, 210-216.
- Avachat, A. M., & Vijay G. Patel. (2015). Self Nanoemulsifying Drug Delivery System Of Stabilized Ellagic Acid–Phospholipid Complex With Improved Dissolution And Permeability. *Saudi Pharmaceutical Journal*, 276-289.
- Baloch , J., Sohail, M. F., Shaib, H., & Kian, M. H. (2019). Self-Nanoemulsifying Drug Delivery System (Snedds) For Improved Oral Bioavailability Of Chlorpromazine: In Vitro And In Vivo Evaluation. *Medicina* , 1-13.
- Beandrade, M. U. (2018). Formulasi Dan Karakterisasi Snedds Ekstrak Jinten Hitam (*Nigella Sativa*) Dengan Fase Minyak Ikan Hiu Cucut Botol (*Centrophorus Sp*) Serta Uji Aktivitas Imunostimulan. *Journal Of Pharmaceutical Science And Clinical Research*, 50-61.
- Borlongan, , C. K., Kanning, K., & Poulos, S. G. (1996). Free Radical Damage And Oxidative Stress In Huntington's Disease. *J. Fla. Med.Assoc*, 335-341.
- Buzea, C., Blandino, I. I., & Robbie, K. (2007). Nanomaterial And Nanoparticles: Sources And Toxicity. *Biointerphases*, Mr170–Mr172.
- Chairissy, V. (2016). *Optimasi Dan Uji Self Nano Emulsifying Drug Delivery System (Snedds) Alfa Tokoferol Asetat Sebagai Antioksidan*. Malang: Program Studi Farmasi Fakultas Kedokteran Universitas Brawijaya.

- Constantinides . (1995). Lipid Microemulsion For Improving Drug Dissolution And Oral Absorption: Physical And Biopharmaceutical Aspects. *Pharm Res*, 1561-1572.
- Costa, J., Lucas, E., Queiros, Y., & Mansur, C. (2012). Evaluation Of Nanoemulsions In The Cleaning Of Polymeric Resins, Colloids And Surfaces A: Physicochem. Eng Aspects, 112-118.
- Date, A. A., Desai, N., Dixit, R., & Nagarsenker. (2010). Self Nano Emulsifying Drug Delivery Systems: Formulation Insights, Applications And Advances. *Nanomedicine*, 1595–1616.
- Daud, N. S., Musdalipah,, & Lamadari, A. (2017). Formulasi Nanoemulsi Aspirin Menggunakan Etanol 96 % Sebagai Ko-Surfaktan. *Warta Farmasi*, 1 – 11
- Debnath, S., Satayanarayanaand, & Kumar, G. V. (2011). Nanoemulsion-A Method To Improve The Solubility Of Lipophilic Drugs . *Int. J. Adv. Pharm. Sci.*, 72-83.
- Eid, A. M., El-Enshasy, H. A., Aziz, R., & Elmarzug. (2014). The Preparation And Evaluation Of Self-Nanoemulsifying Systems Containing Swietenia Oil And An Examination Of Its Antiinflammatory Effects . *Int. J. Nanomedicine*, 4685–4695.
- Fasset, R. G., & Coombes, J. S. (2011). Astaxanthin: A Potential Therapeutic Agent In Cardiovascular Disease. *Marine Drugs*, 447-465.
- Fudholi, A. (2013). *Disolusi Dan Pelepasan Obat In-Vitro*,. Pustaka Pelajar: Yogyakarta.
- Gedivya, S.K. (2011). Herbal Plants: Used As A Cosmetics. Journal Nature Product Plant Resources. *India*.
- Gershanik, T., & Benita, S. (2000). Self-Dispersing Lipid Formulations For Improving Oral Absorption Of Lipophilic Drugs. *European Journal Of Pharmaceutics And Biopharmaceutics*, 179-188.
- Gursoy, R. N., & Benita, S. (2004). Self-Emulsifying Drug Delivery System (Sedds) For Improved Oral Delivery Of Lipophilic Drugs. *Biomed And Pharmacother* , 173-182.
- Hakima, N. A., Ariantoa, A., & Banguna, H. (2018). Formulasi Dan Evaluasi Nanoemulsi Dari Extra Virgin Olive Oil (Minyak Zaitun Ekstra Murni) Sebagai Anti-Aging. *Tm Conference Series 02*, 397-403.

- Huda, N., & Iis Wahyuningsih. (2016). Karakterisasi Self-Nanoemulsifying Drug Delivery System (Snedds) Minyak Buah Merah (Pandanus Conoideus Lam.). *Jurnal Farmasi Dan Ilmu Kefarmasian Indonesia*, 49-57.
- Iglesias, E., Anderez, J., Forgiarini, A., & Salager, J. L. (1995). A New Method To Estimate The Stability Of Short-Life Foams. *Colloid Surface A: Physicochem*, 167-174.
- Indonesia, B. P. (2003, Mei 5). Batas Maksimum Penggunaan Pengawet Paraben. No. Hk.00.05.4.1745.
- Indratmoko, S. (2014). *Pengembangan Nanopartikel Ekstrak Temulawak (Curcuma Xanthorrhiza, Roxb) Dengan Teknik Selfnanoemulsifying Drug Delivery System (Snedds) Menggunakan Fase Minyak Ikan Cicut Botol (Centrocymnus Crepidater) Sebagai Obat Antiinflamasi*. Yogyakarta: Universitas Gadjah Mada.
- Indriani, V., Novita Eka Kartab Putri Tobing, & Laode Rija. (2018). Formulasi Self-Nanoemulsifying Drug Delivery System (Snedds) Ekstrak Biji Rmania (Bouea Macrophylla Griff) Dengan Asam Oleat Oleic Acid Sebagai Minyak Pembawa. *Mulawarman Pharmaceuticals Conferences*, 276-284.
- Junaidi. (2017). Spektrofotometer Uv-Vis Untuk Estimasi Ukuran Nanopartikel Perak. 97-102.
- Jyonouchi, H., Sun , S., & Gross, M. (1995). Effect Of Carotenoids On In Vitro Immunoglobulin Production By Human Peripheral Blood Mononuclear Cells Astaxanthin, A Carotenoid Without Vitamin A Activity, Enhances In Vitro Immunoglobulin Production In Response To A T-Dependent Stimulant And Antigen. *Nutr. Cancer*, 171–183.
- Kaur, G., Pankaj, C., & Halikumar, S. L. (2013). Formulation Development Of Selfnanoemulsifying Drug Delivery System (Snedds) Of Celecoxib For Improvement Of Oral Bioavailability. *Pharmacophore*, 120-133.
- Kibbe, A. H. (2000). *Handbook Of Pharmaceutical Excipients.3rd Ed.* London: The Pharmaceutical Press.
- Koroleva, M. Y., & Yurtov, E. (2012). Nanoemulsions: The Properties, Methods Of Preparation And Promising Applications. *Russian Chemical Reviews*, 21-43.
- Kumar, D. (2009). Investigation Of A Nanoemulsion As Vehicle For Transdermal Delivery Of Amlodipine. *Pharmazie* 64, 80-85.

- Kurihara , H., Koda, H., Asami , S., & Kiso , Y. (2002). Contribution Of The Antioxidative Property Of Astaxanthin To Its Protective Effect On The Promotion Of Cancer Metastasis In Mice Treated With Restraint Stress. *Life Sci*, 09-20.
- Kusumawati, E., Wahyuningsih, L., & Khasnah, N. (2021). Pengembangan Self Nano Emulsifying Drug Delivery System (Snedds) Ekstrak Daun Senggugu (Clerodendron Serratum [L.]Spr.). *Jurnal Ilmiah Manuntung*,, 57-65.
- Kyatanwar, A. U., Jadhav, K. R., & Kadam, V. J. (2010). Self Micro-Emulsifying Drug Delivery System (Smedds): Review. *J Pharm Res*, 75-83.
- Lachman, L., Liberman, H., & Kanig, J. L. (1994). *The Theory And Practice Of Industrial Pharmacy*. Philla: Lea & Febiges.
- Makadia, H. A., Bhatt, A. Y., Parmar, R. B., Paun, J. S., & Tank, H. M. (2013). Selfcnano Emulsifying Drug Delivery System (Snedds): Future Aspect. *Asian Journal Of Pharmaceutical Research*, 21-27.
- Martien, R., Adhyatmika, Irianto, I., Farida, V., & Sari, D. P. (2012). Perkembangan Teknologi Nanopartikel Sebagai Sistem Penghantaran Obat. *Majalah Farmaseutik*, Vol. 8 No. 1 , 133-144.
- Martin, A., Swarbrick, J., & Cammarata, A. (1993). *Farmasi Fisik: Dasar-Dasar Farmasi Fisik Dalam Ilmu Farmasetik*. Jakarta: Universitas Indonesia.
- McClements, D. J. (2012). Nanoemulsions Versus Microemulsions: Terminology, Differences, And Similarities. *Soft Matter*, 1719-1729.
- Meitria, C. (2017). *Preparasi Dan Karakterisasi Nanopartikel Isolat Andrografilida Dengan Variasi Perbandingan Pva* . Yogyakarta: Universitas Islam Indonesia.
- Mustika, A., Fatimah, N., & Sari, M. G. (2019). Formulation And Characterizations Of Self-Nanoemulsifying Drug Delivery System Of Extract Petiveria Alliacea (Singawalang) Leaves. *International Conference On Pharmacy And Pharmaceutical Science (Icpps)* , 61-65.
- Nasr, A., Gardouh, A., Ghonaim, H., Abdelghany, E., & Ghorab, M. (2016). Effect Of Oils, Surfactants And Cosurfactants On Phase Behavior And Physicochemical Properties Of Self-Nanoemulsifying Drug Delivery System (Snedds) For Irbesartan And Olmesartan. *International Journal Of Applied Pharmaceutics*, 13-24.

- Nazzal S, S. I. (2002). Preparation And In Vitro Characterization Of A Eutectic Based Semisolid Self Nanoemulsified Drug Delivery Systems (Snedds) Of Ubiquinone: Mechanism And Progress Of Emulsion Formation. *Int J Pharm* , 247-265.
- Nugroho, B. H., & Sari, N. P. (2018). Fomulasi Self Nano Emulsifying Drug Delivery System (Snedds) Ekstrak Daun Karamunting (*Rhodomyrtus Tomentosa* (Ait.) Hassk). *Jurnal Ilmiah Farmasi (Jif)*, 1-8.
- Nurdianti, L., Aryani, R., & Indra. (2017). Formulasi Dan Karakterisasi Sne (Self Nanoemulsion) Astaxanthin Dari *Haematococcus Pluvialis* Sebagai Super Antioksidan Alami. *Jurnal Sains Farmasi & Klinis*, 30-36.
- Nurfauziah, R., & Rusdiana, T. (2018). Review: Formulasi Nanoemulsi Untuk Meningkatkan Kelarutan Obat Lipofilik. *Farmaka Suplemen Volume 16 Nomor 1*, 352-360.
- Otarola, J., Lista, A. G., Fernández Band, & Garrido, M. (2015). Capillary Electrophoresis To Determine Entrapment Efficiency Of A Nanostructured Lipid Carrier Loaded With Piroxicam. *Journal Of Pharmaceutical Analysis*, 70-73.
- Patel, J., Kadam, C., Vishwajith, V., & Gopal, V. (2011). Formulation, Design, And Evaluation Of Orally Disintegrating Tablets Of Loratadine Using Direct Compression Process. *Int. J. Pharm. Biol. Sci*, 389-400.
- Pouton, C. W. (2000). Lipid Formulations For Oral Administration Of Drugs: Nonemulsifying, Self-Emulsifying And Self-Microemulsifying Drug Delivery Systems. *Eur. J. Pharm. Sci* , 93–98.
- Priani , S. E., Somantri, S. Y., & Ratih, A. (2020). Formulasi Dan Karakterisasi Snedds (Self Nanoemulsifying Drug Delivery System) Mengandung Minyak Jintan Hitam Dan Minyak Zaitun. *Jurnal Sains Farmasi & Klinis*, 31-28.
- Rahmawati, D., Sukmawati, A., & Indrayudha, P. (2010). *Formulasi Krim Minyak Atsiri Rimpang Temu Giring (Curcumae Heyneana/ Dan Zijp): Uji Sifat Fisik Dan Daya Anti Jamur Terhadap Candida Albicans Secara In Vitro*. Surakarta: Skripsi Fakultas Farmasi Universitas Muhammadiyah Surakarta.
- Ramadon, D., & Mun'im, A. (2016). Pemanfaatan Nanoteknologi Dalam Sistem Penghantaran Obat Baru Untuk Produk Bahan Alam . *Jurnal Ilmu Kefarmasian Indonesia*, 118-127.

- Ratnasari, D., Noviardi, H., & Apriyanti, B. (2019). Pengaruh Perbandingan Surfaktan Dan Ko-Surfaktan Terhadap Karakteristik Dan Kestabilan Mikroemulsi Minyak Zaitun (Olive Oil). *Farmasetika*, 1-10.
- Reiss, H. (1975). Entropy-Induced Dispersion Of Bulk Liquids. *J Colloids Interface Sci*, 61-70.
- Rowe, R. C., Sheskey, P. J., & Quinn, M. E. (2009). *Handbook Of Pharmaceutical Excipients Sixth Edition*. London: Pharmaceutical Press.
- Sahumena, M. H., Suryani, & Rahmadani, N. (2019). Formulasi Self-Nanoemulsifying Drug Delivery System (Snedds) Asam Mefenamat Menggunakan Vco Dengan Kombinasi Surfaktan Tween Dan Span. *Journal Syifa Sciences And Clinical Research*, 37-46.
- Saleha, S., & Murniana. (2009). *Aktivitas Antioksidan Astaxanthin Dari Limbah Kulit Udang*. Banda Aceh: Universitas Syiah Kuala.
- Sapraa, K., Saprab, A., Singha, S. K., & Kakkar, S. (2012). Self Emulsifying Drug Delivery System: A Tool In Solubility Enhancement Of Poorly Soluble Drugs. *Indo Global Journal Of Pharmaceutical Sciences*, 313-332.
- Sari, A. I., & Herdiana, Y. (2018). Formulasi Nanoemulsi Terhadap Peningkatan Kualitas Obat : Review Jurnalformulasi Nanoemulsi Terhadap Peningkatan Kualitas Obat : Review Jurnal. *Suplemen Volume 16 Nomor 1*, 278-284.
- Seema, G., & Kuma, S. A. (2014). Self Nanoemulsifying Drug Delivery System- A Noval Approach For Improving Bioavailability . *Journal Of Drug Delivery & Therapeutics*, 2191-2194.
- Shah, P., Bhalodia, D., & Shelat, P. (2010). Nanoemulsions. *A Pharmaceutical Review Syst Rev Pharm*, Vol 1.
- Sharma , V., Pratiush Saxena, Lalit Singh, & Pooja Singh. (2012). Self Emulsifying Drug Delivery System; A Novel Approach. *Journal Of Pharmacy Research*, Vol 5.
- Sigh, K., & Shah. (2009). Xanthan Gum. In R. C. Rowe, P. J. Sheskey , & W. G. Cook, *Handbook Of Pharmaceutical Excipients 6 Th Edition*. Minneapolis: Pharmaceutical Press.
- Suryani, Wa Ode , S. Z., Muhammad , H. S., Siti, A., & Ririn , W. (2019). Preparation And Characterization Of Self-Nanoemulsifying Drug Delivery System (Snedds) From Moringa Oleifera L.And Cassia Alata

- L.Leavesextracts. *Proceedings Of The 2nd International Conference On Bioscience, Biotechnology, And Biometrics* , 1-8.
- Syah, A.N.A. (2005). *Virgin Coconut Oil: Minyak Penakluk Aneka Penyakit*. Depok: Agromedia Pustaka.
- Syukri, Y., Kholidah, Z., & Chabib, L. (2019). Formulasi Dan Studi Stabilitas Self-Nano Emulsifying Propolis Menggunakan Minyak Kesturi, Cremophor Rh 40 Dan Peg 400 Sebagai Pembawa. *Journal Sains Farmasi & Klinis*, 265-273.
- Szumała, P. (2015). Structure Of Microemulsion Formulated With Monoacylglycerols In The Presence Of Polyols And Ethanol. *Journal Of Surfactants And Detergents*, 97–106.
- Thakkar, Hetal, & Nangesh, J. (2011). Formulation And Characterization Of Lipid-Based Drug Delivery System Of Raloxifene-Microemulsion And Self-Microemulsifying Drug Delivery System. *Journal Of Pharmacy And Bio Allied Sciences*, Volume 3 Issue 3 : 442-448 .
- Tulandi, G., Sri , S., & Widya, A. (2015). Validasi Metode Analisis Untuk Penetapan Kadar Paracetamol Dalam Sediaan Tablet Secara Spektrofotometri Ultraviolet. Manado : *Pharmacon Jurnal Ilmiah Farmasi*
- Villar, A. S., Naveros , B. C., Campmany, A. C., Trenchs, M. A., Rocabert , C. B., & Bellowa, L. H. (2012). Design And Optimization Of Self-Nanoemulsifying Drug Delivery Systems (Snedds) For Enhanced Dissolution Of Gemfibrozil. *International Journal Of Pharmaceutics*. (431), 161-175.
- Wahyuningsih, I., Sugiyanto, Ag. Yuswanto, & Martien, R. (2015). Ji Kelarutan Untuk Seleksi Fase Minyak, Surfaktan Dan Kosurfaktan Dalam Preparasi Self-Nano Emulsifying Drug Delivery System (Snedds) Furosemid. *Prosiding Seminar Nasional Peluang Herbal Sebagai Alternatif Medicine* , 2-8.
- Wirnarti, Suwaldi, Matin, & Hakim. (2018). Formulation Of Insulin Self Nanoemulsifying Drug Delivery System And Its In Vitro-In Vivo Study. *Indonesian J. Pharm. Vol. 29, No. 3*, 158-166.
- Yuliani , H. S., Hartini , M., Pudyastuti , B., & Istyastono , E. P. (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*,