



## DAFTAR PUSTAKA

- Abbas, A.K., Lichtman, A.H., dan Pillai, S., 2012. Cellular and Molecular Immunology Seventh Edition. Elsevier Saunders, Philadelphia; USA.
- Abd El-Fattah, A.I., Fathy, M.M., Ali, Z.Y., El-Garawany, A.E.R.A., dan Mohamed, E.K., 2017. Enhanced therapeutic benefit of quercetin-loaded phytosome nanoparticles in ovariectomized rats. *Chemico-Biological Interactions*, **271**: 30–38.
- Abd El-Rahmanand, S.N. dan Al-Jameel, S., S., 2014. Quercetin nanoparticles: preparation and characterization. *Indian Journal of Drugs*, **2**: 96–103.
- Abd-Elbaset, M., Arafa, E.-S.A., El Sherbiny, G.A., Abdel-Bakky, M.S., dan Elgendi, A.N.A.M., 2015. Quercetin modulates iNOS, eNOS and NOSTRIN expressions and attenuates oxidative stress in warm hepatic ischemia-reperfusion injury in rats. *Beni-Suef University Journal of Basic and Applied Sciences*, **4**: 246–255.
- Akrom, A. dan Fatimah, F., 2015. Ekstrak heksan biji jintan hitam (*Nigella sativa* L) meningkatkan aktivitas fagositosis makrofag tikus betina galur SD (Sprague dawley) yang diinduksi DMBA (7,12Dimetilbenz(α)antrasen) secara in vitro. *Pharmaciana*, **5**: 69–76.
- Aldi, Y., Novelin, F., dan Handayani, D., 2015. Aktivitas beberapa subfraksi herba meniran (*Phyllanthus niruri* Linn.) terhadap aktivitas dan kapasitas fagositosis makrofag. *Scientia Jurnal Farmasi dan Kesehatan*, **5**: 92–96.
- Aluani, D., Tzankova, V., Kondeva-Burdina, M., Yordanov, Y., Nikolova, E., Odzhakov, F., dkk., 2017. Evaluation of biocompatibility and antioxidant efficiency of chitosan-alginate nanoparticles loaded with quercetin. *International Journal of Biological Macromolecules*, **103**: 771–782.
- Arifah, A.N. dan Nurkhasanah, N., 2014. Efek fraksi etil asetat ekstrak etanol akar pasak bumi (*Eurycoma longifolia* Jack) terhadap aktivitas fagositosis makrofag secara in vitro. *Pharmaciana*, **4**: 9–14.
- Armstrong, N.A., 2006. *Pharmaceutical Experimental Design and Interpretation*. CRC Press, London; UK.
- Arum, I., Purwanto, A.P., dan Rya, H., 2011. *Phyllanthus niruri* L terhadap imunitas seluler tikus. *Indonesian Journal of Clinical Pathology and Medical Laboratory*, **18**: 35–42.



- Avadi, M.R., Sadeghi, A.M.M., Mohammadpour, N., Abedin, S., Atyabi, F., Dinarvand, R., dkk., 2010. Preparation and characterization of insulin nanoparticles using chitosan and arabic gum with ionic gelation method. *Nanomedicine: Nanotechnology, Biology and Medicine*, **6**: 58–63.
- Azuma, K., Izumi, R., Osaki, T., Ifuku, S., Morimoto, M., Saimoto, H., dkk., 2015. Chitin, chitosan, and its derivatives for wound healing: Old and new materials. *Journal of Functional Biomaterials*, **6**: 104–142.
- Bagalkotkar, G., Sagineedu, S.R., Saad, M.S., dan Stanslas, J., 2006. Phytochemicals from *Phyllanthus niruri* Linn. and their pharmacological properties: a review. *Journal of Pharmacy and Pharmacology*, **58**: 1559–1570.
- Baratawidjaja, K.G. dan Rengganis, I., 2014. *Imunologi Dasar*, 11th ed. Balai Penerbit FKUI, Jakarta.
- Beandrade, M.U., 2016. 'Optimasi formula SNEDDS ekstrak jinten hitam (*Nigella sativa L.*) dengan fase minyak ikan hiu cicut botol (*Centrophorus sp*) serta uji aktivitas imunostimulan'. Tesis. Universitas Gadjah Mada.
- Bernkop-Schnürch, A. dan Dünnhaupt, S., 2012. Chitosan-based drug delivery systems. *European Journal of Pharmaceutics and Biopharmaceutics*, **81**: 463–469.
- Bhatia, A., Shard, P., Chopra, D., dan Mishra, T., 2011. Chitosan nanoparticles as carrier of immunorestorative plant extract: synthesis, characterization and immunorestorative efficacy. *International Journal of Drug Delivery*, **1**: 381–385.
- Bilia, A.R., Isacchi, B., Righeschi, C., Guccione, C., dan Bergonzi, M.C., 2014. Flavonoids loaded in nanocarriers: an opportunity to increase oral bioavailability and bioefficacy. *Food and Nutrition Sciences*, **5**: 1212.
- Bintang, M., 2010. *Biokimia Teknik Penelitian*. Erlangga, Jakarta.
- Bolton, S. dan Bon, C., 2004. *Pharmaceutical Statistics: Practical and Clinical Applications*, 4th ed., and expanded ed., Drugs and the pharmaceutical sciences. M. Dekker, New York.
- Chang, C.C., Yang, M.H., Wen, H.M., dan Chern, J.C., 2002. Estimation of total flavonoid content in propolis by two complementary colorimetric methods. *Journal of Food and Drug Analysis; Philadelphia*, **10**: 178-182.
- Chapra, S.C. dan Canale, R.P., 2001. *Numerical Methods for Engineers: With Software and Programming Applications*, 4th ed. McGraw-Hill Publishing Co., Boston.



- Chen, X., Liu, L., dan Jiang, C., 2016. Charge-reversal nanoparticles: novel targeted drug delivery carriers. *Acta Pharmaceutica Sinica B, Functional Materials, Nanocarriers, and Formulations for Targeted Therapy* **6**: 261–267.
- Choi, C., Nam, J.P., dan Nah, J.W., 2016. Application of chitosan and chitosan derivatives as biomaterials. *Journal of Industrial and Engineering Chemistry*, **33**: 1–10.
- Date, A.A., Hanes, J., dan Ensign, L.M., 2016. Nanoparticles for oral delivery: Design, evaluation and state-of-the-art. *Journal of Controlled Release, SI: North America Part II* **240**: 504–526.
- Daud, N.S. dan Martien, R., 2015. 'Formulasi dan karakterisasi nanopartikel insulin menggunakan polimer kitosan bobot molekul rendah dan pektin dengan metode gelasi ionik'. Tesis. Universitas Gadjah Mada.
- Departemen Kesehatan, 2008. Farmakope Herbal Indonesia. Jakarta, Indonesia.
- Difita, L., 2014. 'Uji aktivitas fagositosis makrofag kombinasi ekstrak etanol herba meniran (*Phyllanthus niruri L.*), daun sirih merah (*Piper crocatum Ruiz. & Pav.*) dan umbi keladi tikus'. Skripsi. Universitas Gadjah Mada.
- Dube, A., Nicolazzo, J.A., dan Larson, I., 2010. Chitosan nanoparticles enhance the intestinal absorption of the green tea catechins (+)-catechin and (-)-epigallocatechin gallate. *European Journal of Pharmaceutical Sciences*, **41**: 219–225.
- El-Denshary, E.S., Aljawish, A., El-Nekeety, A.A., Hassan, N.S., Saleh, R.H., Rihn, B.H., dkk., 2015. Possible synergistic effect and antioxidant properties of chitosan nanoparticles and quercetin against carbon tetrachloride-induce hepatotoxicity in rats. *Soft Nanoscience Letters*, **5**: 36–51.
- Fan, W., Yan, W., Xu, Z., dan Ni, H., 2012. Formation mechanism of monodisperse, low molecular weight chitosan nanoparticles by ionic gelation technique. *Colloids and Surfaces B: Biointerfaces*, **90**: 21–27.
- Gordon, S., 2016. Phagocytosis: An Immunobiologic Process. *Immunity*, **44**: 463–475.
- Grasianto dan Siswanta, D., 2014. 'Enkapsulasi kurkumin dalam nanopartikel kitosan pektin tertaut silang glutaraldehida dan studi pelepasannya secara in vitro'. Disertasi. Universitas Gadjah Mada.
- Han, J., Guenier, A.S., Salmieri, S., dan Lacroix, M., 2008. Alginate and chitosan functionalization for micronutrient encapsulation. *Journal of Agricultural and Food Chemistry*, **56**: 2528–2535.



Honary, S. dan Zahir, F., 2013. Effect of zeta potential on the properties of nano-drug delivery systems - A review (Part 2). *Tropical Journal of Pharmaceutical Research*, **12**: 265–273.

Ibnul, 2012. 'Uji komparasi aktivitas fagositosis makrofag dan produksi nitrit oksida pada mencit Balb/c akibat perlakuan ekstrak meniran hijau (*Phyllanthus niruri*) dan meniran merah (*Phyllanthus urinaria*) yang diinfeksi bakteri *Salmonella thypi*'. Tesis. Universitas Sebelas Maret.

Jahromi, M.A.M., Al-Musawi, S., Pirestani, M., Ramandi, M.F., Ahmadi, K., Rajayi, H., dkk., 2014. Curcumin-loaded chitosan tripolyphosphate nanoparticles as a safe, natural and effective antibiotic inhibits the infection of *Staphylococcus aureus* and *Pseudomonas aeruginosa* in vivo. *Iranian Journal of Biotechnology*, **12**: 1–8.

Kašpar, O., Tokárová, V., Nyanhongo, G.S., Gübitz, G., dan Štěpánek, F., 2013. Effect of cross-linking method on the activity of spray-dried chitosan microparticles with immobilized laccase. *Food and bioproducts processing*, **91**: 525–533.

Kharkar, P.B., Talkar, S.S., Kadwadkar, N.A., dan Patravale, V.B., 2017. Nanosystems for oral delivery of immunomodulators, dalam: Andronescu, E. dan Grumezescu, A.M. (Editor), *Nanostructures for Oral Medicine, Micro and Nano Technologies*. Elsevier, hal. 295–334.

Konecsni, K., Low, N.H., dan Nickerson, M.T., 2012. Chitosan–tripolyphosphate submicron particles as the carrier of entrapped rutin. *Food Chemistry*, **134**: 1775–1779.

Kothamasu, P., Kanumur, H., Ravur, N., Maddu, C., Parasuramrajam, R., dan Thangavel, S., 2012. Nanocapsules: the weapons for novel drug delivery systems. *BioImpacts : BI*, **2**: 71–81.

Kulig, D., Zimoch-Korzycka, A., Król, Ż., Oziembłowski, M., dan Jarmoluk, A., 2017. Effect of film-forming alginate/chitosan polyelectrolyte complex on the storage quality of pork. *Molecules*, **22**: 98.

Kumar, P.V., Mangilal, T., Kumar, S.M., dan Kishore, N.R., 2015. Effect of *Phyllanthus niruri* extracts on colony forming units of the granulocyte-macrophage series activity in serum of mice. *World Journal of Pharmacy and Pharmaceutical Sciences*, **4**: 1984–1992.

Kumar, S., Sharma, S., Kumar, D., Kumar, K., dan Arya, R., 2014. Immunostimulant activity of *Phyllanthus reticulatus* Poir: a useful plant for infectious tropical diseases. *Asian Pacific Journal of Tropical Disease*, **4**: 491–495.



- Kumari, A., Yadav, S.K., Pakade, Y.B., Singh, B., dan Yadav, S.C., 2010. Development of biodegradable nanoparticles for delivery of quercetin. *Colloids and Surfaces B: Biointerfaces*, **80**: 184–192.
- Liu, H., Zhang, L., dan Lu, S., 2012. Evaluation of antioxidant and immunity activities of quercetin in isoproterenol-treated rats. *Molecules*, **17**: 4281–4291.
- Lobatto, M.E., Fuster, V., Fayad, Z.A., dan Mulder, W.J.M., 2011. Perspectives and opportunities for nanomedicine in the management of atherosclerosis. *Nature Reviews Drug Discovery*, **10**: 835–852.
- López-León, T., Carvalho, E.L.S., Seijo, B., Ortega-Vinuesa, J.L., dan Bastos-González, D., 2005. Physicochemical characterization of chitosan nanoparticles: electrokinetic and stability behavior. *Journal of Colloid and Interface Science*, **283**: 344–351.
- Mahapatro, A. dan Singh, D.K., 2011. Biodegradable nanoparticles are excellent vehicle for site directed in-vivo delivery of drugs and vaccines. *Journal of nanobiotechnology*, **9**: 55–66.
- Mahmoodi, N.O., Ghavidast, A., dan Amirmahani, N., 2016. A comparative study on the nanoparticles for improved drug delivery systems. *Journal of Photochemistry and Photobiology B: Biology*, **162**: 681–693.
- Maity, S., Mukhopadhyay, P., Kundu, P.P., dan Chakraborti, A.S., 2017. Alginate coated chitosan core-shell nanoparticles for efficient oral delivery of naringenin in diabetic animals—An in vitro and in vivo approach. *Carbohydrate Polymers*, **170**: 124–132.
- Manach, C., Williamson, G., Morand, C., Scalbert, A., dan Rémesy, C., 2005. Bioavailability and bioefficacy of polyphenols in humans. I. Review of 97 bioavailability studies. *The American Journal of Clinical Nutrition*, **81**: 230S–242S.
- Martien, R., Adhyatmika, Irianto, I.D., Farida, V., dan Sari, D.P., 2012. Perkembangan teknologi nanopartikel sebagai sistem penghantaran obat. *Majalah Farmaseutik*, **8**: 133–144.
- Martien, R., Loretz, B., dan Schnürch, A.B., 2006. Oral gene delivery: Design of polymeric carrier systems shielding toward intestinal enzymatic attack. *Biopolymers*, **83**: 327–336.
- Masood, F., 2016. Polymeric nanoparticles for targeted drug delivery system for cancer therapy. *Materials Science and Engineering: C*, **60**: 569–578.
- Middleton, E., Kandaswami, C., dan Theoharides, T.C., 2000. The effects of plant flavonoids on mammalian cells: implications for inflammation, heart disease, and cancer. *Pharmacological Reviews*, **52**: 673–751.



Mohammed, M., Syeda, J., Wasan, K., dan Wasan, E., 2017. An overview of chitosan nanoparticles and its application in non-parenteral drug delivery. *Pharmaceutics*, **9**: 53.

Mohanraj, V.J. dan Chen, Y., 2006. Nanoparticles - a review. *Tropical Journal of Pharmaceutical Research*, **5**: 561–573.

Mukhopadhyay, P., Chakraborty, S., Bhattacharya, S., Mishra, R., dan Kundu, P.P., 2015. pH-sensitive chitosan/alginate core-shell nanoparticles for efficient and safe oral insulin delivery. *International Journal of Biological Macromolecules*, **72**: 640–648.

Nagpal, K., Singh, S.K., dan Mishra, D.N., 2010. Chitosan nanoparticles: A promising system in novel drug delivery. *Chemical and Pharmaceutical Bulletin*, **58**: 1423–1430.

Nakorn, P.N.N., 2008. Chitin nanowhisker and chitosan nanoparticles in protein immobilization for biosensor applications. *ResearchGate*, **18**: 73–77.

Narendra, K., Swathi, J., Sowjanya, K.M., dan Satya, A.K., 2012. *Phyllanthus niruri*: a review on its ethno botanical, phytochemical and pharmacological profile. *Journal of Pharmacy Research*, **5**: 4681–4691.

Nasr, A., Gardouh, A., Ghonaim, H., Abdelghany, E., dan 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*, **8**: 13–24.

Natesan, S., Pandian, S., Ponnusamy, C., Palanichamy, R., Muthusamy, S., dan Kandasamy, R., 2017. Co-encapsulated resveratrol and quercetin in chitosan and peg modified chitosan nanoparticles: For efficient intra ocular pressure reduction. *International Journal of Biological Macromolecules*, **104**: 1837–1845.

Nilsen-Nygaard, J., Strand, S.P., Vårum, K.M., Draget, K.I., dan Nordgård, C.T., 2015. Chitosan: gels and interfacial properties. *Polymers*, **7**: 552–579.

Nurkhasanah, N. dan Zulkarmen, L.R., 2014. Efek ekstrak etanol kelopak rosella (*Hibiscus sabdariffa* L.) terhadap sekresi nitrit oxida (NO) makrofag peritoneum tikus yang diinduksi 7,12-dimethylbenz(α)antracene (DMBA). *Media Farmasi*, **11**: 155–166.

Nworu, C.S., Akah, P.A., Okoye, F.B.C., dan Esimone, C.O., 2010a. Aqueous extract of *Phyllanthus niruri* (Euphorbiaceae) enhances the phenotypic and functional maturation of bone marrow-derived dendritic cells and their antigen-presentation function. *Immunopharmacology and Immunotoxicology*, **32**: 393–401.



- Nworu, C.S., Akah, P.A., Okoye, F.B.C., Proksch, P., dan Esimone, C.O., 2010b. The effects of *Phyllanthus niruri* aqueous extract on the activation of murine lymphocytes and bone marrow-derived macrophages. *Immunological Investigations*, **39**: 245–267.
- Oh, S.Y., Mead, P.J., Sharma, B.S., Quinton, V.M., Boermans, H.J., Smith, T.K., dkk., 2015. Effect of *Penicillium* mycotoxins on the cytokine gene expression, reactive oxygen species production, and phagocytosis of bovine macrophage (BoMacs) function. *Toxicology in Vitro*, **30**: 446–453.
- Orhan, I.E., Mesaik, M.A., Jabeen, A., dan Kan, Y., 2016. Immunomodulatory properties of various natural compounds and essential oils through modulation of human cellular immune response. *Industrial Crops and Products*, **81**: 117–122.
- Othman, A.I., El-Sherbiny, I.M., El-Missiry, M.A., Ali, D.A., dan Abd El-Hakim, E., 2017. Polyphenon-E encapsulated into chitosan nanoparticles inhibited proliferation and growth of Ehrlich solid tumor in mice. *Egyptian Journal of Basic and Applied Sciences*, <https://doi.org/10.1016/j.ejbas.2017.10.008>.
- Pandey, A. dan Pandey, G., 2013. Research and reviews: journal of pharmaceutics and nanotechnology. *Journal of Pharmaceutics and Nanotechnology*, **2**: 13–16.
- Park, S.J., Garcia, C.V., Shin, G.H., dan Kim, J.T., 2015. Fabrication and optimization of EGCG-loaded nanoparticles by high pressure homogenization. *Journal of Applied Polymer Science*, **133**: 1–7.
- Parmar, N., Singla, N., Amin, S., dan Kohli, K., 2011. Study of cosurfactant effect on nanoemulsifying area and development of lercanidipine loaded (SNEDDS) self nanoemulsifying drug delivery system. *Colloids and Surfaces B: Biointerfaces*, **86**: 327–338.
- Pekal, A. dan Pyrzynska, K., 2014. Evaluation of aluminium complexation reaction for flavonoid content assay. *Food Analytical Methods*, **7**: 1776–1782.
- Plapied, L., Duhem, N., des Rieux, A., dan Préat, V., 2011. Fate of polymeric nanocarriers for oral drug delivery. *Current Opinion in Colloid & Interface Science*, **16**: 228–237.
- Politis, S.N., Colombo, P., Colombo, G., dan Rekkas, D.M., 2017. Design of experiments (DoE) in pharmaceutical development. *Drug Development and Industrial Pharmacy*, **43**: 889–901.
- Racoviță, ř., Vasiliu, S., Popa, M., dan Luca, C., 2009. Polysaccharides based on micro- and nanoparticles obtained by ionic gelation and their applications as drug delivery systems. *Revue Roumaine de Chimie*, **54**: 709–718.
- Radji, M., 2015. *Imunologi Dan Virologi*. PT ISFI Penerbitan, Jakarta.



- Rahayu, M.P., 2014. Aktivitas fagositosis makrofag dari fraksi n-heksan herba sambiloto (*Andrographis paniculata* (Burm.F) Nees) terhadap mencit yang diinduksi vaksin hepatitis B. *Pharmaceutical Journal of Indonesia*, **11**: 181–199.
- Rakhmaningtyas, W.A., 2012. 'Preparasi dan karakterisasi nanopartikel sambungsilang kitosan-natrium tripolifosfat dalam sediaan film bukal verapamil hidroklorida'. Skripsi. FMIPA Univrsitas Indonesia.
- Rasaie, S., Ghanbarzadeh, S., Mohammadi, M., dan Hamishehkar, H., 2014. Nano phytosomes of quercetin: A promising formulation for fortification of food products with antioxidants. *Pharmaceutical Sciences*, **20**: 96.
- Rasheed, A., Reddy, S.B., dan Roja, C., 2012. A review on standardisation of herbal formulation. *Journal of Phytotherapy*, **2**: 74–88.
- Rázga, F., Vnuková, D., Némethová, V., Mazancová, P., dan Lacík, I., 2016. Preparation of chitosan-TPP sub-micron particles: Critical evaluation and derived recommendations. *Carbohydrate Polymers*, **151**: 488–499.
- Redhead, H.M., Davis, S.S., dan Illum, L., 2001. Drug delivery in poly(lactide-co-glycolide) nanoparticles surface modified with poloxamer 407 and poloxamine 908: in vitro characterisation and in vivo evaluation. *Journal of Controlled Release: Official Journal of the Controlled Release Society*, **70**: 353–363.
- Rong, X., Xie, Y., Hao, X., Chen, T., Wang, Y., dan Liu, Y., 2011. Applications of polymeric nanocapsules in field of drug delivery systems. *Current Drug Discovery Technologies*, **8**: 173–187.
- Roshanak, S., Rahimmalek, M., dan Goli, S.A.H., 2016. Evaluation of seven different drying treatments in respect to total flavonoid, phenolic, vitamin C content, chlorophyll, antioxidant activity and color of green tea (*Camellia sinensis* or *C. assamica*) leaves. *Journal of Food Science and Technology*, **53**: 721–729.
- Sæther, H.V., Holme, H.K., Maurstad, G., Smidsrød, O., dan Stokke, B.T., 2008. Polyelectrolyte complex formation using alginate and chitosan. *Carbohydrate Polymers*, **74**: 813–821.
- Saikia, C., Gogoi, P., dan Maji, T.K., 2015. Chitosan: a promising biopolymer in drug delivery applications. *Journal of Molecular and Genetic Medicine*, 1–10.
- Sanna, V., Lubinu, G., Madau, P., Pala, N., Nurra, S., Mariani, A., dkk., 2015. Polymeric nanoparticles encapsulating white tea extract for nutraceutical application. *Journal of Agricultural and Food Chemistry*, **63**: 2026–2032.
- Sarjadi, 2001. Patologi Umum. Badan Penerbit Universitas Diponegoro, Semarang, Indonesia.



- Sarkar, A., Ghosh, S., Chowdhury, S., Pandey, B., dan Sil, P.C., 2016. Targeted delivery of quercetin loaded mesoporous silica nanoparticles to the breast cancer cells. *Biochimica et Biophysica Acta (BBA) - General Subjects*, **1860**: 2065–2075.
- Sawtarie, N., Cai, Y., dan Lapitsky, Y., 2017. Preparation of chitosan/tripolyphosphate nanoparticles with highly tunable size and low polydispersity. *Colloids and Surfaces B: Biointerfaces*, **157**: 110–117.
- Sherwood, L., 2001. *Fisiologi Manusia Dari Sel Ke Sistem*, 2001st ed. EGC, Jakarta.
- Shukla, S.K., Mishra, A.K., Arotiba, O.A., dan Mamba, B.B., 2013. Chitosan-based nanomaterials: A state-of-the-art review. *International Journal of Biological Macromolecules*, **59**: 46–58.
- Singh, D., Tanwar, H., Jayashankar, B., Sharma, J., Murthy, S., Chanda, S., dkk., 2017. Quercetin exhibits adjuvant activity by enhancing Th2 immune response in ovalbumin immunized mice. *Biomedicine & Pharmacotherapy*, **90**: 354–360.
- Sipoli, C.C., Santana, N., Shimojo, A.A.M., Azzoni, A., dan de la Torre, L.G., 2015. Scalable production of highly concentrated chitosan/TPP nanoparticles in different pHs and evaluation of the in vitro transfection efficiency. *Biochemical Engineering Journal*, **94**: 65–73.
- Soares, L.A.L., Bassani, V.L., Ortega, G.G., dan Petrovick, P.R., 2003. Total flavonoid determination for the quality control of aqueous extractives from *Phyllanthus niruri L.* *Acta Farmacéutica Bonaerense*, **22**: 203–208.
- Stahl, W., van den Berg, H., Arthur, J., Bast, A., Dainty, J., Faulks, R.M., dkk., 2002. Bioavailability and metabolism. *Molecular Aspects of Medicine*, **23**: 39–100.
- Stat-Ease, 2018. *Handbook for Experimenters: A Concise Collection of Handy Tips to Help You Set up and Analyze Your Designed Experiments*, 11. Stat-Ease, Inc., Minneapolis, USA.
- Stoica, R., Šomoghi, R., dan Ion, R.M., 2013. Preparation of chitosan – tripolyphosphate nanoparticles For the encapsulation of polyphenols extracted from rose Hips. *Digest Journal of Nanomaterials and Biostructures*, **8**: 955–963.
- Sujatno, A., Salam, R., Bandriyana, dan Dimyati, A., 2015. Studi scanning electron microscopy (SEM) untuk karakterisasi proses oksidasi paduan zirkonium. *Jurnal Forum Nuklir*, **9**: 44–50.
- Sun, D., Li, N., Zhang, W., Zhao, Z., Mou, Z., Huang, D., dkk., 2016. Design of PLGA-functionalized quercetin nanoparticles for potential use in Alzheimer's disease. *Colloids and Surfaces B: Biointerfaces*, **148**: 116–129.



Thapa, R.K., Khan, G.M., Parajuli-Baral, K., dan Thapa, P., 2013. Herbal medicine incorporated nanoparticles: advancements in herbal treatment. *Asian Journal of Biomedical and Pharmaceutical Sciences*, **3**: 7–14.

Tiyaboonchai, W., 2003. Chitosan nanoparticles : a promising system for drug delivery. *Naresuan University Journal*, **11**: 51–66.

Tjandrawinata, R.R., Susanto, L.W., dan Nofiarny, D., 2017. The use of *Phyllanthus niruri L.* as an immunomodulator for the treatment of infectious diseases in clinical settings. *Asian Pacific Journal of Tropical Disease*, **7**: 132–140.

Tjay, T.H. dan Rahardja, K., 2007. *Obat-Obat Penting Khasiat, Penggunaan Dan Efek-Efek Sampingnya*, 6th ed. Elex Media Komputindo, Jakarta.

Tsai, M.L., Chen, R.H., Bai, S.W., dan Chen, W.Y., 2011. The storage stability of chitosan/tripolyphosphate nanoparticles in a phosphate buffer. *Carbohydrate Polymers*, , Advances in chitin/chitosan science and their applications **84**: 756–761.

Van den Bossche, J., O'Neill, L.A., dan Menon, D., 2017. Macrophage Immunometabolism: Where Are We (Going). *Trends in Immunology*, **38**: 395–406.

Venkatesan, J., Bhatnagar, I., dan Kim, S.K., 2014. Chitosan-alginate biocomposite containing fucoidan for bone tissue engineering. *Marine Drugs*, **12**: 300–316.

Wang, W., Sun, C., Mao, L., Ma, P., Liu, F., Yang, J., dkk., 2016. The biological activities, chemical stability, metabolism and delivery systems of quercetin: A review. *Trends in Food Science & Technology*, **56**: 21–38.

Watson, L.J., 2014. 'Immune Response'. Geeky Medics. diakses pada 10 Juli 2017. <<https://geekymedics.com/immune-response/>>.

Weissman, S.A. dan Anderson, N.G., 2015. Design of experiments (DoE) and process optimization. A Review of Recent Publications. *Organic Process Research & Development*, **19**: 1605–1633.

Xu, L., Huang, Y.-A., Zhu, Q.-J., dan Ye, C., 2015. Chitosan in molecularly-imprinted polymers: current and future prospects. *International Journal of Molecular Sciences*, **16**: 18328–18347.

Yaswinda, D.Q., 2015. 'Uji aktivitas fagositosis makrofag pada mencit c3h yang diberi tepung tempe kedelai sebelum diinokulasi sel Adenocarcinoma mammae'. Tesis. Universitas Jember, Jember.

Yen, F.L., Wu, T.H., Lin, L.T., Cham, T.M., dan Lin, C.C., 2008. Nanoparticles formulation of *Cuscuta chinensis* prevents acetaminophen-induced hepatotoxicity in rats. *Food and Chemical Toxicology*, **46**: 1771–1777.



UNIVERSITAS  
GADJAH MADA

**FORMULASI DAN UJI AKTIVITAS IMUNOMODULATOR NANOPARTIKEL POLIMERIK EKSTRAK  
ETANOLIK HERBA MENIRAN  
(*Phyllanthus niruri* L.)**

GALIH PRATIWI, Dr.rer.nat. Ronny Martien, M.Si.; drh. Retno Murwanti, M.P., Ph.D.

Universitas Gadjah Mada, 2018 | Diunduh dari <http://etd.repository.ugm.ac.id/>

Younes, I. dan Rinaudo, M., 2015. Chitin and chitosan preparation from marine sources. Structure, properties and applications. *Marine Drugs*, **13**: 1133–1174.

Zalizar, L., 2013. Flavonoids of *Phyllanthus niruri* as immunomodulators a prospect to animal disease control. *ARPN Journal of Science and Technology*, **3**: 529–532.

Zhang, Y., Yang, Y., Tang, K., Hu, X., dan Zou, G., 2008. Physicochemical characterization and antioxidant activity of quercetin-loaded chitosan nanoparticles. *Journal of Applied Polymer Science*, **107**: 891–897.

Zolezzi, P.C., Fernández, T., Aulicino, P., Cavaliere, V., Greczanik, S., Caldas Lopes, E., dkk., 2005. Ligaria cuneifolia flavonoid fractions modulate cell growth of normal lymphocytes and tumor cells as well as multidrug resistant cells. *Immunobiology*, **209**: 737–749.