UNIVERSITAS GADJAH MADA
EKSTRAKSI, IDENTIFIKASI DAN NANOENKAPSULASI FLAVONOID BIJI KAKAO (Theobroma cacao L.) SEGAR SEBAGAI ANTIOKSIDAN ALAMI
ROSSI INDIARTO, Prof. Dr. Ir. Supriyanto, M.S.; Prof. Dr. Ir. Umar Santoso, M.Sc.; Prof. Dr. Yudi Pranoto, S.TP., M.
Universitas Gadjah Mada, 2019 | Diunduh dari http://etd.repository.ugm.ac.id/

DAFTAR PUSTAKA

Abbe Maleyki, M.J. and Ismail, A. (2010), "Antioxidant properties of cocoa powder", *Journal of Food Biochemistry*, Vol. 34 No. 1, pp. 111–128.

Abu, F., Mat Taib, C.N., Mohd Moklas, M.A. and Mohd Akhir, S. (2017), "Antioxidant Properties of Crude Extract, Partition Extract, and Fermented Medium of Dendrobium sabin Flower", *Evidence-Based Complementary and Alternative Medicine*, Vol. 2017, pp. 1–9.

Adamson, G.E., Lazarus, S.A., Mitchell, A.E., Prior, R.L., Cao, G., Jacobs, P.H., Kremers, B.G., et al. (1999), "HPLC method for the quantification of procyanidins in cocoa and chocolate samples and correlation to total antioxidant capacity", *Journal of Agricultural and Food Chemistry*, Vol. 47 No. 10, pp. 4184–4188.

Adedayo, B.C., Oboh, G., Oyeleye, S.I., Ejakpovi, I.I., Boligon, A.A. and Athayde, M.L. (2015), "Blanching alters the phenolic constituents and in vitro antioxidant and anticholinesterases properties of fireweed (Crassocephalum crepidioides)", *Journal of Taibah University Medical Sciences*, Elsevier Ltd, Vol. 10 No. 4, pp. 419–426.

Adjimani, J.P. and Asare, P. (2015), "Antioxidant and free radical scavenging activity of iron chelators", *Toxicology Reports*, Elsevier Ireland Ltd, Vol. 2, pp. 721–728.

Afoakwa, E.O., Kongor, J.E., Takrama, J.F., Budu, A.S. and Mensah-Brown, H. (2013), "Effects of pulp preconditioning on total polyphenols, O-diphenols and anthocyamin concentrations during fermentation and drying of cocoa (Theobroma cacao) beans.", *Journal of Food Science and Engineering*, Vol. 3 No. 5, pp. 235–245.

Afoakwa, E.O., Quao, J., Takrama, F.S., Budu, A.S. and Saalia, F.K. (2012), "Changes in total polyphenols, o-diphenols and anthocyanin concentrations during fermentation of pulp pre-conditioned cocoa (Theobroma cacao) beans", *International Food Research Journal*, Vol. 19 No. 3, pp. 1071–1077.

Aikpokpodion, P.E. and Dongo, L.N. (2010), "Effects of Fermentation Intensity on Polyphenols and Antioxidant Capacity", *International Journal of Sustainable Crop Production*, Vol. 5 No. 4, pp. 66–70.

Akhter, K.F. (2012), "Nanoencapsulation of Protein Drug for Controlled Release", *Journal of Physical Chemistry & Biophysics*, Vol. S11 No. 01, pp. 1–5.

Ali, F., Ranneh, Y., Ismail, A. and Esa, N.M. (2015), "Identification of phenolic compounds in polyphenols-rich extract of Malaysian cocoa powder using the HPLC-UV-ESI—MS/MS and probing their antioxidant properties", *Journal of Food Science and Technology*, Vol. 52 No. 4, pp. 2103–2111.

Altunkaya, A. (2014), "Partial purification and characterization of polyphenoloxidase from Turkish tea leaf (Camellia Sinensis L.)", *International Journal of Food Properties*, Taylor & Francis, Vol. 17 No. 7, pp. 1490–1497.

Alvim, I.D. and Grosso, C.R.F. (2010), "Microparticles obtained by complex

UNIVERSITAS GADJAH MADA
EKSTRAKSI, IDENTIFIKASI DAN NANOENKAPSULASI FLAVONOID BIJI KAKAO (Theobroma cacao L.) SEGAR SEBAGAI ANTIOKSIDAN ALAMI
ROSSI INDIARTO, Prof. Dr. Ir. Supriyanto, M.S.; Prof. Dr. Ir. Umar Santoso, M.Sc.; Prof. Dr. Yudi Pranoto, S.TP., M.
Universitas Gadjah Mada, 2019 | Diunduh dari http://etd.repository.ugm.ac.id/

coacervation: influence of the type of reticulation and the drying process on the release of the core material", *Ciência e Tecnologia de Alimentos*, Vol. 30 No. 4, pp. 1069–1076.

Amic, D., Davidovic-Amic, D., Beslo, D., Rastija, V., Lucic, B. and Trinajstic, N. (2007), "SAR and QSAR of the Antioxidant Activity of Flavonoids", *Current Medicinal Chemistry*, Vol. 14 No. 7, pp. 827–845.

Amić, D. and Lučić, B. (2010), "Reliability of bond dissociation enthalpy calculated by the PM6 method and experimental TEAC values in antiradical QSAR of flavonoids", *Bioorganic and Medicinal Chemistry*, Vol. 18 No. 1, pp. 28–35.

Aprotosoaie, A., Miron, A., Trifan, A., Luca, V. and Costache, I.-I. (2016), "The Cardiovascular Effects of Cocoa Polyphenols—An Overview", *Diseases*, Vol. 4 No. 4, p. 39.

Aprotosoaie, A.C., Luca, S.V. and Miron, A. (2016), "Flavor Chemistry of Cocoa and Cocoa Products-An Overview", *Comprehensive Reviews in Food Science and Food Safety*, Vol. 15 No. 1, pp. 73–91.

Araujo-Díaz, S.B., Leyva-Porras, C., Aguirre-Bañuelos, P., Álvarez-Salas, C. and Saavedra-Leos, Z. (2017), "Evaluation of the physical properties and conservation of the antioxidants content, employing inulin and maltodextrin in the spray drying of blueberry juice", *Carbohydrate Polymers*, Vol. 167, pp. 317–325.

Arroqui, C., Lopez, A., Esnoz, A. and Virseda, P. (2003), "Mathematical model of heat transfer and enzyme inactivation in an integrated blancher cooler", *Journal of Food Engineering*, Vol. 58 No. 3, pp. 215–225.

Arroqui, C., Rumsey, T.R., Lopez, A. and Virseda, P. (2001), "Effect of different soluble solids in the water on the ascorbic acid losses during water blanching of potato tissue", *Journal of Food Engineering*, Vol. 47 No. 2, pp. 123–126.

Arroyo-Maya, I.J., Rodiles-López, J.O., Cornejo-Mazón, M., Gutiérrez-López, G.F., Hernández-Arana, A., Toledo-Núñez, C., Barbosa-Cánovas, G.V., et al. (2012), "Effect of different treatments on the ability of α-lactalbumin to form nanoparticles", *Journal of Dairy Science*, Elsevier, Vol. 95 No. 11, pp. 6204–6214.

Arteel, G.E. and Sies, H. (1999), "Protection against peroxynitrite by cocoa polyphenol oligomers", *FEBS Letters*, Vol. 462 No. 1–2, pp. 167–170.

Aswal, V.K. and Kohlbrecher, J. (2005), "Synthesis of Gelatin Nanoparticles via Simple Coacervation", *Journal of Surface Science and Technology*, Vol. 21 No. 3, pp. 149–160.

Azam, S., Hadi, N., Khan, N.U. and Hadi, S.M. (2003), "Antioxidant and prooxidant properties of caffeine, theobromine and xanthine.", *Medical Science Monitor : International Medical Journal of Experimental and Clinical Research*, Vol. 9 No. 9, pp. BR325-R330.

Azarmi, S., Huang, Y., Chen, H., McQuarrie, S., Abrams, D., Roa, W., Finlay, W.H., et al. (2006), "Optimization of a two-step desolvation method for preparing gelatin nanoparticles and cell uptake studies in 143B osteosarcoma cancer cells", *Journal of Pharmacy and Pharmaceutical Sciences*, Vol. 9 No. 1, pp. 124–132.

UNIVERSITAS GADJAH MADA
EKSTRAKSI, IDENTIFIKASI DAN NANOENKAPSULASI FLAVONOID BIJI KAKAO (Theobroma cacao L.) SEGAR SEBAGAI ANTIOKSIDAN ALAMI
ROSSI INDIARTO, Prof. Dr. Ir. Supriyanto, M.S.; Prof. Dr. Ir. Umar Santoso, M.Sc.; Prof. Dr. Yudi Pranoto, S.TP., M.
Universitas Gadjah Mada, 2019 | Diunduh dari http://etd.repository.ugm.ac.id/

Barbé, C., Bartlett, J., Kong, L., Finnie, K., Lin, H.Q., Larkin, M., Calleja, S., et al. (2004), "Silica particles: A novel drug-delivery system", *Advanced Materials*, Vol. 16 No. 21, pp. 1959–1966.

Barbosa, M.I.M.J., Borsarelli, C.D. and Mercadante, A.Z. (2005), "Light stability of spray-dried bixin encapsulated with different edible polysaccharide preparations", *Food Research International*, Vol. 38 No. 8–9, pp. 989–994.

Bareras-Urbina, C.G., Ramírez-Wong, B., López-Ahumada, G.A., Burruel-Ibarra, S.E., Martínez-Cruz, O., Tapia-Hernández, J.A. and Rodríguez Félix, F. (2016), "Nano- and Micro-Particles by Nanoprecipitation: Possible Application in the Food and Agricultural Industries", *International Journal of Food Properties*, Taylor & Francis, Vol. 19 No. 9, pp. 1912–1923.

Batista, N.N., de Andrade, D.P., Ramos, C.L., Dias, D.R. and Schwan, R.F. (2016), "Antioxidant capacity of cocoa beans and chocolate assessed by FTIR", *Food Research International*, Elsevier Ltd, Vol. 90, pp. 313–319.

Bhattacharjee, S. (2016), "DLS and zeta potential - What they are and what they are not?", *Journal of Controlled Release*, Elsevier B.V., Vol. 235, pp. 337–351.

Bhowmik, M., Kumari, P., Sarkar, G., Bain, M.K., Bhowmick, B., Mollick, M.M.R., Mondal, D., et al. (2013), "Effect of xanthan gum and guar gum on in situ gelling ophthalmic drug delivery system based on poloxamer-407", *International Journal of Biological Macromolecules*, Elsevier B.V., Vol. 62, pp. 117–123.

Bilati, U., Allémann, E. and Doelker, E. (2005), "Development of a nanoprecipitation method intended for the entrapment of hydrophilic drugs into nanoparticles", *European Journal of Pharmaceutical Sciences*, Vol. 24 No. 1, pp. 67–75.

Bilati, U., Allémann, E. and Doelker, E. (2006), "Nanoprecipitation versus emulsion-based techniques for the encapsulation of proteins into biodegradable nanoparticles and process-related stability issues", *AAPS PharmSciTech*, Vol. 6 No. 4, pp. E594–E604.

Botrel, D.A., Borges, S.V., Fernandes, R.V. de B., Antoniassi, R., de Faria-Machado, A.F., Feitosa, J.P. de A. and de Paula, R.C.M. (2017), "Application of cashew tree gum on the production and stability of spray-dried fish oil", *Food Chemistry*, Elsevier Ltd, Vol. 221, pp. 1522–1529.

de Brito, E.S., Garcia, N.H.P., Gallao, M.I., Cortelazzo, A.L., Fevereiro, P.S. and Braga, M.R. (2004), "Structural and chemical changes in cocoa (Theobroma cacao L) during fermentation, drying and roasting", *Journal of the Science of Food and Agriculture*, Vol. 81, pp. 281–288.

Brown, J.E., Khodr, H., Hider, R.C. and Rice-evans, C.A. (1998), "Structural dependence of flavonoid interactions with Cu2+ ions: implications for their antioxidant properties", *Biochemical Journal*, Vol. 330, pp. 1173–1178.

Bruschi, M.L., Borghi-Pangoni, F.B., Junqueira, M. V. and de Souza Ferreira, S.B. (2017), *Nanostructured Therapeutic Systems with Bioadhesive and Thermoresponsive Properties, Nanostructures for Novel Therapy: Synthesis, Characterization and Applications*, Elsevier Inc., available at:https://doi.org/10.1016/B978-0-323-46142-9.00012-8.

UNIVERSITAS GADJAH MADA
EKSTRAKSI, IDENTIFIKASI DAN NANOENKAPSULASI FLAVONOID BIJI KAKAO (Theobroma cacao L.) SEGAR SEBAGAI ANTIOKSIDAN ALAMI
ROSSI INDIARTO, Prof. Dr. Ir. Supriyanto, M.S.; Prof. Dr. Ir. Umar Santoso, M.Sc.; Prof. Dr. Yudi Pranoto, S.TP., M.
Universitas Gadjah Mada, 2019 | Diunduh dari http://etd.repository.ugm.ac.id/

Burda, S. and Oleszek, W. (2001), "Antioxidant and Antiradical Activities of Flavonoids", *Journal of Agricultural and Food Chemistry*, Vol. 49, pp. 2774–2779.

Busch, V.M., Pereyra-Gonzalez, A., Šegatin, N., Santagapita, P.R., Poklar Ulrih, N. and Buera, M.P. (2017), "Propolis encapsulation by spray drying: Characterization and stability", *LWT - Food Science and Technology*, Vol. 75, pp. 227–235.

Camu, N., De Winter, T., Addo, S.K., Takrama, J.S., Bernaert, H. and De Vuyst, L. (2008), "Fermentation of cocoa beans: influence of microbial activities and polyphenol concentrations on the flavour of chocolate", *Revista de Fitoterapia*, Vol. 88, pp. 2288–2297.

Cano-Chauca, M., Stringheta, P.C., Ramos, A.M. and Cal-Vidal, J. (2005), "Effect of the carriers on the microstructure of mango powder obtained by spray drying and its functional characterization", *Innovative Food Science and Emerging Technologies*, Vol. 6 No. 4, pp. 420–428.

Castellani, O., Guibert, D., Al-Assaf, S., Axelos, M., Phillips, G.O. and Anton, M. (2010), "Hydrocolloids with emulsifying capacity. Part 1 - Emulsifying properties and interfacial characteristics of conventional (Acacia senegal (L.) Willd. var. senegal) and matured (Acacia (sen) SUPER GUM^{TM}) Acacia senegal", *Food Hydrocolloids*, Elsevier Ltd, Vol. 24 No. 2–3, pp. 193–199.

Cháfer, M., González-Martínez, C., Fernández, B., Pérez, L. and Chiralt, A. (2003), "Effect of blanching and vacuum pulse application on osmotic dehydration of pear", *Food Science and Technology International*, Vol. 9 No. 5, pp. 321–328.

Chen, L., Remondetto, G.E. and Subirade, M. (2006), "Food protein-based materials as nutraceutical delivery systems", *Trends in Food Science and Technology*, Vol. 17 No. 5, pp. 272–283.

Chen, Q., Shi, H. and Ho, C.T. (1992), "Effects of rosemary extracts and major constituents on lipid oxidation and soybean lipoxygenase activity", *Journal of the American Oil Chemists' Society*, Vol. 69 No. 10, pp. 999–1002.

Cheng, C.M., Jalil, A.M.M. and Ismail, A. (2009), "Phenolic and theobromine contents of commercial dark, milk and white chocolates on the Malaysian market", *Molecules*, Vol. 14 No. 1, pp. 200–209.

Chew, K.K., Khoo, M.Z., Ng, S.Y., Thoo, Y.Y., Wan Aida, W.M. and Ho, C.W. (2011), "Effect of ethanol concentration , extraction time and extraction temperature on the recovery of phenolic compounds and antioxidant capacity of Orthosiphon stamineus extracts", *International Food Research Journal*, Vol. 18 No. 4, pp. 1427–1435.

Chew, Y.L., Goh, J.K. and Lim, Y.Y. (2009), "Assessment of in vitro antioxidant capacity and polyphenolic composition of selected medicinal herbs from Leguminosae family in Peninsular Malaysia", *Food Chemistry*, Elsevier Ltd, Vol. 116 No. 1, pp. 13–18.

Chin, E., Miller, K.B., Payne, M.J., Hurst, W.J. and Stuart, D.A. (2013), "Comparison of antioxidant activity and flavanol content of cacao beans processed by modern and traditional Mesoamerican methods", *Heritage Science*, Vol. 1 No. 1, p. 9.

Choi, M.H., Kim, G.H. and Lee, H.S. (2002), "Effects of ascorbic acid retention on

UNIVERSITAS GADJAH MADA
EKSTRAKSI, IDENTIFIKASI DAN NANOENKAPSULASI FLAVONOID BIJI KAKAO (Theobroma cacao L.) SEGAR SEBAGAI ANTIOKSIDAN ALAMI
ROSSI INDIARTO, Prof. Dr. Ir. Supriyanto, M.S.; Prof. Dr. Ir. Umar Santoso, M.Sc.; Prof. Dr. Yudi Pranoto, S.TP., M.
Universitas Gadjah Mada, 2019 | Diunduh dari http://etd.repository.ugm.ac.id/

juice color and pigment stability in blood orange (Citrus sinensis) juice during refrigerated storage", *Food Research International*, Vol. 35 No. 8, pp. 753–759.

Choubey, J. and Bajpai, A.K. (2010), "Investigation on magnetically controlled delivery of doxorubicin from superparamagnetic nanocarriers of gelatin crosslinked with genipin", *Journal of Materials Science: Materials in Medicine*, Vol. 21 No. 5, pp. 1573–1586.

Claeys, W.L., Schmit, J.F., Bragard, C., Maghuin-Rogister, G., Pussemier, L. and Schiffers, B. (2011), "Exposure of several Belgian consumer groups to pesticide residues through fresh fruit and vegetable consumption", *Food Control*, Elsevier Ltd, Vol. 22 No. 3–4, pp. 508–516.

Counet, C. and Collin, S. (2003), "Effect of the Number of Flavanol Units on the Antioxidant Activity of Procyanidin Fractions Isolated from Chocolate", *Journal of Agricultural and Food Chemistry*, Vol. 51 No. 23, pp. 6816–6822.

Dag, D., Kilercioglu, M. and Oztop, M.H. (2017), "Physical and chemical characteristics of encapsulated goldenberry (Physalis peruviana L.) juice powder", *LWT - Food Science and Technology*, Elsevier Ltd, Vol. 83, pp. 86–94.

Desai, M.P., Labhasetwar, V., Walter, E., Levy, R.J. and Amidon, G.L. (1997), "The mechanism of uptake of biodegradable microparticles in cacao-2 cells is size dependent", *Pharmaceutical Research*, Vol. 14 No. 11, pp. 1568–1573.

Devi, N., Sarmah, M., Khatun, B. and Maji, T.K. (2017), "Encapsulation of active ingredients in polysaccharide–protein complex coacervates", *Advances in Colloid and Interface Science*, Elsevier B.V., Vol. 239, pp. 136–145.

Diaz, D.I., Beristain, C.I., Azuara, E., Luna, G. and Jimenez, M. (2015), "Effect of wall material on the antioxidant activity and physicochemical properties of Rubus fruticosus juice microcapsules", *Journal of Microencapsulation*, Informa UK Ltd, Vol. 32 No. 3, pp. 247–254.

Dorantes-Alvarez, L., Jaramillo-Flores, E., González, K., Martinez, R. and Parada, L. (2011), "Blanching peppers using microwaves", *Procedia Food Science*, Elsevier Srl, Vol. 1, pp. 178–183.

Đorđević, V., Balanč, B., Belščak-Cvitanović, A., Lević, S., Trifković, K., Kalušević, A., Kostić, I., et al. (2014), *Trends in Encapsulation Technologies for Delivery of Food Bioactive Compounds*, *Food Engineering Reviews*, Vol. 7, available at:https://doi.org/10.1007/s12393-014-9106-7.

Dorman, H.J.D. and Hiltunen, R. (2004), "Fe(III) reductive and free radical-scavenging properties of summer savory (Satureja hortensis L.) extract and subfractions", *Food Chemistry*, Vol. 88 No. 2, pp. 193–199.

Durling, N.E., Catchpole, O.J., Grey, J.B., Webby, R.F., Mitchell, K.A., Foo, L.Y. and Perry, N.B. (2007), "Extraction of phenolics and essential oil from dried sage (Salvia officinalis) using ethanol-water mixtures", *Food Chemistry*, Vol. 101 No. 4, pp. 1417–1424.

Ebrahimzadeh, M.A., Seyed Mohammad, N. and Seyed Fazel, N. (2009), "Correlation between the in vitro iron chelating activity and polyphenol and flavonoid contents of some medicinal plant", *Pakistan Journal of Biological Sciences*, Vol. 12 No. 12, pp. 934–938.

UNIVERSITAS GADJAH MADA
EKSTRAKSI, IDENTIFIKASI DAN NANOENKAPSULASI FLAVONOID BIJI KAKAO (Theobroma cacao L.) SEGAR SEBAGAI ANTIOKSIDAN ALAMI
ROSSI INDIARTO, Prof. Dr. Ir. Supriyanto, M.S.; Prof. Dr. Ir. Umar Santoso, M.Sc.; Prof. Dr. Yudi Pranoto, S.TP., M.
Universitas Gadjah Mada, 2019 | Diunduh dari http://etd.repository.ugm.ac.id/

El-Housiny, S., Eldeen, M.A.S., El-Attar, Y.A., Salem, H.A., Attia, D., Bendas, E.R. and El-Nabarawi, M.A. (2018), "Fluconazole-loaded solid lipid nanoparticles topical gel for treatment of pityriasis versicolor: Formulation and clinical study", *Drug Delivery*, Informa Healthcare USA, Inc, Vol. 25 No. 1, pp. 78–90.

El-Shabouri, M.H. (2002), "Positively charged nanoparticles for improving the oral bioavailability of cyclosporin-A", *International Journal of Pharmaceutics*, Vol. 249, pp. 101–108.

Elzoghby, A.O. (2013), "Gelatin-based nanoparticles as drug and gene delivery systems: Reviewing three decades of research", *Journal of Controlled Release*, Elsevier B.V., Vol. 172 No. 3, pp. 1075–1091.

Erlejman, A.G., Fraga, C.G. and Oteiza, P.I. (2006), "Procyanidins protect Caco-2 cells from bile acid- and oxidant-induced damage", *Free Radical Biology and Medicine*, Vol. 41 No. 8, pp. 1247–1256.

Estevinho, B.N., Rocha, F., Santos, L. and Alves, A. (2013), "Microencapsulation with chitosan by spray drying for industry applications - A review", *Trends in Food Science and Technology*, Vol. 31 No. 2, pp. 138–155.

Fang, Z. and Bhandari, B. (2010), "Encapsulation of polyphenols - A review", *Trends in Food Science and Technology*, Vol. 21 No. 10, pp. 510–523.

Faridi Esfanjani, A. and Jafari, S.M. (2016), "Biopolymer nano-particles and natural nano-carriers for nano-encapsulation of phenolic compounds", *Colloids and Surfaces B: Biointerfaces*, Elsevier B.V., Vol. 146, pp. 532–543.

Farrugia, C.A. and Groves, Mi.J. (1999), "Gelatin Behaviour in Dilute Aqueous Solution: Designing a Nanoparticulate Formulation", *Journal of Pharmacy and Pharmacology*, Vol. 51 No. 6, pp. 643–649.

Fatnassi, M., Tourné-Péteilh, C., Peralta, P., Cacciaguerra, T., Dieudonné, P., Devoisselle, J.M. and Alonso, B. (2013), "Encapsulation of complementary model drugs in spray-dried nanostructured materials", *Journal of Sol-Gel Science and Technology*, Vol. 68 No. 2, pp. 307–316.

Ferrali, M., Signorini, C., Caciotti, B., Sugherini, L., Ciccoli, L., Giachetti, D. and Comporti, M. (1997), "Protection against oxidative damage of erythrocyte membrane by the flavonoid quercetin and its relation to iron chelating activity", *FEBS Letters*, Vol. 416 No. 2, pp. 123–129.

Firuzi, O., Lacanna, A., Petrucci, R., Marrosu, G. and Saso, L. (2005), "Evaluation of the antioxidant activity of flavonoids by 'ferric reducing antioxidant power' assay and cyclic voltammetry", *Biochimica et Biophysica Acta - General Subjects*, Vol. 1721 No. 1–3, pp. 174–184.

Firuzi, O., Mladenka, P., Petrucci, R., Marrosu, G. and Saso, L. (2004), "Hypochlorite scavenging in activity of flavonoids", *Journal of Pharmacy and Pharmacology*, Vol. 56 No. 6, pp. 801–807.

Food and Drug Administration. (2018), "Food additives permitted for direct addition to food for human consumption", *Electronic Code of Federal Regulations*.

Fraga, C.G., Actis-Goretta, L., Ottaviani, J.I., Carrasquedo, F., Lotito, S.B., Lazarus, S., Schmitz, H.H., et al. (2005), "Regular consumption of a flavanol-rich chocolate can improve oxidant stress in young soccer players", *Clinical*

UNIVERSITAS GADJAH MADA
EKSTRAKSI, IDENTIFIKASI DAN NANOENKAPSULASI FLAVONOID BIJI KAKAO (Theobroma cacao L.) SEGAR SEBAGAI ANTIOKSIDAN ALAMI
ROSSI INDIARTO, Prof. Dr. Ir. Supriyanto, M.S.; Prof. Dr. Ir. Umar Santoso, M.Sc.; Prof. Dr. Yudi Pranoto, S.TP., M.
Universitas Gadjah Mada, 2019 | Diunduh dari http://etd.repository.ugm.ac.id/

and Developmental Immunology, Vol. 12 No. 1, pp. 11–17.

Friess, W. (1998), "Review Article. Collagen-biomaterial for drug delivery.", *European Journal of Pharmaceutics and Biopharmaceutics*, Vol. 45 No. 2, pp. 113–136.

Fukumoto, L.R. and Mazza, G. (2000), "Assessing antioxidant and prooxidant activities of phenolic compounds", *Journal of Agricultural and Food Chemistry*, Vol. 48 No. 8, pp. 3597–3604.

Furniss, B.S., Hannaford, A.J., Smith, P.W.G. and Tatchell, A.R. (1999), *Textbook of Practical Organic Chemistry*, Fifth edit., Longman Scientific & Technical, New Yor.

Ganachaud, F. and Katz, J.L. (2005), "Nanoparticles and nanocapsules created using the ouzo effect: Spontaneous emulsification as an alternative to ultrasonic and high-shear devices", *ChemPhysChem*, Vol. 6 No. 2, pp. 209–216.

Garrote, R.L., Silva, E.R., Bertone, R.A. and Avalle, A. (1997), "Effect of Time and Number of Cycles on Yield and Peeling Quality of Steam Peeled Potatoes and Asparagus", *LWT - Food Science and Technology*, Vol. 30 No. 5, pp. 448–451.

Gharsallaoui, A., Roudaut, G., Chambin, O., Voilley, A. and Saurel, R. (2007), "Applications of spray-drying in microencapsulation of food ingredients: An overview", *Food Research International*, Vol. 40 No. 9, pp. 1107–1121.

Gìltekin-Özgìven, M., Berktaş, I. and Özçelik, B. (2016), "Change in stability of procyanidins, antioxidant capacity and in-vitro bioaccessibility during processing of cocoa powder from cocoa beans", *LWT - Food Science and Technology*, Vol. 72, pp. 559–565.

Giuliano, E., Paolino, D., Fresta, M. and Cosco, D. (2018), "Mucosal Applications of Poloxamer 407-Based Hydrogels: An Overview", *Pharmaceutics*, Vol. 10 No. 3, p. 159.

Gliszczyńska-Świgło, A., Ciska, E., Pawlak-Lemańska, K., Chmielewski, J., Borkowski, T. and Tyrakowska, B. (2006), "Changes in the content of health-promoting compounds and antioxidant activity of broccoli after domestic processing", *Food Additives and Contaminants*, Vol. 23 No. 11, pp. 1088–1098.

Gocho, H., Shimizu, H., Tanioka, A., Chou, T.J. and Nakajima, T. (2000), "Effect of polymer chain end on sorption isotherm of water by chitosan", *Carbohydrate Polymers*, Vol. 41 No. 1, pp. 87–90.

Gonçalves, E.M., Pinheiro, J., Abreu, M., Brandão, T.R.S. and Silva, C.L.M. (2010), "Carrot (Daucus carota L.) peroxidase inactivation, phenolic content and physical changes kinetics due to blanching", *Journal of Food Engineering*, Elsevier Ltd, Vol. 97 No. 4, pp. 574–581.

Gordon, M.H. (1990), "The mechanism of antioxidant action in vitro", in Hudson, B.F.. (Ed.), *Food Antioxidants*, Springer Netherlands, pp. 1–18.

Goula, A.M. and Adamopoulos, K.G. (2004), "Spray drying of tomato pulp: Effect of feed concentration", *Drying Technology*, Vol. 22 No. 10, pp. 2309–2330.

Guehi, T.S., Zahouli, I.B., Ban-Koffi, L., Fae, M.A. and Nemlin, J.G. (2010), "Performance of different drying methods and their effects on the chemical

UNIVERSITAS GADJAH MADA
EKSTRAKSI, IDENTIFIKASI DAN NANOENKAPSULASI FLAVONOID BIJI KAKAO (Theobroma cacao L.) SEGAR SEBAGAI ANTIOKSIDAN ALAMI
ROSSI INDIARTO, Prof. Dr. Ir. Supriyanto, M.S.; Prof. Dr. Ir. Umar Santoso, M.Sc.; Prof. Dr. Yudi Pranoto, S.TP., M.
Universitas Gadjah Mada, 2019 | Diunduh dari http://etd.repository.ugm.ac.id/

quality attributes of raw cocoa material", *International Journal of Food Science and Technology*, Vol. 45 No. 8, pp. 1564–1571.

Gül, A. and Pehlivan, T. (2018), "Antioxidant activities of some monofloral honey types produced across Turkey", *Saudi Journal of Biological Sciences*, Elsevier, Vol. 25 No. 6, pp. 1056–1065.

Gupta, A.K., Gupta, M., Yarwood, S.J. and Curtis, A.S.G. (2004), "Effect of cellular uptake of gelatin nanoparticles on adhesion, morphology and cytoskeleton organisation of human fibroblasts", *Journal of Controlled Release*, Vol. 95 No. 2, pp. 197–207.

Hall C. A. and Cuppet S. L. (1997), *Antioxidant Methodology: In Vivo and in Vitro Concepts*, edited by Aruoma, O.I. and Cuppett, S.L., AOAC Press, Champaign, Illionis, available at: http://books.google.com/books?hl=it&lr=&id=tnyEBXXEJkgC&pgis=1.

Hammerstone, J.F., Lazarus, S.A., Mitchell, A.E., Rucker, R. and Schmitz, H.H. (1999), "Identification of procyanidins in cocoa (Theobroma cacao) and chocolate using high-performance liquid chromatography/mass spectrometry", *Journal of Agricultural and Food Chemistry*, Vol. 47 No. 2, pp. 490–496.

Han, H.J., Lee, J.S., Park, S.A., Ahn, J.B. and Lee, H.G. (2015), "Extraction optimization and nanoencapsulation of jujube pulp and seed for enhancing antioxidant activity", *Colloids and Surfaces B: Biointerfaces*, Elsevier B.V., Vol. 130, pp. 93–100.

Hasrini, R.F., Zakaria, F.R., Adawiyah, D.R. and Suparto, I.H. (2017), "Mikroenkapsulasi Minyak Sawit Mentah Dengan Penyalut Maltodekstrin Dan Isolat Protein Kedelai", *Jurnal Teknologi Dan Industri Pangan*, Vol. 28 No. 1, pp. 10–19.

Honary, S., Ebrahimi, P. and Hadianamrei, R. (2014), "Optimization of particle size and encapsulation efficiency of vancomycin nanoparticles by response surface methodology", *Pharmaceutical Development and Technology*, Vol. 19 No. 8, pp. 987–998.

Hu, S.J., Kim, B.Y. and Baik, M.Y. (2016), "Physicochemical properties and antioxidant capacity of raw, roasted and puffed cacao beans", *Food Chemistry*, Vol. 194, pp. 1089–1094.

Indiarto, R., Pranoto, Y., Santoso, U. and . S. (2019), "Evaluation of Physicochemical Properties and Antioxidant Activity of Polyphenol-Rich Cacao Bean Extract Through Water Blanching", *Pakistan Journal of Nutrition*, Vol. 18 No. 3, pp. 278–287.

Ioannou, I. and Ghoul, M. (2012), "Biological activities and effects of food processing on flavonoids as phenolics antioxidants", in Marian Petre (Ed.), *Advances in Applied Biotechnology*, In Tech Open, pp. 101–124.

Islam Shishir, M.R., Taip, F.S., Aziz, N.A., Talib, R.A. and Hossain Sarker, M.S. (2016), "Optimization of spray drying parameters for pink guava powder using RSM", *Food Science and Biotechnology*, Vol. 25 No. 2, pp. 461–468.

Jalil, A.M.M. and Ismail, A. (2008), "Polyphenols in cocoa and cocoa products: Is there a link between antioxidant properties and health?", *Molecules*, Vol. 13 No. 9, pp. 2190–2219.

UNIVERSITAS GADJAH MADA
EKSTRAKSI, IDENTIFIKASI DAN NANOENKAPSULASI FLAVONOID BIJI KAKAO (Theobroma cacao L.) SEGAR SEBAGAI ANTIOKSIDAN ALAMI
ROSSI INDIARTO, Prof. Dr. Ir. Supriyanto, M.S.; Prof. Dr. Ir. Umar Santoso, M.Sc.; Prof. Dr. Yudi Pranoto, S.TP., M.
Universitas Gadjah Mada, 2019 | Diunduh dari http://etd.repository.ugm.ac.id/

Jinap, M.S., Jamilah, B. and Nazamid, S. (2004), "Effect of polyphenol concentration on pyrazine formation during cocoa liquor roasting", *Food Chemistry*, Vol. 85 No. 1, pp. 73–80.

Kabanov, A. V, Batrakova, E. V and Miller, D.W. (2003), "Pluronic block copolymers as modulators of drug efflux transporter activity in the blood-barrier", *Advanced Drug Delivery Reviews*, Vol. 55, pp. 151–164.

Kanakdande, D., Bhosale, R. and Singhal, R.S. (2007), "Stability of cumin oleoresin microencapsulated in different combination of gum arabic, maltodextrin and modified starch", *Carbohydrate Polymers*, Vol. 67 No. 4, pp. 536–541.

Kandansamy, K. and Somasundaram, P.D. (2012), "Microencapsulation of colors by spray drying-A review", *International Journal of Food Engineering*, Vol. 8 No. 2, available at:https://doi.org/10.1515/1556-3758.2647.

Keen, C.L. (2001), "Chocolate: Food as Medicine/Medicine as Food", *Journal of the American College of Nutrition*, Vol. 20 No. September, pp. 436S-439S.

Kelly, E.H., Dennis, J.B. and Anthony, R.T. (2002), "Flavonoid antioxidants: chemistry, metabolism and structure-activity relationships", *Journal of Nutritional Biochemistry*, Vol. 13, pp. 572–584.

Kha, T.C., Nguyen, M.H. and Roach, P.D. (2010), "Effects of spray drying conditions on the physicochemical and antioxidant properties of the Gac (Momordica cochinchinensis) fruit aril powder", *Journal of Food Engineering*, Elsevier Ltd, Vol. 98 No. 3, pp. 385–392.

Khan, S.A. and Schneider, M. (2013), "Improvement of Nanoprecipitation Technique for Preparation of Gelatin Nanoparticles and Potential Macromolecular Drug Loading", *Macromolecular Bioscience*, Vol. 13 No. 4, pp. 455–463.

Khan, S.A. and Schneider, M. (2014), "Stabilization of gelatin nanoparticles without crosslinking", *Macromolecular Bioscience*, Vol. 14 No. 11, pp. 1627–1638.

Khokhar, S. and Owusu Apenten, R.K. (2003), "Iron binding characteristics of phenolic compounds: Some tentative structure-activity relations", *Food Chemistry*, Vol. 81 No. 1, pp. 133–140.

Kommareddy, S., Shenoy, D.B. and Amiji, M.M. (2007), "Gelatin Nanoparticles and Their Biofunctionalization", *Nanotechnologies for the Life Sciences*, Vol. 1, pp. 330–352.

Kongor, J.E., Hinneh, M., Van de Walle, D., Afoakwa, E.O., Boeckx, P. and Dewettinck, K. (2016), "Factors influencing quality variation in cocoa (Theobroma cacao)bean flavour profile — A review", *Food Research International*, Elsevier Ltd, Vol. 82, pp. 44–52.

Krishna Sailaja, A. and Amareshwar, P. (2012), "Preparation of BSA nanoparticles by desolvation technique using acetone as desolvating agent", *Asian Journal of Pharmaceutical and Clinical Research*, Vol. 5 No. 2, pp. 132–134.

Krishnan, S., Kshirsagar, A.C. and Singhal, R.S. (2005), "The use of gum arabic and modified starch in the microencapsulation of a food flavoring agent", *Carbohydrate Polymers*, Vol. 62 No. 4, pp. 309–315.

Kurosawa, T., Itoh, F., Nozaki, A., Nakano, Y., Katsuda, S.I., Osakabe, N.,

UNIVERSITAS GADJAH MADA
EKSTRAKSI, IDENTIFIKASI DAN NANOENKAPSULASI FLAVONOID BIJI KAKAO (Theobroma cacao L.) SEGAR SEBAGAI ANTIOKSIDAN ALAMI
ROSSI INDIARTO, Prof. Dr. Ir. Supriyanto, M.S.; Prof. Dr. Ir. Umar Santoso, M.Sc.; Prof. Dr. Yudi Pranoto, S.TP., M.
Universitas Gadjah Mada, 2019 | Diunduh dari http://etd.repository.ugm.ac.id/

Tsubone, H., et al. (2005), "Suppressive effects of cacao liquor polyphenols (CLP) on LDL oxidation and the development of atherosclerosis in Kurosawa and Kusanagi-hypercholesterolemic rabbits", *Atherosclerosis*, Vol. 179 No. 2, pp. 237–246.

De La Vega-Miranda, B., Santiesteban-López, N.A., López-Malo, A. and Sosa-Morales, M.E. (2012), "Inactivation of Salmonella Typhimurium in fresh vegetables using water-assisted microwave heating", *Food Control*, Elsevier Ltd, Vol. 26 No. 1, pp. 19–22.

Lai, L., Chou, S. and Chao, W. (2001), "Studies on the Antioxidative Activities of Hsian-tsao (", *Journal of Agricultural and Food Chemistry*, Vol. 49 No. 2, pp. 963–968.

Lai, P., Daear, W., Löbenberg, R. and Prenner, E.J. (2014), "Overview of the preparation of organic polymeric nanoparticles for drug delivery based on gelatine, chitosan, poly(d,l-lactide-co-glycolic acid) and polyalkylcyanoacrylate", *Colloids and Surfaces B: Biointerfaces*, Elsevier B.V., Vol. 118, pp. 154–163.

Lamuela-Raventós, R.M., Andrés-Lacueva, C., Permanyer, J. and Izquierdo-Pulido, M. (2001), "More antioxidants in cocoa", *The Journal of Nutrition*, Vol. 131 No. 3, pp. 834–835.

Lee, E.J., Khan, S.A. and Lim, K.H. (2011), "Gelatin nanoparticle preparation by nanoprecipitation", *Journal of Biomaterials Science, Polymer Edition*, Vol. 22 No. 4–6, pp. 753–771.

Lee, E.J., Khan, S.A., Park, J.K. and Lim, K.H. (2012), "Studies on the characteristics of drug-loaded gelatin nanoparticles prepared by nanoprecipitation", *Bioprocess and Biosystems Engineering*, Vol. 35 No. 1–2, pp. 297–307.

Lee, K.W., Kundu, J.K., Kim, S.O., Chun, K.-S., Lee, H.J. and Surh, Y.-J. (2006), "Cocoa polyphenols inhibit phorbol ester-induced superoxide anion formation in cultured HL-60 cells and expression of cyclooxygenase-2 and activation of NF-kappa B and MAPKs in mouse skin in vivo.", *The Journal of Nutrition*, Vol. 136 No. 5, pp. 1150–1155.

Lee, S.J. and Wong, M. (2014), "Nano- and microencapsulations of food ingredients", *Nano-and Microencapsulation for Foods*, p. 48.

Leo, E., Vandelli, M., Cameroni, R., Of, F.F.-I. journal and 1997, U. (1997), "Doxorubicin-loaded gelatin nanoparticles stabilized by glutaraldehyde Involvement of the drug in the cross-linking process", *International Journal of Pharmaceutics*, Vol. 155, pp. 75–82.

Lima, Lí.J.R., Almeida, M.H., Rob Nout, M.J. and Zwietering, M.H. (2011), "Theobroma cacao L., 'the food of the gods': Quality determinants of commercial cocoa beans, with particular reference to the impact of fermentation", *Critical Reviews in Food Science and Nutrition*, Vol. 51 No. 8, pp. 731–761.

Lin, J.K. and Weng, M.S. (2006), "Flavonoids as nutraceuticals", *The Science of Flavonoids*, Vol. 74 No. 4, pp. 213–238.

Loksuwan, J. (2007), "Characteristics of microencapsulated β-carotene formed by spray drying with modified tapioca starch, native tapioca starch and

UNIVERSITAS GADJAH MADA
EKSTRAKSI, IDENTIFIKASI DAN NANOENKAPSULASI FLAVONOID BIJI KAKAO (Theobroma cacao L.) SEGAR SEBAGAI ANTIOKSIDAN ALAMI
ROSSI INDIARTO, Prof. Dr. Ir. Supriyanto, M.S.; Prof. Dr. Ir. Umar Santoso, M.Sc.; Prof. Dr. Yudi Pranoto, S.TP., M.
Universitas Gadjah Mada, 2019 | Diunduh dari http://etd.repository.ugm.ac.id/

maltodextrin", *Food Hydrocolloids*, Vol. 21 No. 5–6, pp. 928–935.

Lotito, S.B., Actis-Goretta, L., Renart, M.L., Caligiuri, M., Rein, D., Schmitz, H.H., Steinberg, F.M., et al. (2000), "Influence of oligomer chain length on the antioxidant activity of procyanidins", *Biochemical and Biophysical Research Communications*, Vol. 276 No. 3, pp. 945–951.

Lotito, S.B. and Frei, B. (2006), "Consumption of flavonoid-rich foods and increased plasma antioxidant capacity in humans: Cause, consequence, or epiphenomenon?", *Free Radical Biology and Medicine*, Vol. 41 No. 12, pp. 1727–1746.

Lupo, B., Maestro, A., Gutiérrez, J.M. and González, C. (2015), "Characterization of alginate beads with encapsulated cocoa extract toprepare functional food: Comparison of two gelation mechanisms", *Food Hydrocolloids*, Vol. 49, pp. 25–34.

Lupo, B., Maestro, A., Porras, M., Gutiérrez, J.M. and González, C. (2014), "Preparation of alginate microspheres by emulsification/internal gelation to encapsulate cocoa polyphenols", *Food Hydrocolloids*, Elsevier Ltd, Vol. 38, pp. 56–65.

Macedo, A.S.L., Rocha, F. de S., Ribeiro, M. da S., Soares, S.E. and Bispo, E. da S. (2016), "Characterization of polyphenol oxidase in two cocoa (Theobroma cacao L.) cultivars produced in the south of Bahia, Brazil", *Food Science and Technology*, Vol. 36 No. 1, pp. 56–63.

Maeta, K., Nomura, W., Takatsume, Y., Izawa, S. and Inoue, Y. (2007), "Green tea polyphenols function as prooxidants to activate oxidative-stress-responsive transcription factors in yeasts", *Applied and Environmental Microbiology*, Vol. 73 No. 2, pp. 572–580.

Maji, T.K. and Hussain, M.R. (2007), "Microencapsulation of zanthoxylum limonella oil (ZLO) in genipin crosslinked chitosan-gelatin complex for mosquito repellent application", *Bioresource Technology*, Vol. 98, pp. 840–844.

Makkar, H.P.S., Dawra, R.K. and Singh, B. (1987), "Protein precipitation assay for quantitation of tannins: determination of protein in tannin-protein complex", *Analytical Biochemistry*, Vol. 166, pp. 435–439.

Martïn, M.A. and Ramos, S. (2016), "Cocoa polyphenols in oxidative stress: Potential health implications", *Journal of Functional Foods*, Elsevier Ltd, Vol. 27, pp. 570–588.

Mateos, R., Lecumberri, E., Ramos, S., Goya, L. and Bravo, L. (2005), "Determination of malondialdehyde (MDA) by high-performance liquid chromatography in serum and liver as a biomarker for oxidative stress: Application to a rat model for hypercholesterolemia and evaluation of the effect of diets rich in phenolic antioxidant", *Journal of Chromatography B: Analytical Technologies in the Biomedical and Life Sciences*, Vol. 827 No. 1, pp. 76–82.

Mayer, A.M. (2006), "Polyphenol oxidases in plants and fungi: Going places? A review", *Phytochemistry*, Vol. 67 No. 21, pp. 2318–2331.

Maynard, C., Swenson, R., Paris, J.A., Martin, J.S., Hallstrom, A.P., Cerqueira, M.D. and Weaver, W.D. (1998), "Randomized, controlled trial of RheothRx

UNIVERSITAS GADJAH MADA
EKSTRAKSI, IDENTIFIKASI DAN NANOENKAPSULASI FLAVONOID BIJI KAKAO (Theobroma cacao L.) SEGAR SEBAGAI ANTIOKSIDAN ALAMI
ROSSI INDIARTO, Prof. Dr. Ir. Supriyanto, M.S.; Prof. Dr. Ir. Umar Santoso, M.Sc.; Prof. Dr. Yudi Pranoto, S.TP., M.
Universitas Gadjah Mada, 2019 | Diunduh dari http://etd.repository.ugm.ac.id/

(poloxamer 188) in patients with suspected acute myocardial infarction", *American Heart Journal*, Vol. 135 No. 5 I, pp. 797–804.

Mayorga-Gross, A.L., Quirós-Guerrero, L.M., Fourny, G. and Vaillant, F. (2016), "An untargeted metabolomic assessment of cocoa beans during fermentation", *Food Research International*, Elsevier Ltd, Vol. 89, pp. 901–909.

McDonald, S., Prenzler, P.D., Antolovich, M. and Robards, K. (2001), "Phenolic content and antioxidant activity of olive extracts", *Food Chemistry*, Vol. 73 No. 1, pp. 73–84.

Menon, A., Hii, C., Law, C., Suzannah, S. and Djaenali, M. (2015), "Effects of water blanching on total polyphenol contents of dried cocoa beans", *The 8th Asia-Pacific Drying Conference (ADC)*, No. August, pp. 10–12.

Miller, K.B., Hurst, W.J., Flannigan, N., Ou, B., Lee, C.Y., Smith, N. and Stuart, D.A. (2009), "Survey of Commercially Available Chocolate- and Cocoa-Containing Products in the United States . 2 . Comparison of Flavan-3-ol Content with Nonfat Cocoa Solids , Total Polyphenols , and Percent Cacao", *Journal of Agricultural and Food Chemistry*, Vol. 57 No. 19, pp. 9169–9180.

Mishra, P., Mishra, S. and Mahanta, C.L. (2014), "Effect of maltodextrin concentration and inlet temperature during spray drying on physicochemical and antioxidant properties of amla (Emblica officinalis) juice powder", *Food and Bioproducts Processing*, Institution of Chemical Engineers, Vol. 92 No. 3, pp. 252–258.

Misnawi. (2003), "Influences of cocoa polyphenols and enzyme reactivation on the flavor development of unfermented and under-fermented cocoa beans", *Thesis, Universitas Putra Malaysia*, p. 329p.

Mohanraj, V.J. and Chen, Y. (2006), "Nanoparticles–a review", *Tropical Journal of Pharmaceutical Research*, Vol. 5 No. 1, pp. 561–573.

Mohanty, B. and Bohidar, H.B. (2003), "Systematic of Alcohol-Induced Simple Coacervation in Aqueous Gelatin Solutions", *Biomacromolecules*, Vol. 4, pp. 1080–1086.

Mora-Huertas, C.E., Fessi, H. and Elaissari, A. (2010), "Polymer-based nanocapsules for drug delivery", *International Journal of Pharmaceutics*, Vol. 385 No. 1–2, pp. 113–142.

Morgan, K.T., Clarke, D.O., Beauchamp, R.O., St Clair, M.B.G., Fennell, T.R. and Karl, F.W. (1992), "A Critical Review of the Toxicology of Glutaraldehyde", *Critical Reviews in Toxicology*, Vol. 22 No. 3–4, pp. 143–174.

Mozafari, M.R., Flanagan, J., Matia-Merino, L., Awati, A., Omri, A., Suntres, Z.E. and Singh, H. (2006), "Recent trends in the lipid-based nanoencapsulation of antioxidants and their role in foods", *Journal of the Science of Food and Agriculture*, Vol. 86, pp. 2038–2045.

Muhammad, D.R.A., Saputro, A.D., Rottiers, H., Van de Walle, D. and Dewettinck, K. (2018), "Physicochemical properties and antioxidant activities of chocolates enriched with engineered cinnamon nanoparticles", *European Food Research and Technology*, Springer Berlin Heidelberg, Vol. 244 No. 7, pp. 1185–1202.

Mukherjee, S. and Chattopadhyay, P.K. (2007), "Whirling bed blanching of potato cubes and its effects on product quality", *Journal of Food Engineering*, Vol.

UNIVERSITAS GADJAH MADA
EKSTRAKSI, IDENTIFIKASI DAN NANOENKAPSULASI FLAVONOID BIJI KAKAO (Theobroma cacao L.) SEGAR SEBAGAI ANTIOKSIDAN ALAMI
ROSSI INDIARTO, Prof. Dr. Ir. Supriyanto, M.S.; Prof. Dr. Ir. Umar Santoso, M.Sc.; Prof. Dr. Yudi Pranoto, S.TP., M.
Universitas Gadjah Mada, 2019 | Diunduh dari http://etd.repository.ugm.ac.id/

78 No. 1, pp. 52–60.

Naczk, M. and Shahidi, F. (2006), "Phenolics in cereals , fruits and vegetables : Occurrence , extraction and analysis", *Journal of Pharmaceutical and Biomedical Analysis*, Vol. 41, pp. 1523–1542.

Nahar, M., Mishra, D., Dubey, V. and Jain, N.K. (2008), "Development, characterization, and toxicity evaluation of amphotericin B-loaded gelatin nanoparticles", *Nanomedicine: Nanotechnology, Biology, and Medicine*, Vol. 4 No. 3, pp. 252–261.

Nakamura, M., Ra, J.H., Jee, Y. and Kim, J.S. (2017), "Impact of different partitioned solvents on chemical composition and bioavailability of Sasa quelpaertensis Nakai leaf extract", *Journal of Food and Drug Analysis*, Elsevier Ltd, Vol. 25 No. 2, pp. 316–326.

Nakao, M., Takio, S. and Ono, K. (1998), "Alkyl peroxyl radical-scavenging activity of catechins", *Phytochemistry*, Vol. 49 No. 8, pp. 2379–2382.

Nijveldt, R.J., Nood, E. van, Hoorn, D.E. van, Boelens, P.G., Norren, K. van and Leeuwen, P.A. van. (2001), "Flavonoids : a review of probable mechanisms of action and", *The American Journal of Clinical Nutrition*, Vol. 74, pp. 418–425.

Ninan, G., Jose, J. and Abubacker, Z. (2011), "Preparation and characterization of gelatin extracted from the skins of rohu (labeo rohita) and common carp (cyprinus carpio)", *Journal of Food Processing and Preservation*, Vol. 35 No. 2, pp. 143–161.

Noronha, C.M., Granada, A.F., de Carvalho, S.M., Lino, R.C., Matheus, M.V. and Barreto, P.L.M. (2013), "Optimization of α-tocopherol loaded nanocapsules by the nanoprecipitation method", *Industrial Crops and Products*, Elsevier B.V., Vol. 50, pp. 896–903.

Nourian, F., Ramaswamy, H.S. and Kushalappa, A.C. (2003), "Kinetics of quality change associated with potatoes stored at different temperatures", *LWT - Food Science and Technology*, Vol. 36 No. 1, pp. 49–65.

Nurhayati, Setyabudi, S.F., Marseno, D.W. and Supriyanto. (2017), "Inactivation of Polyphenol oxidase with Microwave and Its Influence on Total Polyphenol Content and Antioxidant Activity of Cocoa Beans (Theobroma Cacao L .)", *The International Journal Of Science & Technoledge*, Vol. 5 No. 2, pp. 52–57.

Ofokansi, K., Winter, G., Fricker, G. and Coester, C. (2010), "Matrix-loaded biodegradable gelatin nanoparticles as new approach to improve drug loading and delivery", *European Journal of Pharmaceutics and Biopharmaceutics*, Elsevier B.V., Vol. 76 No. 1, pp. 1–9.

Ojwang, L.O., Yang, L., Dykes, L. and Awika, J. (2013), "Proanthocyanidin profile of cowpea (Vigna unguiculata) reveals catechin-O-glucoside as the dominant compound", *Food Chemistry*, Elsevier Ltd, Vol. 139 No. 1–4, pp. 35–43.

Oracz, J. and Nebesny, E. (2016), "Antioxidant Properties of Cocoa Beans (Theobroma cacao L.): Influence of Cultivar and Roasting Conditions", *International Journal of Food Properties*, Taylor & Francis, Vol. 19 No. 6, pp. 1242–1258.

Oracz, J., Nebesny, E. and Żyżelewicz, D. (2015), "Changes in the flavan-3-ols,

UNIVERSITAS GADJAH MADA
EKSTRAKSI, IDENTIFIKASI DAN NANOENKAPSULASI FLAVONOID BIJI KAKAO (Theobroma cacao L.) SEGAR SEBAGAI ANTIOKSIDAN ALAMI
ROSSI INDIARTO, Prof. Dr. Ir. Supriyanto, M.S.; Prof. Dr. Ir. Umar Santoso, M.Sc.; Prof. Dr. Yudi Pranoto, S.TP., M.
Universitas Gadjah Mada, 2019 | Diunduh dari http://etd.repository.ugm.ac.id/

anthocyanins, and flavanols composition of cocoa beans of different Theobroma cacao L. groups affected by roasting conditions", *European Food Research and Technology*, Vol. 241 No. 5, pp. 663–681.

Ortega, N., Romero, M.P., MacIà, A., Reguant, J., Anglès, N., Morelló, J.R. and Motilva, M.J. (2008), "Obtention and characterization of phenolic extracts from different cocoa sources", *Journal of Agricultural and Food Chemistry*, Vol. 56 No. 20, pp. 9621–9627.

Ortiz-Basurto, R.I., Rubio-Ibarra, M.E., Ragazzo-Sanchez, J.A., Beristain, C.I. and Jiménez-Fernández, M. (2017), "Microencapsulation of Eugenia uniflora L. juice by spray drying using fructans with different degrees of polymerisation", *Carbohydrate Polymers*, Elsevier Ltd., Vol. 175, pp. 603–609.

Othman, A., Ismail, A., Abdul Ghani, N. and Adenan, I. (2007), "Antioxidant capacity and phenolic content of cocoa beans", *Food Chemistry*, Vol. 100 No. 4, pp. 1523–1530.

Ottaviani, J.I., Balz, M., Kimball, J., Ensunsa, J.L., Fong, R., Momma, T.Y., Kwik-uribe, C., et al. (2015), "Safety and efficacy of cocoa flavanol intake in healthy adults: a randomized, controlled, double-masked trial", *American Journal of Clinical Nutrition*, Vol. 102, pp. 1425–1435.

Owens, D.E. and Peppas, N.A. (2006), "Opsonization, biodistribution, and pharmacokinetics of polymeric nanoparticles", *International Journal of Pharmaceutics*, Vol. 307 No. 1, pp. 93–102.

Özkan, G. and Bilek, S.E. (2014), "Microencapsulation of natural food colourants", *International Journal of Nutrition and Food Sciences*, Vol. 3 No. 3, pp. 145–156.

Ozkan, G., Franco, P., De Marco, I., Xiao, J. and Capanoglu, E. (2019), "A review of microencapsulation methods for food antioxidants: Principles, advantages, drawbacks and applications", *Food Chemistry*, Elsevier, Vol. 272 No. July 2018, pp. 494–506.

Patel, H.R., Patel, R.P. and Patel, M.M. (2009), "Poloxamers: A pharmaceutical excipients with therapeutic behaviors", *International Journal of PharmTech Research*, Vol. 1 No. 2, pp. 299–303.

Patel, Z.S., Yamamoto, M., Ueda, H., Tabata, Y. and Mikos, A.G. (2008), "Biodegradable gelatin microparticles as delivery systems for the controlled release of bone morphogenetic protein-2", *Acta Biomaterialia*, Vol. 4 No. 5, pp. 1126–1138.

Patras, M.A., Milev, B.P., Vrancken, G. and Kuhnert, N. (2014), "Identification of novel cocoa flavonoids from raw fermented cocoa beans by HPLC-MSn", *Food Research International*, Elsevier B.V., Vol. 63, pp. 353–359.

Payne, M.J., Hurst, W.J., Miller, K.B., Rank, C. and Stuart, D.A. (2010), "Impact of fermentation, drying, roasting, and dutch processing on epicatechin and catechin content of cacao beans and cocoa ingredients", *Journal of Agricultural and Food Chemistry*, Vol. 58 No. 19, pp. 10518–10527.

Peláez, P., Bardón, I. and Camasca, P. (2016), "Methylxanthine and catechin content of fresh and fermented cocoa beans, dried cocoa beans, and cocoa liquor", *Scientia Agropecuaria*, Vol. 7 No. 4, pp. 355–365.

Pietta, P.G. (2000), "Flavonoids as antioxidants", *Journal of Natural Products*, Vol.

UNIVERSITAS GADJAH MADA
EKSTRAKSI, IDENTIFIKASI DAN NANOENKAPSULASI FLAVONOID BIJI KAKAO (Theobroma cacao L.) SEGAR SEBAGAI ANTIOKSIDAN ALAMI
ROSSI INDIARTO, Prof. Dr. Ir. Supriyanto, M.S.; Prof. Dr. Ir. Umar Santoso, M.Sc.; Prof. Dr. Yudi Pranoto, S.TP., M.
Universitas Gadjah Mada, 2019 | Diunduh dari http://etd.repository.ugm.ac.id/

63 No. 7, pp. 1035–1042.

Pillai, D.S., Prabhasankar, P., Jena, B.S. and Anandharamakrishnan, C. (2012), "Microencapsulation of garcinia cowa fruit extract and effect of its use on pasta process and quality", *International Journal of Food Properties*, Vol. 15 No. 3, pp. 590–604.

Pimpaporn, P., Devahastin, S. and Chiewchan, N. (2007), "Effects of combined pretreatments on drying kinetics and quality of potato chips undergoing low-pressure superheated steam drying", *Journal of Food Engineering*, Vol. 81 No. 2, pp. 318–329.

Pollard, S.E., Kuhnle, G.G.C., Vauzour, D., Vafeiadou, K., Tzounis, X., Whiteman, M., Rice-Evans, C., et al. (2006), "The reaction of flavonoid metabolites with peroxynitrite", *Biochemical and Biophysical Research Communications*, Vol. 350 No. 4, pp. 960–968.

Prajapati, V.D., Jani, G.K., Moradiya, N.G. and Randeria, N.P. (2013), "Pharmaceutical applications of various natural gums, mucilages and their modified forms", *Carbohydrate Polymers*, Elsevier Ltd., Vol. 92 No. 2, pp. 1685–1699.

Prior, R.L. and Cao, G. (2000), "Antioxidant phytochemicals in fruits and vegetables: Diet and health implications", *HortScience*, Vol. 35 No. 4, pp. 588–592.

Procházková, D., Boušová, I. and Wilhelmová, N. (2011), "Antioxidant and prooxidant properties of flavonoids", *Fitoterapia*, Vol. 82 No. 4, pp. 513–523.

Pujimulyani, D., Raharjo, S., Marsono, Y. and Santoso, U. (2012), "The effect of blanching on antioxidant activity and glycosides of white saffron (Curcuma mangga Val.)", *International Food Research Journal*, Vol. 19 No. 2, pp. 617–621.

Pujimulyani, W., Raharjo, S., Marsono, Y. and Santoso, U. (2010), "Aktivitas Antioksidan Dan Kadar Senyawa Fenolik Pada Kunir Putih", *Agritech*, Vol. 30 No. 2, pp. 68–74.

Pulicharla, R., Marques, C., Das, R.K., Rouissi, T. and Brar, S.K. (2016), "Encapsulation and release studies of strawberry polyphenols in biodegradable chitosan nanoformulation", *International Journal of Biological Macromolecules*, Elsevier B.V., Vol. 88, pp. 171–178.

Putra, G., Wartini and Anggreni, D. (2010), "Characterization of Polyphenol Oxidase Enzyme of Cocoa Beans (Theobroma cacao Linn.)", *Agritech*, Vol. 30 No. 3, pp. 152–157.

Putra Ganda, G.P., Wartini, N.M. and Anggreni, A.A.M. (2010), "Characterization of Polyphenol Oxidase Enzyme of Cocoa Beans (Theobroma cacao Linn.)", *Agritech*, Vol. 30 No. 3, pp. 152–157.

Puupponen-Pimiä, R., Häkkinen, S.T., Aarni, M., Suortti, T., Lampi, A.M., Eurola, M., Piironen, V., et al. (2003), "Blanching and long-term freezing affect various bioactive compounds of vegetables in different ways", *Journal of the Science of Food and Agriculture*, Vol. 83 No. 14, pp. 1389–1402.

Raharjo, S. (2006), *Kerusakan Oksidatif Pada Makanan*, Gadjah Mada University Press, Yogyakarta, available at: http://ugmpress.ugm.ac.id/id/product/pertanian/kerusakan-oksidatif-pada-

UNIVERSITAS GADJAH MADA
EKSTRAKSI, IDENTIFIKASI DAN NANOENKAPSULASI FLAVONOID BIJI KAKAO (Theobroma cacao L.) SEGAR SEBAGAI ANTIOKSIDAN ALAMI
ROSSI INDIARTO, Prof. Dr. Ir. Supriyanto, M.S.; Prof. Dr. Ir. Umar Santoso, M.Sc.; Prof. Dr. Yudi Pranoto, S.TP., M.
Universitas Gadjah Mada, 2019 | Diunduh dari http://etd.repository.ugm.ac.id/

makanan.

Ramesh, M.N., Wolf, W., Tevini, D. and Jung, G. (2001), "Influence of processing parameters on the drying of spice paprika", *Journal of Food Engineering*, Vol. 49 No. 1, pp. 63–72.

Ramiro-Puig, E., Pérez-Cano, F.J., Ramírez-Santana, C., Castellote, C., Izquierdo-Pulido, M., Permanyer, J., Franch, A., et al. (2007), "Spleen lymphocyte function modulated by a cocoa-enriched diet", *Clinical and Experimental Immunology*, Vol. 149 No. 3, pp. 535–542.

Rao, J.P. and Geckeler, K.E. (2011), "Polymer nanoparticles: Preparation techniques and size-control parameters", *Progress in Polymer Science (Oxford)*, Elsevier Ltd, Vol. 36 No. 7, pp. 887–913.

Rao, P.J. and Khanum, H. (2016), "A green chemistry approach for nanoencapsulation of bioactive compound - Curcumin", *LWT - Food Science and Technology*, Elsevier Ltd, Vol. 65, pp. 695–702.

Rattes, A.L.R. and Oliveira, W.P. (2007), "Spray drying conditions and encapsulating composition effects on formation and properties of sodium diclofenac microparticles", *Powder Technology*, Vol. 171 No. 1, pp. 7–14.

Rawson, A., Tiwari, B.K., Tuohy, M.G., O'Donnell, C.P. and Brunton, N. (2011), "Effect of ultrasound and blanching pretreatments on polyacetylene and carotenoid content of hot air and freeze dried carrot discs", *Ultrasonics Sonochemistry*, Elsevier B.V., Vol. 18 No. 5, pp. 1172–1179.

Rezende, Y.R.R.S., Nogueira, J.P. and Narain, N. (2018), "Microencapsulation of extracts of bioactive compounds obtained from acerola (Malpighia emarginata DC) pulp and residue by spray and freeze drying: Chemical, morphological and chemometric characterization", *Food Chemistry*, Elsevier, Vol. 254, pp. 281–291.

Rice-Evans, C., Miller, N.J. and Paganga, G. (1997), "Antioxidant properties of phenolic", *Trends in Plant Sciencecience*, Vol. 2 No. 4, pp. 152–159.

Rice-Evans, C.A., Miller, N.J. and Paganga, G. (1996), "Structure-antioxidant activity relationships of flavonoids and phenolic acids", *Free Radical Biology and Medicine*, Vol. 20 No. 7, pp. 933–956.

Rimbach, G., Melchin, M., Moehring, J. and Wagner, A.E. (2009), "Polyphenols from cocoa and vascular health - A critical review", *International Journal of Molecular Sciences*, Vol. 10 No. 10, pp. 4290–4309.

Rodríguez, J., Martín, M.J., Ruiz, M.A. and Clares, B. (2016), "Current encapsulation strategies for bioactive oils: From alimentary to pharmaceutical perspectives", *Food Research International*, Elsevier Ltd, Vol. 83, pp. 41–59.

Rose, J.B., Pacelli, S., El Haj, A.J., Dua, H.S., Hopkinson, A., White, L.J. and Rose, F.R.A.J. (2014), "Gelatin-based materials in ocular tissue engineering", *Materials*, Vol. 7 No. 4, pp. 3106–3135.

Şahin-Nadeem, H., Dinçer, C., Torun, M., Topuz, A. and özdemir, F. (2013), "Influence of inlet air temperature and carrier material on the production of instant soluble sage (Salvia fruticosa Miller) by spray drying", *LWT - Food Science and Technology*, Vol. 52 No. 1, pp. 31–38.

Sahoo, N., Sahoo, R.K., Biswas, N., Guha, A. and Kuotsu, K. (2015), "Recent advancement of gelatin nanoparticles in drug and vaccine delivery",

UNIVERSITAS GADJAH MADA
EKSTRAKSI, IDENTIFIKASI DAN NANOENKAPSULASI FLAVONOID BIJI KAKAO (Theobroma cacao L.) SEGAR SEBAGAI ANTIOKSIDAN ALAMI
ROSSI INDIARTO, Prof. Dr. Ir. Supriyanto, M.S.; Prof. Dr. Ir. Umar Santoso, M.Sc.; Prof. Dr. Yudi Pranoto, S.TP., M.
Universitas Gadjah Mada, 2019 | Diunduh dari http://etd.repository.ugm.ac.id/

International Journal of Biological Macromolecules, Elsevier B.V., Vol. 81, pp. 317–331.

Saloko, S., Darmadji, P., Setiaji, B., Pranoto, Y. and Anal, A.K. (2013), "Encapsulation of coconut shell liquid smoke in chitosan-maltodextrin based nanoparticles", *International Food Research Journal*, Vol. 20 No. 3, pp. 1269–1276.

Santiago, D., Paese, K., Stanisçuaski, S., Jablonski, A., Hickmann, S. and Oliveira, A. De. (2018), "Industrial Crops & Products Encapsulation e ffi ciency and thermal stability of norbixin microencapsulated by spray-drying using di ff erent combinations of wall materials", *Industrial Crops & Products*, Vol. 111 No. July 2017, pp. 846–855.

Saxena, A., Sachin, K., Bohidar, H.B. and Verma, A.K. (2005), "Effect of molecular weight heterogeneity on drug encapsulation efficiency of gelatin nano-particles", *Colloids and Surfaces B: Biointerfaces*, Vol. 45 No. 1, pp. 42–48.

Scapagnini, G., Davinelli, S., Di Renzo, L., De Lorenzo, A., Olarte, H.H., Micali, G., Cicero, A.F., et al. (2014), "Cocoa bioactive compounds: Significance and potential for the maintenance of skin health", *Nutrients*, Vol. 6 No. 8, pp. 3202–3213.

Schafroth, N., Arpagaus, C., Jadhav, U.Y., Makne, S. and Douroumis, D. (2012), "Nano and microparticle engineering of water insoluble drugs using a novel spray-drying process", *Colloids and Surfaces B: Biointerfaces*, Elsevier B.V., Vol. 90 No. 1, pp. 8–15.

Schoubben, A., Blasi, P., Giovagnoli, S., Rossi, C. and Ricci, M. (2010), "Development of a scalable procedure for fine calcium alginate particle preparation", *Chemical Engineering Journal*, Vol. 160 No. 1, pp. 363–369.

Serra Bonvehí, J. and Ventura Coll, F. (1997), "Evaluation of bitterness and astringency of polyphenolic compounds in cocoa powder", *Food Chemistry*, Vol. 60 No. 3, pp. 365–370.

Shahidi, F. and Naczk, M. (2004), *Phenolics in Food and Nutraceuticals*, *Phenolics in Food and Nutraceuticals*, Vol. 14, CRC Press Inc, Boca Raton London New York Washington, D.C., available at:https://doi.org/10.1017/CBO9781107415324.004.

Shishir, M.R.I., Xie, L., Sun, C., Zheng, X. and Chen, W. (2018), "Advances in micro and nano-encapsulation of bioactive compounds using biopolymer and lipid-based transporters", *Trends in Food Science and Technology*, Elsevier, Vol. 78 No. May, pp. 34–60.

Siegbahn, P.E.M. (2004), "The catalytic cycle of catechol oxidase", *Journal of Biological Inorganic Chemistry*, Vol. 9 No. 5, pp. 577–590.

Singh, D.K. and Mahapatro, A. (2011), "Biodegradable nanoparticles are excellent vehicle for site directed in-vivo delivery of drugs and vaccines", *Journal of Nanobiotechnology*, Vol. 9 No. 1, p. 55.

de Souza Simões, L., Madalena, D.A., Pinheiro, A.C., Teixeira, J.A., Vicente, A.A. and Ramos, Ó.L. (2017), "Micro- and nano bio-based delivery systems for food applications: In vitro behavior", *Advances in Colloid and Interface Science*, Vol. 243, pp. 23–45.

UNIVERSITAS GADJAH MADA
EKSTRAKSI, IDENTIFIKASI DAN NANOENKAPSULASI FLAVONOID BIJI KAKAO (Theobroma cacao L.) SEGAR SEBAGAI ANTIOKSIDAN ALAMI
ROSSI INDIARTO, Prof. Dr. Ir. Supriyanto, M.S.; Prof. Dr. Ir. Umar Santoso, M.Sc.; Prof. Dr. Yudi Pranoto, S.TP., M.
Universitas Gadjah Mada, 2019 | Diunduh dari http://etd.repository.ugm.ac.id/

Souza, V.B. De, Fujita, A., Thomazini, M., Da Silva, E.R., Lucon, J.F., Genovese, M.I. and Favaro-Trindade, C.S. (2014), "Functional properties and stability of spray-dried pigments from Bordo grape (Vitis labrusca) winemaking pomace", *Food Chemistry*, Elsevier Ltd, Vol. 164, pp. 380–386.

de Souza, V.B., Thomazini, M., Echalar Barrientos, M.A., Nalin, C.M., Ferro-Furtado, R., Genovese, M.I. and Favaro-Trindade, C.S. (2018), "Functional properties and encapsulation of a proanthocyanidin-rich cinnamon extract (Cinnamomum zeylanicum) by complex coacervation using gelatin and different polysaccharides", *Food Hydrocolloids*, Vol. 77, pp. 297–306.

Stalikas, C.D. (2007), "Extraction, separation, and detection methods for phenolic acids and flavonoids", *Journal of Separation Science*, Vol. 30 No. 18, pp. 3268–3295.

Stuckey, B. (1972), *Antioxidants as Food Stabilizers, in: Handbook of Food Additives.*, edited by Furia, T..*Handbook of Food Additives*, Vol I., CRC Press Inc, Florida.

Suazo, Y., Davidov-Pardo, G. and Arozarena, I. (2014), "Effect of Fermentation and Roasting on the Phenolic Concentration and Antioxidant Activity of Cocoa from Nicaragua", *Journal of Food Quality*, Vol. 37 No. 1, pp. 50–56.

Sugiyanti, D., Darmadji, P., Anggrahini, S., Anwar, C. and Santoso, U. (2018), "Preparation and Characterization of Chitosan from Indonesian Tambak Lorok Shrimp Shell Waste and Crab Shell Waste", *Pakistan Journal of Nutrition*, Vol. 17 No. 9, pp. 446–453.

Supriyanto, Haryadi, Raharjo, B. and Marseno, D.W. (2006), "Aktivitas antioksidan ekstrak polifenol kasar dari kakao hasil penyangraian menggunakan enerji gelombang mikro", *Jurnal Teknologi Dan Industri Pangan*, Vol. XVII No. 3, pp. 176–182.

Taifi, M. (2016), "Cocoa extracts encapsulation for avoiding polyphenols degradation", *Report*, Barcelona, No. January, pp. 1–37.

Tamaroh, S., Raharjo, S., Murdiati, A. and Anggrahini, S. (2018), "Total Phenolic Content and Antioxidant Activity of Anthocyanin Extract from Purple Yam (Dioscorea alata L .) Flour Using Different Solvents", *Pakistan Journal of Nutrition*, Vol. 16 No. 6, pp. 260–267.

Tan, C., Xie, J., Zhang, X., Cai, J. and Xia, S. (2016), "Polysaccharide-based nanoparticles by chitosan and gum arabic polyelectrolyte complexation as carriers for curcumin", *Food Hydrocolloids*, Elsevier Ltd, Vol. 57, pp. 236–245.

Tang, D.W., Yu, S.H., Ho, Y.C., Huang, B.Q., Tsai, G.J., Hsieh, H.Y., Sung, H.W., et al. (2013), "Characterization of tea catechins-loaded nanoparticles prepared from chitosan and an edible polypeptide", *Food Hydrocolloids*, Elsevier Ltd, Vol. 30 No. 1, pp. 33–41.

Tang, S.Z., Kerry, J.P., Sheehan, D. and Buckley, D.J. (2002), "Antioxidative mechanisms of tea catechins in chicken meat systems", *Food Chemistry*, Vol. 76 No. 1, pp. 45–51.

Taruna Syah, I., Darmadji, P. and Pranoto, Y. (2016), "Microencapsulation of Refined Liquid Smoke Using Maltodextrin Produced from Broken Rice Starch", *Journal of Food Processing and Preservation*, Vol. 40 No. 3, pp.

UNIVERSITAS GADJAH MADA
EKSTRAKSI, IDENTIFIKASI DAN NANOENKAPSULASI FLAVONOID BIJI KAKAO (Theobroma cacao L.) SEGAR SEBAGAI ANTIOKSIDAN ALAMI
ROSSI INDIARTO, Prof. Dr. Ir. Supriyanto, M.S.; Prof. Dr. Ir. Umar Santoso, M.Sc.; Prof. Dr. Yudi Pranoto, S.TP., M.
Universitas Gadjah Mada, 2019 | Diunduh dari http://etd.repository.ugm.ac.id/

437–446.

Tiwari, B.K., Muthukumarappan, K., O'Donnell, C.P. and Cullen, P.J. (2008), "Effects of sonication on the kinetics of orange juice quality parameters", *Journal of Agricultural and Food Chemistry*, Vol. 56 No. 7, pp. 2423–2428.

Tolun, A., Altintas, Z. and Artik, N. (2016), "Microencapsulation of grape polyphenols using maltodextrin and gum arabic as two alternative coating materials: Development and characterization", *Journal of Biotechnology*, Elsevier B.V., Vol. 239, pp. 23–33.

Tomas-Barberán, F.A., Cienfuegos-Jovellanos, E., Marín, A., Muguerza, B., Gil-Izquierdo, A., Cerdá, B., Zafrilla, P., et al. (2007), "A new process to develop a cocoa powder with higher flavonoid monomer content and enhanced bioavailability in healthy humans", *Journal of Agricultural and Food Chemistry*, Vol. 55 No. 10, pp. 3926–3935.

Tonon, R. V., Brabet, C. and Hubinger, M.D. (2010), "Anthocyanin stability and antioxidant activity of spray-dried açai (Euterpe oleracea Mart.) juice produced with different carrier agents", *Food Research International*, Elsevier Ltd, Vol. 43 No. 3, pp. 907–914.

Tonon, R. V., Brabet, C., Pallet, D., Brat, P. and Hubinger, M.D. (2009), "Physicochemical and morphological characterisation of açai (Euterpe oleraceae Mart.) powder produced with different carrier agents", *International Journal of Food Science and Technology*, Vol. 44 No. 10, pp. 1950–1958.

Tran, T.T.. and Nguyen, H.V.H. (2018), "Effects of Spray-Drying Temperatures and Carriers on Physical and Antioxidant Properties of Lemongrass Leaf Extract Powder", *Beverages*, Vol. 4 No. 4, p. 84.

Tribst, A.A.L., Leite Júnior, B.R.D.C., De Oliveira, M.M. and Cristianini, M. (2016), "High pressure processing of cocoyam, Peruvian carrot and sweet potato: Effect on oxidative enzymes and impact in the tuber color", *Innovative Food Science and Emerging Technologies*, Elsevier Ltd, Vol. 34, pp. 302–309.

Trognitz, B., Cros, E., Assemat, S., Davrieux, F., Forestier-Chiron, N., Ayestas, E., Kuant, A., et al. (2013), "Diversity of Cacao Trees in Waslala, Nicaragua: Associations between Genotype Spectra, Product Quality and Yield Potential", *PLoS ONE*, Vol. 8 No. 1, available at:https://doi.org/10.1371/journal.pone.0054079.

Turkmen, N., Sari, F. and Velioglu, Y.S. (2005), "The effect of cooking methods on total phenolics and antioxidant activity of selected green vegetables", *Food Chemistry*, Vol. 93 No. 4, pp. 713–718.

Utami, R.R., Armunanto, R., Rahardjo, S. and Supriyanto. (2016), "Effects of cocoa bean (Theobroma cacao L.) fermentation on phenolic content, antioxidant activity and functional group of cocoa bean shell", *Pakistan Journal of Nutrition*, Science Alert, Vol. 15 No. 10, pp. 948–953.

Volden, J., Borge, G.I.A., Bengtsson, G.B., Hansen, M., Thygesen, I.E. and Wicklund, T. (2008), "Effect of thermal treatment on glucosinolates and antioxidant-related parameters in red cabbage (Brassica oleracea L. ssp. capitata f. rubra)", *Food Chemistry*, Vol. 109 No. 3, pp. 595–605.

Weber, C., Coester, C., Kreuter, J. and Langer, K. (2000), "Desolvation process and surface characterisation of protein nanoparticles", *International Journal of*

UNIVERSITAS GADJAH MADA
EKSTRAKSI, IDENTIFIKASI DAN NANOENKAPSULASI FLAVONOID BIJI KAKAO (Theobroma cacao L.) SEGAR SEBAGAI ANTIOKSIDAN ALAMI
ROSSI INDIARTO, Prof. Dr. Ir. Supriyanto, M.S.; Prof. Dr. Ir. Umar Santoso, M.Sc.; Prof. Dr. Yudi Pranoto, S.TP., M.
Universitas Gadjah Mada, 2019 | Diunduh dari http://etd.repository.ugm.ac.id/

Pharmaceutics, Vol. 194, pp. 91–102.

Wen, T.N., Prasad, K.N., Yang, B. and Ismail, A. (2010), "Bioactive substance contents and antioxidant capacity of raw and blanched vegetables", *Innovative Food Science and Emerging Technologies*, Elsevier Ltd, Vol. 11 No. 3, pp. 464–469.

Wollgast, J. and Anklam, E. (2000), "Review on polyphenols in Theobroma cacao: Changes in composition during the manufacture of chocolate and methodology for identification and quantification", *Food Research International*, Vol. 33 No. 6, pp. 423–447.

Won, Y.W. and Kim, Y.H. (2009), "Preparation and cytotoxicity comparison of type a gelatin nanoparticles with recombinant human gelatin nanoparticles", *Macromolecular Research*, Vol. 17 No. 7, pp. 464–468.

Xiao, H.W., Bai, J.W., Xie, L., Sun, D.W. and Gao, Z.J. (2015), "Thin-layer air impingement drying enhances drying rate of American ginseng (Panax quinquefolium L.) slices with quality attributes considered", *Food and Bioproducts Processing*, Institution of Chemical Engineers, Vol. 94 No. August, pp. 581–591.

Xiao, H.W., Pan, Z., Deng, L.Z., El-Mashad, H.M., Yang, X.H., Mujumdar, A.S., Gao, Z.J., et al. (2017), "Recent developments and trends in thermal blanching – A comprehensive review", *Information Processing in Agriculture*, China Agricultural University, Vol. 4 No. 2, pp. 101–127.

Xiao, H.W., Yao, X.D., Lin, H., Yang, W.X., Meng, J.S. and Gao, Z.J. (2012), "Effect of SSB (Superheated Steam Blanching) time and drying temperature on hot air impingement drying kinetics and quality attributes of yam slices", *Journal of Food Process Engineering*, Vol. 35 No. 3, pp. 370–390.

Xu, B. and Chang, S.K.C. (2008), "Effect of soaking, boiling, and steaming on total phenolic contentand antioxidant activities of cool season food legumes", *Food Chemistry*, Vol. 110 No. 1, pp. 1–13.

Xu, G., Ye, X., Chen, J. and Liu, D. (2007), "Effect of Heat Treatment on the Phenolic Compounds and Antioxidant Capacity of Citrus Peel Extract", *Journal of Agricultural and Food Chemistry*, Vol. 55, pp. 330–335.

Xu, Z., Wei, L. hong, Ge, Z. zhen, Zhu, W. and Li, C. mei. (2015), "Comparison of the degradation kinetics of A-type and B-type proanthocyanidins dimers as a function of pH and temperature", *European Food Research and Technology*, Vol. 240 No. 4, pp. 707–717.

Yang, H., Feng, K., Wen, P., Zong, M.H., Lou, W.Y. and Wu, H. (2017), "Enhancing oxidative stability of encapsulated fish oil by incorporation of ferulic acid into electrospun zein mat", *LWT - Food Science and Technology*, Elsevier Ltd, Vol. 84, pp. 82–90.

Yeh, C.-T. and Yen, G.-C. (2006), "Induction of hepatic antioxidant enzymes by phenolic acids in rats is accompanied by increased levels of multidrug resistance-associated protein 3 mRNA expression.", *The Journal of Nutrition*, Vol. 136 No. 1, pp. 11–15.

Yeh, S.L., Wang, W.Y., Huang, C.H. and Hu, M.L. (2005), "Pro-oxidative effect of β-carotene and the interaction with flavonoids on UVA-induced DNA strand breaks in mouse fibroblast C3H10T1/2 cells", *Journal of Nutritional*

UNIVERSITAS
GADJAH MADA
EKSTRAKSI, IDENTIFIKASI DAN NANOENKAPSULASI FLAVONOID BIJI KAKAO (Theobroma cacao L.) SEGAR SEBAGAI ANTIOKSIDAN ALAMI
ROSSI INDIARTO, Prof. Dr. Ir. Supriyanto, M.S.; Prof. Dr. Ir. Umar Santoso, M.Sc.; Prof. Dr. Yudi Pranoto, S.TP., M.
Universitas Gadjah Mada, 2019 | Diunduh dari http://etd.repository.ugm.ac.id/

Biochemistry, Vol. 16 No. 12, pp. 729–735.

Yilmaz, Y. and Toledo, R.T. (2004), "Major Flavonoids in Grape Seeds and Skins: Antioxidant Capacity of Catechin, Epicatechin, and Gallic Acid", *Journal of Agricultural and Food Chemistry*, Vol. 52 No. 2, pp. 255–260.

Yu, C., Ma, J. and Wang, W. (2010), "Preparation of redispersible emulsion powder by spray drying", *International Journal of Food Engineering*, Vol. 6 No. 2, available at:https://doi.org/10.2202/1556-3758.1840.

Zauner, W., Farrow, N.A. and Haines, A.M.R. (2001), "In vitro uptake of polystyrene microspheres: Effect of particle size, cell line and cell density", *Journal of Controlled Release*, Vol. 71 No. 1, pp. 39–51.

Zhao, B., Xie, J. and Zhao, J. (2004), "A novel water-soluble nanoparticles of hypocrellin B and their interaction with a model protein: C-phycocyanin", *Biochimica et Biophysica Acta - General Subjects*, Vol. 1670 No. 2, pp. 113–120.